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SELF-FEEDING OF SILAGE IN DEVON 1957/58

An Interim Report

by

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and

J. A. LANGLEY, M.Sc.

Price Two Shillings and Sixpence

I, COURTENAY PARK,
NEWTON ABBOT,
DEVON.

S E L F-F E E D I N G O F S I L A G E I N D E V O N.

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FOREWORD.

Enquiries for information on the developing practice of self-feeding silage prompted the Department in the spring of 1958 to undertake a brief survey of the practice as found in one County when an increasing number of farmers were known to be experimenting with the technique.

The data on which this report is based were collected from 30 Devon farmers practising self-feeding of silage during the 1957/58 winter. The survey has yielded some very useful information but, since it only relates to one feeding period, it is hoped to supplement the data with the results for an additional winter. In the meantime, this interim report is published with the object of providing some standards for farmers considering the introduction of self-feeding techniques. The Department gratefully acknowledges the help of the co-operating farmers.

S.T. Morris

Provincial Agricultural Economist.

C O N T E N T S

1. INTRODUCTION

British Agriculture is characterised by its high livestock population. The feeding of the livestock constitutes one of the main preoccupations of our farmers, and grassland, either in the form of grazing or as conserved grass, contributes a major part to the total feed supply of our cattle and sheep. In recent years, grassland enthusiasts, while recognising this major contribution of grassland, have suggested that suitable grass properly managed can provide an even bigger supply of feed and thereby enable a substantial reduction to be made in imported animal feed. Successive Government White Papers have also emphasised the need for better utilisation of grassland. As a result, increasing interest is being shown in the different methods of utilising grass and conserving the crop for winter feeding.

The various problems of silage making are claiming the attention of more and more farmers in the wetter western parts of the country. In these areas grass is relatively more important, the cattle populations are higher than elsewhere, and the farmers have always striven to make high quality hay in extremely variable and, indeed, frequently disastrous weather conditions. Some are now taking advantage of the benefits which silage making can confer and are making little or no hay. But even with silage there are many problems, particularly in the feeding stage and better techniques are constantly being sought. The difficulties of feeding silage are largely due to the weight, bulk and quite frequently the persistent pungent smell of the material. Since the product contains 70-80% water, the stockman often handles appreciable weights, especially where the silage is cut and then carted from the silo to the livestock. Apart from the unpleasant and laborious nature of this task, there is the added objection that it is very time consuming work—a drawback of some considerable concern in view of the rising agricultural wage rates and a possible tendency towards a shorter working week and more expensive overtime. To meet these new developments, farmers have been forced to economise on labour in every possible way. More capital is being invested in buildings and equipment in an effort to increase the volume of work which can be performed in a particular time. Already there is evidence that cowmen are now able to milk far more dairy cows because of better work routines and better buildings. In recent years the feeding of cattle has received attention and layouts which enable livestock to help themselves to the supply of silage are being evolved. The object of this report is to consider some of the technical and economic aspects of self-feeding silage on Devon farms in the winter period, 1957/58.

Although self-feeding has been practised in the United States for very many years, the technique has only been considered seriously in this country in the last few years. Even now, its introduction has not been

rapid. Indeed, in Devon, relatively few farmers had the system established on their farms in the 1957/58 winter. Some 30 farms in the county were visited for this survey and it appears that the number represents a high proportion of the farms where self-feeding is being practised. Some pioneers have been self-feeding for four or five years but the majority of the farmers interviewed have put up silos in the last year or so, being encouraged to do so by the silo subsidy. It should be borne in mind, therefore, that the experiences recorded in this report refer mainly to one winter feeding period.

II. DESCRIPTION OF THE FARMS

Size and Type of Farm

The distribution of the sample of 30 farms by size and type is set out in Table 1. The average size of farm is 177 acres, with individual farm acreage varying in size from as little as 30 to as much as 450 acres. More than two-thirds of the farms exceed 100 acres and nearly one-third are more than 200 acres in extent. Therefore, it does appear that at the moment the practice of self-feeding silage in Devon is more popular on the larger holdings.

Table 1.

Distribution of 30 Farms by Size and Type of Farm

Size of Farm (acres)	Type of Farm			All Types
	Dairy or Mainly Dairy	Mixed Livestock		
		With Milk	Without Milk	
	Number of Farms			
Under 100	8	1	-	9
100 - 200	10	1	1	12
200 - 300	1	1	-	2
300 and Over	5	1	1	7
Total	24	4	2	30

The importance of milk production in the county is reflected in the sample. As many as 24 out of the 30 are dairy or mainly dairy farms, although several have quite large pig and poultry enterprises. A further four farmers are also producing milk but concentrate more on mixed livestock farming. There are only two holdings in the sample with no milk sales--here beef cattle are self-fed with silage.

Cropping and Stocking.

A further indication of the systen of farming practised on the holdings can be gleaned from the cropping and stocking data set out in Table 2.

Cereals are relatively unimportant except on holdings of over 200 acres where they account for over a quarter of the farm acreage. On practically all farms

Table 2.

Average Cropping and Stocking by Size Groups

(Per 100 total acres)

Size Group	Under 100 acres	100 - 200 acres	200 acres and over
Cropping:			
Cereals	4·0	5·2	25·6
Arable Silage	0·7	1·2	2·0
Kale	9·8	5·2	6·8
Other Roots	0·3	1·2	0·8
Total Tillage	14·8	12·8	35·2
Temporary Grass:			
Mowing	34·1	33·2	19·8
Grazing	17·6	18·5	21·4
Permanent Grass:			
Mowing	11·9	7·8	5·7
Grazing	17·7	19·3	8·4
Rough Grazing	3·9	8·4	9·5
Total Crops & Grass	100·0	100·0	100·0
Cows	38·0	22·2	16·0
Other Cattle	22·4	22·6	17·4
Breeding Sheep	15·8	42·2	24·8
" Pigs	7·6	7·8	3·2
Other Pigs	50·4	35·3	35·2
Poultry	305·9	182·5	72·7

the kale crop is quite important but without exception grass is the biggest single crop on these holdings. It is also noteworthy that in England and Wales the proportion of grass in temporary leys is about 27%, with the proportions for individual regions varying from less than 20% to as much as 36%. In the sample of farms included in the present investigation about 65% of the grass on farms of less than 200 acres is in leys, and on the bigger farms the proportion is 74%. Clearly, therefore, the farmers practising self-feeding are paying particular regard to renewing grassland regularly and most of the

hay and silage is made from temporary grass. The data on livestock show that the farms are quite heavily stocked, and the smaller farms in particular carry a large head of cattle.

