May, 1954

Economic Report No. 29

Silage Cost of production

ECONOMICS OF SILAGE MAKING IN THE EAST OF SCOTLAND, 1953

by

A.B.K. TRACEY, B.Sc., N.D.A.

EDINBURGH AND EAST OF SCOTLAND COLLEGE OF AGRICULTURE
(Department of Economics), 22 ROSE STREET, EDINBURGH 2, SCOTLAND

DEPARTMENT OF ECONOMICS

STAFF

D. WITNEY, B. Com.
J.D. NUTT, B.A., N.D.A.
D.M.R. LEASK, B.Sc.
W.B. DUTHIE, B.Sc.
C.J. BLACK, B.Sc., Dip.Agric.Econ.
J.A. MACLENNAN, B.Sc.
J.D. ROWBOTTOM, B.Sc.
B. PEART, B.A.
HELEN L. SMITH, B.Sc.
A.B.K. TRACEY, B.Sc.
A.S. HORSBURGH, B.Sc.

RECENT PUBLICATIONS

FINANCIAL RESULTS OF EAST OF SCOTLAND FARMS:-

Group	1946-1947	1947-1948	1948-1949	1949-1950	1950-1951	1951-1952
	No. of Farms					
1. Hill Sheep Farms 2. Stock Rearing Farms	52	48	54	52	53	57
3. Stock Raising and Feeding Farms 4. Arable Farms 5. Dairy Farms	153	143	184	175	178	173
	205	191	238	227	231	230

COSTS OF MILK PRODUCTION 1945-46, 1946-47, 1947-48, 1948-49, 1949-50, 1950-51, 1951-52, 1952-53.

ECONOMICS OF LIVESTOCK PRODUCTION:-

(a) Winter Fattening of Sheep : 1947-48, 1948-49, 1949-50.
(b) Winter Fattening of Cattle : 1947-48, 1948-49, 1949-50.
(c) Commercial Egg Production : 1949-50, 1950-51, 1951-52.
(d) Cattle Rearing : 1951-52.

ENTERPRISE COSTS:- Economics of Silage Making in East of Scotland, 1950, 1951, 1952.

Wheat Costs - 1952 Crop.

Barley Costs - 1952 Crop.

DAIRY LABOUR IN THE EAST OF SCOTLAND.

ECONOMICS OF BRACKEN ERADICATION, 1951, 1952, 1953.

Inquiries regarding the above publications should be addressed to either the Secretary of the College or the Provincial Agricultural Economist

ECONOMICS OF SILAGE MAKING IN THE EAST OF SCOTLAND, 1953

C O N T E N T S

SECTION I.

SUMMARY

1. The thirty-six farms included in the survey are all in the area served by the Edinburgh and East of Scotland College of Agriculture. Thirteen of the farms are dairy farms where the sale of milk is a major source of income and the remaining twenty-three are cattle rearing or feeding farms producing no milk for sale. Twenty-seven of the farmers made grass silage only, four made arable silage only and five made both arable and grass silage.

2. Altogether 1,036 acres of silage were costed in 1953, of which 900 acres were grass silage and 136 arable silage. The average acreage of grass silage was 29 per farm and the average acreage of arable silage costed was 15.1 per farm.

3. Costs of production are set out in detail. The average costs of pro-:duction were £2.10. 5d. per ton for grass silage and £3. 2s. per ton for arable silage, though there were considerable variations from farm to farm.

4. The distribution of the costs of making silage under various headings - manuring costs, rent costs, seed costs, harvesting costs etc., are set out to show the comparative differences between grass and arable silage.

5. Of the factors affecting costs of production, yield per acre is very important, although other factors, notably the harvesting cost per acre and the cost of establishment also cause variations.

6. The section on practical techniques adopted in silage production has been restricted to harvesting techniques since other aspects of the production of silage have remained relatively unchanged since the 1952 season. For those who are interested in this other information, reference should be made to the report on silage making issued in 1952.*

7. It would appear from the data collected on the three main types of silage equipment used - the ordinary buckrake, hydraulic buckrake and green crop loader - that the former is to be preferred where the working team available is small and that the other two may be used most satisfactorily where the working team is larger. For maximum throughput of silage per hour where a large team is available the hydraulic buckrake appears to be the most efficient method.