Type of Livestock

Self-feeding on the 30 farms is confined to cattle although there

Table 3.

Distribution of 30 Farms According to the Livestock Self-fed and Size of Farm

Size Group (acres)	Self-feeding of			All Farms
	Dairy Cows	Dairy Cows & Young Stock	Store Stock Only	
Under 50	-	1	-	1
50 - 100	3	4	1	8
100 - 200	7	3	2	12
200 - 300	2	-	-	2
300 & Over	3	1	3	7
Total	15	9	6	30
Av. Size of Farm (acres)	195	102	244	177

seems no reason why sheep should not be allowed to help themselves to conserved grass. The information set out in Table 3 shows that most farmers restrict the practise to dairy cows only, but systems of self-feeding young stock are also growing in popularity.

It is frequently claimed that bulk-feeding is more suitable for the larger breeds and for stock reared practically from birth on roughages. The investigation failed to obtain conclusive evidence on these points but it is interesting to note that five herds of the Channel Island Breeds are included in the sample and that cows of these breeds are able to cope with substantial quantities of silage. By far the most popular breeds on these farms are the Ayrshires and Friesians but this may be a reflection of the increasing

emphasis on milk production and dairy breeds of cattle since the early forties,

Table 4.

Breeds of Cattle Kept on 30 Farms

Breed	Number of Farms
Ayrshires	9
Friesian	8
Guernsey	3
Jersey	2
Red Polls	1
Shorthorns	1
Mixed	6
Total	30

rather than the suitability of such cows for self-feeding.

III. SILOS AND SILAGE MAKING.

The types of silo used on the farms studied are given in Table 5. Most of these holdings have permanent covered surface silos situated at the farm buildings, but there were six uncovered surface silos of a permanent nature. (On three farms the stock were self-feeding from temporary clamps made either at the buildings or in the field). The most usual type of silo is the one covered by a convential Dutch Barn structure of corrugated iron or corrugated asbestos, measuring 18-20 feet to the eaves. The floors of the silo are usually concreted, sufficient fall being allowed for drainage purposes. A fall of about 1 foot in 20-25 feet is the figure most

Table 5.

The Main Types of Silos for Self-feeding on 30 Farms

Type of Silo	Situation of Silo	
	At the Farm Buildings	In the field
	Number of Farms	
Covered Surface Silo	20	-
Surface Silo (Uncovered)	5	1
Ordinary Pit (Covered)	1	-
Temporary Clamp (Uncovered)	1	2
Total	27	3

commonly quoted. The sides are generally built up to a height of 6-7 feet and made either of concrete, pre-cast concrete slabs, concrete blocks or railway sleepers. A three or four-bay silo with 15 feet length per bay, is most common, but on some of the larger farms there are five and six bay silos. The width of the silos vary from 18 to 24 feet. Most farmers consider that a covered silo is necessary for making good silage, and has the advantage of subsequently providing shelter for the stock when feeding. However, some claim that a cover is not necessary provided an efficient seal is made and rainwater is kept out.

There are also divided opinions about side walls. Those built of concrete blocks are usually upright and the farmers using them seem quite satisfied with the results. On the other hand, farmers using silos with sloping

sides of solid concrete or railway sleepers point out that consolidation with tractors is easier and that overheating due to air spaces which may occur with upright walls is absent. The majority of farmers it would seem prefer side walls with a slope of about 1 foot in 6 feet.

Capacity and Cost of Silos

(a) Covered Surface Silos The average capacity of 20 covered surface silos was 202 tons, equivalent to the capacity of a 4-bay Dutch Barn silo 24 feet wide and 60 feet long (4 bays X 15 feet) and a height of 6 feet of settled silage. The average gross cost was £550--a cost of just under £3 per ton. A charge for work carried out by farm labour is included in these figures.

Table 6.

Average Capacity and Capital Cost of the Main Type of Silos.

	Types of Silo	
	Covered Surface Silo	Uncovered Surface Silo
Number of Silos	20	6
Average Capacity (tons)	202	168
Range in Capacity (tons)	80 - 425	70 - 450
Average Gross Cost (£)	* 550	163
Range in Gross Costs (£)	* 270 - 1000	70 - 250
Average Cost per Ton of Capacity (£)	* 2·9	1·0
Range in Cost per Ton of Capacity (£)	* 1·5 - 5·6	0·4 - 2·5

* Based on 18 silos

About 6 feet or just under of settled silage is the maximum height of feeding face generally advocated for self-feeding. There is, of course, plenty of available space over and above the silage and this can be used for storage. To keep the silage drier, many farmers store their hay and straw bales on top, the straw being then handy for bedding down the covered yard. Other farmers use part of the available height by having up to 8 or 9 feet or more of settled silage still leaving some storage space. In such cases, the top layers of silage are cut and carted out for other stock whilst the bottom

layers are self-fed in situ.

Table 7.

Covered Surface Silos - Cost per 1 ton of Capacity according to Total Capacity of Silo

Capacity of Silo	Number of Farms	Average Capacity	Average Gross Cost	Average Gross Cost per ton Capacity
		tons	(£)	(£)
Up to 100 tons	2	90	377	4·2
101 - 150 tons	5	145	510	3·5
151 - 200 tons	7	187	477	2·5
201 tons and Over	4	312	817	2·6
Total	18	193	550	2.9

In Table 7, eighteen of the 20 covered surface silos are grouped according to capacity and the average cost in each group has been ascertained. The data shows that the average cost per ton of capacity falls from £4·2 for silos of up to 100 tons to approximately £2·5 for silos over 150 tons.

(b) Uncovered Surface Silos. The average capacity of the six uncovered surface silos was 168 tons and the average gross cost was £163 per silo. These usually have a concrete base throughout the length of the silo, a concrete apron or approach, and sides of pre-cast concrete slabs or railway sleepers. With an efficient seal on top, good silage can undoubtedly be made in these silos. The average capital cost per ton of capacity was approximately £1.

Buildings for Dairy Cattle

Table 8 shows the combination of buildings and methods of housing and milking the cows on the 24 farms self-feeding milking cows. The covered yard and parlour or bail is by far the most popular system of housing and milking. Farmers with well constructed and convenient shippons still use these buildings for milking, but yarded their cattle on a convenient site for self-feeding.

Table 8.

Buildings for Milking and Housing Cows at Night on 24 Farms Self-feeding Dairy Cows

Combination of Buildings		Number of Farms
Housing	Milking	
Yard	Parlour	13
Yard	Bail (at buildings)	2
Yard	Cowhouse	3
Loose Boxes	Cowhouse	1
Cows in Field	Cowhouse	1
Cowhouse	Cowhouse	4
Total		24

Covered Space per Cow.

The average lying space per cow in the covered yards was approximately 40 square feet, a figure which most farmers consider adequate. Cows on some farms had more space than this, but in most cases this was due to the yard being built to allow for an expansion in the size of the herd. However, some farmers would suggest that about 60 square feet per cow may be the optimum figure. The average requirements of straw for bedding down the covered yard is approximately $\frac{1}{2}$ cwt., per cow per week. In addition to the bedded

Table 9.

Distribution of 18 Farms with Covered Yards According to the Average Lying Space per Cow

Average Lying Space Per Cow (sq. ft.)	Numbers of Farms
Under 30	2
30 and Under 40	9
40 and Under 50	4
50 and Under 60	-
60 and over	3
Total	18

down covered area of 40 square feet, the cows on most farms have additional space for excercise amounting to about 70 square feet per cow--making a total of about 110 square feet.

Material Ensiled

Twenty of the thirty farmers used mainly spring or early summer grass for silage, and another five farmers relied almost entirely on autumn grass. A further four ensiled both arable crops and grass. It is interesting to note that only one farmer relied exclusively on arable crops for silage making. There can be little doubt that arable crops are not popular for silage making on these farms and the available statistics suggest that the acreages set aside for this purpose are falling. The high cost of growing arable crops and the difficulties involved in ensiling them successfully may be the main reasons for this trend.

Additives Used

Only six of the thirty farmers used additives in their silage making, the others being confident they were unnecessary. It should be pointed out, however, that few of the farmers attempted to make high protein silage from young green grass. Instead they prefer a lower protein silage with a higher dry matter content, and consequently there was little need of additives on most of these farms.

Type of Seal Used.

Table 10 shows that only 9 farmers with covered silos used a seal, the most popular being ground limestone. A seal may be more necessary on farms where hay and straw is not stored over the silage or where the sides

Table 10.

Type of Seal Used on 30 Farms

Type of Seal	Covered Silos	Uncovered Silos
	Number of Farms	
None	12	2
Lime	6	2
Fertilizer Bags	2	1
Soil	1	-
Fert. Bags/Soil	-	1
Sand	-	1
Rushes	-	1
Corrugated Iron	-	1
Total	21	9

of the silos are not protected against driving wind and rain.

The position is somewhat different with uncovered silos, for only two out of nine farmers omitted to use a seal. The opinion has been expressed that with a forage harvester the short lacerated grass forms a good waterproof seal when well rolled. Nevertheless, it is still necessary to prevent rainwater seeping down the sides of the silo and causing waste.

Equipment Used in Silage Making

The buckrake is by far the most popular implement for transporting the crop from field to silo. Nineteen farmers relied on buckrakes, eight had forage harvesters and three used greencrop loaders. The considerations involved in the choice of equipment are outside the scope of the report, but the attraction of the simple, low cost buckrake on many farms, particularly

Table 11.

Equipment Used in Silage Making on 30 Farms

Equipment Used	Number of Farms	Av. Tonnage of Silage Made per Farm (gross)
Buckrake	19	98
Forage Harvester	8	238
Greencrop Loader	3	257
Total	30	151

the small farms should be mentioned. Table 11 shows the average tonnage of silage made by farmers using these various implements. It indicates that the average tonnage made on farms with forage harvesters or greencrop loaders is much greater than on those with buckrakes, but it is interesting to note that several farmers use two or more buckrakes where the tonnage is considerable.

IV. SOME TECHNICAL CONSIDERATIONS OF SELF-FEEDING DAIRY COWS.

Length of Feeding Period

Information on the dates when self-feeding of silage commenced and ended is contained in Table 12. On most farms self-feeding started about the beginning of December, but a third of the farmers began in November, and a few managed to delay the commencement of self-feeding until the New Year. Of course these dates vary with (a) the season, (b) the grazing available in the

Table 12.

Dates Self-feeding Started and Finished on 24 Farms

Date Self-feeding started	Number of Farms	Date Self-feeding finished	Number of Farms
1 - 15th Nov. 1957	4	1 - 14th Feb. 1958	1
16 - 30th Nov. 1957	4	15 - 28th Feb. 1958	2
1 - 15th Dec. 1957	4	1 - 15th Mar. 1958	5
16 - 31st Dec. 1957	8	16 - 31st Mar. 1958	7
1 - 15th Jan. 1958	3	1 - 15th Apl. 1958	7
After 15th Jan. 1958	1	After 15th Apl. 1958	2
Total	24	Total	24

autumn and also with (c) the supply of other crops for winter feeding. Some farmers rely on kale before Christmas and introduce silage afterwards, while others feed silage and kale both before and after Christmas. The end of the self-feeding period depends on the available supply of silage and other foods and also on the acreage that can be grazed in the early spring. Cows can be turned out to graze soon after the middle of March on the drier farms, but even where the supply of grass is adequate this may not be possible on many heavy land farms. In this survey self-feeding generally ended between the middle of March and early April.

The self-feeding period lasted 106 days on average, ranging on individual farms from below 80 to over 140 days. With so many factors influencing both the supply of and the demand for silage it is very unlikely that the quantity of silage and the feeding period can be budgeted with great precision. On many small farms it is difficult to provide enough silage in any year, but

on the other hand, on the larger farms, there may be surplus silage left over when spring grazing commences. Silage can be stored for a further period, but it is usually necessary to empty the silo before filling with the new year's crop. After allowing for waste the average quantity of edible silage self-fed on the 24 farms is 128 tons. Three farmers made less than 50 tons

Table 13.

Distribution of Farms According to the tonnage of Silage Self-fed and the Number of Dairy Cows Self-feeding

Tonnage of Silage (excluding waste)	Number of Farms	Size of Herd	Number of Farms
Under 50 tons	3	Under 10 Cows	-
50 and Under 100 tons	6	10 and Under 20 Cows	4
100 " " 150 "	7	20 " " 30 "	9
150 " " 200 "	3	30 " " 40 "	4
200 " " 250 "	2	40 " " 50 "	4
250 " " 300 "	2	50 " " 60 "	2
300 tons and Over	1	60 Cows and Over	1
Total	24	Total	24
Average = 128 tons per farm		Average = 32 cows per farm	

but at the other extreme five farmers made over 200 tons of silage. The average size of herd per farm is 32 cows. Four farms have less than 20 cows and seven farms over 40 cows.

Silage Consumed

With an average of 32 cows and 128 tons of silage per farm and a feeding period of 106 days, it follows that the average quantity of silage consumed per cow per day is 84 lbs. Table 14 shows that the range on individual farms was enormous---from under 30 lbs, to over 120 lbs, per cow per day.

Table 14.

Distribution of 24 Farms According to the Weight of Silage Eaten per Cow per Day

Quantity Consumed per Day (lbs)	Number of Farms
Under 30 lb.	1
30 and Under 40	1
40 " " 50	1
50 " " 60	1
60 " " 70	3
70 " " 80	3
80 " " 90	2
90 " " 100	6
100 " " 110	1
110 " " 120	3
120 lb. and Over	2
Total	24

Several significant factors influence the daily intake of silage, the more important being:-

(a) Other bulky foods fed with silage
(b) Time the cows are allowed access to the silage
(c) Width of feeding face per animal
(d) Control fence on the feeding face

Other factors include, the height of feeding face, the effect of lacerated silage as opposed to long stemmy material, the consolidation obtained, the uniformity in the quality of the silage, the ease of approach to the feeding face including the condition of the surface area around the feeding face. Some of these factors are discussed below.

(a) Other bulky foods fed Table 15 shows that on 15 out of the 24 farms the cows strip graze kale after morning milking, and self-feed on silage after the evening milking until the following morning. It has been calculated that on average the cows on this system consume 50-60 lbs, of kale plus 75 lbs, of silage per day. In addition, on 10 of these farms, the cows receive an average of 4-5 lbs, of hay per day.

On five farms the cows receive no hay and, apart from a little during

the first two weeks or so of the self-feeding period, no kale. On these

Table 15.

Classification of 24 Farms According to the Other Bulky Foods Fed with Self-feed Silage

Feeding Practices	Number of Farms	Average Consumption per Cow per Day: Silage lbs.	Kale lbs.	Hay lbs.
1. Grazed Kale by day for most or all of self-feeding period (Generally night access to silage)	15	75	50-60	4-5 on 10 farms Nil on 5 farms
2. No Kale but over 10 lbs. of hay per day.	4	82	Nil	12-14
3. No Kale and No Hay except for kale in first week or two on some farms	5	112	Nil	Nil

farms the cows have 24 hours access to the silage and on average consume about 112 lbs, of silage per day. Here the range on individual farms is from about 95 lbs, to as much as 124 lbs. The cows on a further four farms have liberal quantities of hay--12 - to 14 lbs, per day-- and the average intake of silage per cow is 82 lbs, per day.

These figures give an indication of the influence of other bulky foods on the intake of silage. When fairly large quantities of kale or hay are fed the quantity of silage consumed decreases, but not always as much as expected. On average cows having $\frac{1}{2}$ cwt., of kale per day also consume 75 lbs, of silage, supporting the argument that they are very adaptable and that the generally accepted limits with regard to dry matter intake are often exceeded when they are fed a liberal and varied diet of palatable bulky foods.

Access to Silage

The length of time for which the cows are allowed to self-feed, is

closely associated with the other bulky foods fed. Table 16 shows that 24 hours access is allowed on only one-quarter of the farms, and that the majority of farmers confine access to the night period. This latter system ties up with the popular practise of grazing kale by day, as outlined in Table 15.

Table 16.

Distribution of 24 Farms According to Length of Time Allowed for Dairy Cows to Self-feed Silage

Period for Self-feeding	Number of Farms
1. 24-hour	6
2. Night Only	12
3. Day Only	2
4. Restricted to Certain Periods of the Day	4
Total Farms	24

Owing to the influence of so many variable factors and the smallness of the sample, it has not been possible to determine the effect of period of access on the quantity of silage consumed per cow, but a few impressions may be recorded. Where the period of access is restricted to two or three hours, the quantity eaten per day appears to vary between 20 and 45 lbs, per head. With either all day or all night access, and with no other restricting factors, the cows eat up to 120 lbs, or more per day with no other foods fed. With other bulky foods as well they consume 70 - 80 lbs, per day. In this sample, twenty-four hour access is confined to farms with a yard and parlour system, and feeding no other bulky foods. Continous access should provide the cows with better opportunities of consuming adequate feed, an advantage particularly where the feeding face is limited or some other factor is restricting the rapid intake of food. But it may well be that cows do not self-feed so well during the long hours of darkness in mid-winter. If feeding time is restricted to the hours of daylight, the more aggressive cows may prevent timid animals from obtaining adequate feed. Some farmers are now considering artificial light at the feeding face throughout the night, and this should make it easier for every animal to consume as much feed as it wants.

Width of Feeding Face per Animal

The standard often quoted is 9 inches of feeding face per cow, and most farmers planned their silos using this figure. However, some farmers made provision for an expansion in the size of their milking herd at a later

date, so that the average width of feeding face per cow on these farms would be much higher. The distribution of the 24 farms, according to the period of access for self-feeding, is shown in Table 17.

A number of farmers considered that even with a 12-hour feeding period, 9 inches per cow is ample, and experience on one farm would suggest that with a good layout, 4-6 inches per cow is sufficient. This may well be so with the smaller breeds of cow and also where the silage is made of lacerated grass, enabling the cows to feed more rapidly at the silage face.

Table 17.

Distribution of 24 Farms According to the Length of Time allowed for Self-feeding and the Width of Feeding Face per Cow

Period of Time for Self-feeding	Width of Feeding Face per Cow (ins.)					Total Farms
	Under 6	6 & under 9	9 & under 12	12 & under 18	18 & Over	
	Number of Farms					
1. 24-hour	-	1	3	2	1	7
2. Night Only	1	2	4	1	3	11
3. Day Only	-	-	1	-	1	2
4. Restricted to Certain Periods of the Day	-	-	-	-	4	4
Total Farms	1	3	8	3	9	24

Use of a Fence on the Feeding Face

A restricting fence on the feeding face is said to be necessary because (a) it prevents cows from trampling on the silage where the height of the face is fairly low, and (b) it helps to keep the face straight since the stock tend to burrow after the more palatable layers of silage, thereby producing an uneven face and increasing the risk of wastage. Burrowing can be particularly troublesome with silage of variable quality. Some farmers appear to be satisfied with no fence at all, but it may well be that their silage was of uniform quality during the year investigated.

Table 18 gives details of the type of fence used at the feeding face on the twenty-four farms. Several farmers claim that an electric fence with

an ordinary strand of wire is unsatisfactory since the cows often break this. To overcome this difficulty some had reverted to the use of an electrified strand of barbed wire and others were considering using an electrified galvanized pipe suitably supported at both end. No fence was used on nine farms.

Table 18.

Distribution of 24 Farms According to the Type of Fence Used on the Silage Face

	Type of Fence on Feeding Face	Number of Farms
1.	Ordinary electric fence	8
2.	Barbed electric fence	3
3.	Metal or wooden bars or hurdles	4
4.	None	9
	Total Farms	24

It is difficult to assess the effect of a fence on the quantity of silage eaten, but it can readily be appreciated that a fence can be used to prevent the cows consuming silage "ad lib." On most farms, however, it seems doubtful whether a fence on the feeding face has a marked influence on the quantity of silage consumed per day. Many claim that they used a fence merely to prevent cows climbing on the silage and to keep the face reasonably clean and tidy.

Height of Silage Face

It is generally considered that a feeding face of 5-5½ feet in height is most satisfactory for self-feeding. One or two farmers have expressed the view that a somewhat higher face of 6-6½ feet causes no problems--the cows are able to pull down the upper layers of silage, particularly lacerated material, quite easily. The extra weight and consolidation obtained with a 6-6½ feet face is not likely to restrict feeding to the same degree with lacerated silage as with long stemmy material. At the other extreme a low silage face may well affect the quantity consumed per cow, since each animal would have a smaller area of the face at which to feed. To overcome this difficulty the width of feeding face could be increased, but this is likely to lead to greater wastage.

A Concrete Apron and Approach

A concrete approach and apron with sufficient fall to enable rain-water and the liquid manure to drain away from the feeding face is essential.

Even with a good lay-out and efficient drainage, some farmers find that the disposal of manure in uncovered areas and approaches to silos is a difficult task and many are experimenting with different methods of dealing with this problem.

On one or two farms where younger store cattle of 12-15 months of age were being self-fed, the conditions around the feeding face became so muddy in mid-winter that the animals were not so eager to trudge through to the feeding face as often as they might under better conditions. With no other food but silage, they lost condition quite noticeably. Dairy cows also appreciate a good approach to the feeding face.

V. SOME ECONOMIC ASPECTS OF SELF-FEEDING DAIRY COWS

Expected Performance of Bulky Foods

Information was collected on the feeding of dairy cows and the winter rationing system on each farm. Particular attention was paid to the role of bulky foods in milk production, and an attempt was made to ascertain how closely this approached the farmers' expectations. In the first instance it is necessary to know whether farmers expect only maintenance (M) from bulky foods or whether they expect these foods, including self-fed silage, to provide for maintenance and the production of 2, 3, or even 4 gallons of milk per day from a freshly calved cow. The expectations were remarkably similar on the majority of farms. Some twenty out of the twenty-four farmers said they rely on the bulky part of the ration for maintenance and the production of 1-2 gallons of milk. Only on a few farms was M + 3 gallons hoped for and no farmer in the sample budgeted for more than 3 gallons of milk daily.

The average dry matter content and the starch and protein equivalents of the three popular rations of bulky foods mentioned earlier are set out in Table 19. Each ration is then compared with the theoretical requirements of a dairy cow giving various quantities of milk. To make these comparisons, certain assumptions have to be made regarding the quality of the foods, the quality of the milk produced and the type of cow envisaged. Also the small amounts of hay fed with Ration 1 on some farms have been omitted here.

Table 19.

Feed Requirements of a Dairy Cow at Certain Levels of Milk Production and the Nutrients Supplied by Three Individual Rations.

Feed Requirements	DM	SE	PE	Analyses of Rations	DM	SE	PE
Maintenance of Cow(M)	30.0	6.5	.65	No. 1 Ration			
Prod. of 1 gal of Milk		2.5	.50	75 lbs. of Silage	18.75	7.50	1.35
				56 lbs. of Kale	8.40	5.04	.78
M + 1 gallon		9.0	1.15		27.15	12.54	2.13
M + 2 gallons		11.5	1.65	No. 2 Ration			
M + 3 gallons		14.0	2.15	112 lbs. of Silage	28.00	11.20	2.00
				No. 3 Ration			
				80 lbs. of Silage	20.00	8.00	1.44
				14 lbs. of Hay	11.90	4.48	.45
					31.9	12.48	1.89

Assumptions on which Table 19 is based:-

The Dairy Cow weighs 1,100 lbs.

Milk of 3·7 - 3·8 butterfat content.

Crop (medium quality)	Analysis. DM	SE	PE
Silage	25·0	10·0	1·8
Kale	15·0	9·0	1·4
Hay	85·0	32·0	3·2

Several comments may be made on the three rations set out in this table.

1. Rations 1 and 2 provide 27 and 28 lbs of Dry matter respectively, but Ration 3 provides nearly 32 lbs daily.

2. Rations 1 and 3 contain sufficient SE for M + 2 gallons, but Ration 2 is somewhat lower in this respect.

3. The PE supplied in each ration is ample for M + 2 gallons and Ration 1 contributes almost enough for a further gallon.

4. It follows that the general expectation of M + 1 to 2 gallons by farmers is soundly based.

5. At the M + 2 level there is a reserve of protein in each ration and concentrates with a high starch content may be fed for part of the subsequent production requirements.

6. The dry matter in each ration approaches the theoretical maximum that the cow can consume, suggesting that the animal would have little room for concentrates. It must be emphasised, however, that these feeding standards are intended as guides only, and individual animals may consume considerably more. Indeed, on the farm studied, cows consuming the theoretical requirements from bulky foods were still able to consume their concentrate ration. On the other hand, it may well be that many high yielding cows do not eat so much bulky food, their appetites being partly satisfied by the concentrates which most animals seems to prefer.

Milk Yield per Cow.

The average yield per cow on 22 of the 24 farms was 722 gallons per annum. This may be somewhat below the average level of yields in the South-West, but it is extremely difficult to ascertain whether this is a reflection of the system of dairying, or due to the sample. Some individual herds averaged 900 gallons or more per cow. The distribution of herds by yield group,

set out below, shows that some 80% have yields below 800 gallons.

Yield per Cow (gallons)	Number of Farms.
Below 700	8
700 and below 800	10
800 and below 900	2
900 and over	2

The majority of farmers aim at a fairly level output of milk throughout the year, and most herds fell into a group producing 45-50% winter milk, with a few producing more than 50% during the winter six months. It appears then that the pattern of production on these farms was not dissimilar from that exhibited by dairy farms in general.

Level of Concentrate Feeding.

The quantities of concentrates fed and the milk produced was noted for each farm, and the information used to determine the performance from bulky foods. The average results for the 18 herds receiving Rations 1, 2 and 3 set out in Table 19 are given below:-

Average size of herd (cows)	=	31.1
Gallons produced per day (self-feeding period)	=	58.2
Concentrates fed to the herd per day (lbs)	=	157.1

It is impossible to determine from these figures whether the performance which farmers expect from bulky foods approximate the actual recorded performance, the main reason being the lack of adequate information on the feeding of each individual cow in each herd. It is possible, however, to estimate the average achievement. If it is assumed that the feeding of 4 lbs of concentrates results in the production of one gallon of milk then the 157 lbs, fed per day should produce 39 gallons of milk, the remaining 19 gallons being produced from bulky-foods. The average size of herd is 31 cows, so that bulky foods provide maintenance plus the production of about two-thirds of a gallon per cow. This herd figure cannot be compared with the level of maintenance plus 1-2 gallons which most farmers expected from individual cows. After all, the herd is made up of (a) cows giving more than 2 gallons per day, (b) others giving less than 2 gallons and (c) a proportion which are dry. A high proportion of dry cows and cows giving less than 2 gallons per day would, of

course, result in the expected performance differing widely from the overall average calculated here.

It is also possible to make another assessment of the feeding efficiency of the herds by relating the concentrates fed to the milk produced. On the sample of farms studied, it was calculated that 2·7 lbs, of concentrates were fed during the self-feeding period for every gallon of milk produced. Dairy farmers in general use 4 lbs, or more of concentrates for every gallon of milk produced during the winter period. It appears, therefore, that the farmers included in this survey are using at least 1·3 lbs, of concentrates less per gallon produced. It must not be assumed that self-feeding silage enabled this saving to be effected. On the contrary, there may be many farms where kale is grazed and silage hand-fed, and where the average consumption of concentrates is also considerably lower than 4 lbs, per gallon.

The probable effect on profit of substituting home-grown bulky foods for concentrates can be gleaned from the following data:-

Crop	Cost of SE £ per ton	Cost of Food Adequate for 1 gallon of Milk d.
Silage	25	6·7
Kale (grazed)	21	5·6
Dairy Cake	54	14·5

There seems to be every incentive to use kale and silage to replace dairy cake. Whether the self-feeding technique enables greater quantities of cake to be replaced than hand-feeding requires further investigation, but there can be no doubt that this technique can result in considerable savings in labour.

Labour.

In the introduction to this study, some of the difficulties of feeding silage were referred to, and the reasons leading up to the adoption of self-feeding techniques were given. The main difficulties are due to the weight and bulk of the material, making the hand-feeding of silage both laborious and time consuming work. By introducing self-feeding, the drudgery of handling the product is eliminated, and the time taken to feed livestock is considerably reduced. These factors in themselves make the technique particularly attractive, and may eventually encourage more farmers to make silage. In addition, there is the added attraction that self-feeding combined with a yard and parlour system, gives the farmer more scope for varying livestock numbers.

The benefits of eliminating drudgery and making the work more pleasant cannot be valued in monetary terms, but the actual hours saved can be estimated and the effect on the weekly wage bill can be determined. On large farms it may be possible to (a) reduce the number of men employed on livestock, (b) cut out some overtime payments, and (c) expand existing enterprises or introduce new enterprises with the displaced labour. On the other hand, on many small farms, relying to a large extent on unpaid family labour, the benefits of self-feeding may only be felt if the labour saved is used for expanding farm output.

Care must be taken not to credit the technique of self-feeding with labour economies directly attributable to housing of livestock in yards. To overcome the influence of housing in this survey all farmers were asked to make a careful estimate of the extra labour required each day if the silage had to be cut and carted from a silo to the stock with the existing method of housing and milking. On most farms this would involve one or two men plus a tractor and trailer or other suitable transport. For an average herd size of 32 cows it is calculated that the extra labour required for the average situation is 2·15 man hours per day. In addition just over 2 tractor hours are also required. Against this must be set the time required each day for moving the fence and generally tidying up the feeding face. This was estimated at about 20-30 minutes, but would depend on the type of housing. It can be stated, however, that on average the farmers included in the survey managed to save about 1·65 man hours per day during the self-feeding period.

VI. SELF-FEEDING OF DAIRY AND BEEF STORES.

Silage is self-fed to dairy store or beef cattle on 15 farms included in the study. Nine of these are dairy holdings on which 1-2 year old heifers are allowed access to the silage for certain periods of the day when the dairy cows are not self-feeding. A further four are dairy farms, where only the young cattle are allowed to self-feed. The remaining two farms are used for beef rather than milk production.

Number and Age of Cattle.

No precise information on the optimum number of young animals which can be self-fed together, was gleaned from this survey. On the smaller farms groups of 3 or 4 yearlings are fed quite successfully and at the other extreme, on the bigger farms, the farmers seem to be equally successful self-feeding batches of up to 60 store cattle. Yearlings of 12-18 months of age, as well as two year old stores and in-calf heifers, are included in the survey but young stock below a year old are not generally self-fed on silage although on many farms the younger calves received small quantities of silage when 4 to 5 months of age. Occasionally dry cows from the dairy herd are self-fed with the store cattle.

Length of Self-feeding Period (Days).

This varied enormously from farm to farm. On some holdings the store cattle are kept out at grass until the end of the year if the weather allows and then come indoors to self-feed silage for a period of 80-90 days. On other farms store cattle are taken off the pastures and put in yards about the middle of October, silage being self-fed for a winter period of up to 180 days. Similarly access to the silage for feeding varies quite considerably depending mainly on whether other mature stock also feed at the face, and also on the total supply of foods available.

The distribution of the 15 farms by the period of access is as follows:-

Access	No. of Farms
Part of day (3-4 hours)	4
All day (7-8 hours)	3
All night (12 hours)	2
24 hours	6
Total Farms	15

Feeding of Yearlings (12-18 Months)

The average quantity of silage eaten per animal per day is calculated to be 62 lbs. This quantity bears little relationship to the period of access to the silage, but it is influenced by the supply of other bulky foods fed, and the breed of livestock.

At the one extreme, Channel Island heifers eat about 25 lbs, of silage and have hay ad lib. At the other, there are several groups of yearlings eating 40-50 lbs, of silage and having hay or a little kale. The data also show that yearling cattle having silage only, consume 80-85 lbs, of silage per day. On one farm a group of yearlings received only an average of 46 lbs, of silage per day and no other foods. Several of the younger animals in this group lost condition.

Feeding of Two-year Old Animals

The quantity of silage eaten per animal each day (seven groups of cattle on six farms) averages 92 lb. The quantity varies from 55-65 lb., per day on farms where hay is fed ad lib., to 105 lb., per day on a diet of silage only. The animals with a low intake of silage combined with some hay failed to thrive and in one case they lost condition quite noticeably.

Rations and Feed Requirements

The patterns of food consumption emerging here may be compared with the theoretical feed requirements of yearling cattle and older stores. The data is given in Table 20 below.

Table 20.

Theoretical Feed Requirements and Popular Rations
For Yearling Cattle and Older Stores

Feed Requirements	DM	SE	PE	Rations	DM	SE	PE
1. Yearling Age 450 days, live-weight 700 lbs L. W. increase 1·24 lbs per day.	21·0	2·08	1·01	No. 1 Ration			
				50 lbs Silage	12·5	5·0	0·90
				10 lbs Hay	8·5	3·2	0·32
					21·0	8·2	1·22
				No. 2 Ration			
2. 2-year Old Store Age 720 days, live-weight 1008 lbs L. W. increase 0·93 lbs per day.	30·0	8·54	1·06	80 lbs Silage	20·0	8·0	1·44
				No. 3 Ration			
				105 lbs Silage	26·25	10·5	1·89

The quality of food in the foregoing Table is the same as in Table 19.

The following comments may be made on the data contained in Table 20.

Yearlings

1. A ration of 50 lbs, of average quality silage and 10 lbs, of average quality hay is more than equal to meet the theoretical nutrient requirements of a yearling gaining 1¼ lbs, liveweight per day.

2. A ration of 80 lbs, of silage supplies similar quantities of nutrients to those provided in Ration 1, the dry matter and SE content is somehwat lower, but the reserve of protein even higher.

Two-year Olds

1. A ration of 105 lbs, of silage provided liberal quantities of SE and PE for a 2-year old store gaining 1 lb., per day compared with the theoretical requirements, but this ration is rather low in dry matter.

VII. CHOICE FOR THE INDIVIDUAL FARMER.

Farmers contemplating self-feeding of silage should try to assess the effect of all the changes which have to be introduced. The data presented in this report are of limited value because of the number of variable factors which are likely to operate and the smallness of the sample. The survey has, however, identified some of the factors and has also provided some useful average figures of performance which can be of assistance in deciding on possible course of action. The various factors which have to be considered are set out in budget form at the end of this section. Figures have been omitted because their magnitude will depend on the particular situation on each farm. For example, the cost of a concrete apron might be very high if the site required levelling and filling. Similarly the present level of concentrate feeding, and the labour used, have to be considered carefully before assessing any possible economies as a result of self-feeding. The main variable factors are discussed briefly below.

The farmer has to estimate the capital cost of the additional concrete floor and aprons, fences and gates, involved in self-feeding silage, and a charge must be included to cover interest and upkeep costs. It is also necessary to consider the cost of providing additional silage. This may include additional fertilizer, labour and tractor fuel. Against these two main items of cost, the farmer can put any savings in concentrates and labour. There are strong indications that part at least of the additional silage will not replace concentrates, and farmers, particularly the smaller farmer, would be well advised to consider the alternative possibility of introducing some control over the daily intake of silage, such as feeding in racks or cribs. If these are at the silage face, the additional labour involved will be negligible.

Farmers also have to consider the effect on yield levels of allowing cows to help themselves to silage. This survey failed to indicate whether, in fact, the practise results in lower yields, but a fall is more likely with high yielding herds and this should be considered very seriously by farmers embarking on a self-feeding system.

It would appear that the saving in labour and possibly in concentrates as well could be offset by the charge for concreting yards, the cost of producing additional silage and the possibility of a drop in milk yields. There can be no doubt that the real attraction of self-feeding silage is the fact that drudgery is removed and that the labour saved can be used to look after additional cows. A yard and parlour coupled with self-feeding makes it possible to adjust cow numbers easily, and if self-feeding enables the farmer to keep more cows, its attractions, in most cases, are beyond disputo.

EFFECT ON PROFITS OF INTRODUCING SELF-FEEDING OF SILAGE.

Additional Costs.	£ s d	Costs Saved.	£ s d
Interest charges and upkeep costs of concrete apron, fencing and gates for self-feeding	.....	Concentrates replaced	.....
Costs of providing additional silage	.....	Labour saved: Overtime / Ordinary	.....
Concentrates and other costs for additional cows	.....		
Output Sacrificed.		**Additional Output.**	
Fall in milk production	.....	Increase in milk production	.....
Additional Profit	.....		
		Additional Loss	.....
Total		Total	

VIII. SUMMARY

1. This report presents information on the self-feeding of silage on 30 Devon farms in the 1957/58 winter. The majority are dairy or mainly dairy farms and two-thirds are over 100 acres in size. Silage was self-fed to dairy cows only on 24 farms, to dairy cows and young stock on 9 farms, and to store stock only on a further 6 farms.

2. The most popular type of silo was the covered surface silo. The average capacity of these silos, assuming 6 feet of settled silage was about 200 tons. The gross cost of the silo itself, together with roof and concrete floor and apron averaged £550 on 18 farms—equivalent to £2·9 per ton. The average cost per ton of capacity for uncovered silos was £1. (The erection of a silo qualifies for a grant of up to £250 per farm). Gross costs on individual farms ranged from 30s. 0d., to over £5 per ton of capacity for covered silos, the variations being due to differences in capacity, work on preparing site, type of material used and the value placed on the labour used in erecting the silo. Many farmers regard an adequate roof and concrete floors essential for successful silage making, and most consider an apron of concrete or other hard material to be highly desirable for self-feeding. The costs of these components vary, but an indication of present day costs may be gathered from the data set out below for a specific farm.

Gross Cost of a 150 ton Covered Surface Silo

		£
Roof	Material	265
	Labour	65
Silo	Material	135
	Labour	20
Floor	Material and labour	140
		£ 625

Average cost per ton of capacity = £4·1

3. Most farmers relied on the buckrake for transporting the crop from field to silo, but 8 farmers ensiling an average of 238 tons per annum used a forage harvester. Greencrop loaders were used on 3 farms, the average quantity ensiled being 257 tons.

4. **Silage, kale and hay made up most of the bulky foods fed to dairy cows.** The most common combination and quantities are set out below, together with the level of milk production possible from these rations.

	No. of Farms	Quantities Fed per Cow per Day lbs	Possible Production
Ration 1.	15	75 Silage 56 Kale	Maintenance plus 2 galls
Ration 2.	5	112 Silage	" " 2 "
Ration 3.	4	80 Silage 14 Hay	" " 2 "

5. The quantity of silage consumed per cow per day is influenced by the following factors:-

(a) Other bulky foods fed
(b) Period of time cows are allowed to self-feed each day
(c) Width of feeding face per animal
(d) Control fence on the feeding face
(e) Breed of cow
(f) Height of silage face and to a lesser degree factors such as the length of the ensiled grass, consolidation, quality of silage and conditions around the feeding face.

6. On half the farms access to silage was confined to the period between afternoon and morning milking. Only on one-quarter of the farms were the cows allowed 24 hour access.

7. The average width of feeding face per cow was 9-10 inches. This varied from 4 to over 18 inches, the latter figure generally referring to silos planned to allow for an increase in herd size.

8. Fifteen out of twenty-four farmers used a fence on the feeding face.

9. It is generally considered that a face 5-5½ feet high is most satisfactory for self-feeding, and on most farms the height of settled silage was between 4½-6 feet.

10. The average area of covered yard bedded down was about 40 square feet per cow. Most farmers thought this was sufficient, but some preferred to have 60 square feet. In addition each cow had approximately 70 square feet of yard for exercising and approaching the feeding face.

11. The average requirements of straw for bedding in the yards was ½cwt., per cow per week.

12. The saving of labour in self-feeding silage as opposed to cutting it and carting it to the livestock, averaged 2•15 man hours and 2 tractor hours per day for a 32 cow herd. Against this must be set about half a man hour each day for moving the fence and tidying up the feeding face.

13. Most farmers were convinced that greater quantities of silage were necessary with self-feeding. Some of the additional silage replaces concentrates but a proportion is consumed by cows which are either drying off or dry and in such cases the animals may consume more than the theoretical requirements for maintenance and production. There is then an element of "waste" in self-feeding but even so bulky foods were providing maintenance and some production on the self-feeding farms. Concentrates fed per gallon during the self-feeding period average 2•7 lbs, compared with a figure of 4 lbs, for dairy farms in the South West during the winter period.

14. Dairy stores and beef cattle can be self-fed on silage quite successfully. The data show that the average daily intake of silage is 60 - 65 lbs, for yearlings and 90 lbs, or more for two-year old animals and in-calf heifers.