8. The choice of silage crop "Arable or Grass?" is a question now being asked by many farmers. Some principles on which a reasonable choice might be based are outlined in the last section of the report.

SECTION II.

INTRODUCTION

This report is the fourth of a series based on economic surveys of the silage crop in East and South East Scotland in the years 1950, 1951, 1952 and 1953. The growth in the popularity of this crop, pointed out in the two previous reports, continued in 1953 when the estimated total production of grass silage reached the record figure of 241,442 tons. Arable silage pro-:duction has dropped from an estimated production of 68,157 tons in 1952 to 60,585 tons in 1953. The actual extent of these changes is illustrated in the table below referring to the expansion of the silage crop in Scotland over the last few years.

TABLE /

* Economic Report No. 24, May 1953, Edinburgh and East of Scotland College of Agriculture (Department of Economics), 22 Rose Street, Edinburgh. "Economics of Silage Making in the East of Scotland 1952" by A.B.K. Tracey, B.Sc., N.D.A.

TABLE I. GROWTH IN SILAGE MAKING IN SCOTLAND : 1949 to 1953 *

Year	Grass Silage		Arable Silage **	
	All Scotland tons	East Scotland tons	All Scotland tons	East Scotland tons
1949	102,100	26,618	42,177	17,712
1950	142,758	40,872	53,518	20,139
1951	187,293	60,741	70,861	25,137
1952	229,141	75,422	68,157	24,453
1953	241,442	83,017	60,585	23,895

These figures, in addition to illustrating the increase in the quantity of silage produced in the East of Scotland also show that the rate of growth in this area has been greater than in the country as a whole. East of Scotland grass silage production in 1949 represented 26% of the total for Scotland and in 1953 this figure had risen to 35%. In the case of arable silage the East of Scotland figures would appear to march in step with the Scotland figures fairly consistently and the difference in the rates of increase of the two types of silage is clearly seen. The downward tendency in the case of arable silage continues from 1952 in contrast with the rise in grass silage production. It is to be noted however that the amount of increase in grass silage production since 1952 is only 12,301 tons compared with an average annual increase of nearly 40,000 tons over the previous four years.

Various reasons have been suggested for the apparent difference in popularity between grass and arable silage. For one thing, in the case of arable silage, the crop occupies the ground for a whole year - unless catch cropping is practised - and there is a considerable risk of unsatisfactory ensilage if the crop is not chopped. In the case of grass silage the yield per acre may be less than with arable silage, but usually good preservation is obtained more easily and in addition the field can be used for grazing both before and after cutting. Whatever the reasons swaying the individual farmer's choice of silage crop may be, the fact remains, as has been pointed out in previous reports, that grass silage production is expanding more rapidly than arable silage production. Again therefore, emphasis in the report is placed mainly on the grass silage crop.

SECTION III.

DESCRIPTION OF THE FARMS COSTED IN THE SURVEY

Thirty-six farmers in the College area (comprising the eleven counties of East and South East Scotland) co-operated with the staff of the Economics Department by furnishing them with complete records of the operations involved in growing and harvesting their silage crops. Of these farmers twenty-seven made grass silage only, four made arable silage only and five made both grass and arable silage. Altogether 1,036 acres were costed in 1953, 900 acres of grass silage and 136 acres of arable silage. In only very few cases was silage fed to sheep, the vast majority of it having been made for cattle feeding. Thirteen of the farms were dairy farms where the sale of milk was the main source of income, and the remaining twenty-three were cattle rearing or feeding farms producing no milk for sale. Most of the farms had acreages of cash crops in addition to the average set aside for fodder crop production.

The /

* 1949 and 1950 figures for grass silage production are taken from "The Production of Grass Silage in Scotland" by A.M. Mackenzie, Farm Economics, Autumn 1950. The other figures have been supplied or calculated from data kindly supplied by the Department of Agriculture, Statistics Branch.

** Defined in Department of Agriculture Statistics as "Silage produced from other sources than grass".

The location of the farms and the size distribution of the acreages of silage costed per farm are given in Table II.

TABLE II. LOCATION OF FARMS

ACREAGES OF SILAGE COSTED : 1953

County	Under 20 Acres	20-40 Acres	Over 40 Acres	County Totals
Angus	3	3	1	7
Fife	3	3	4	10
Berwick	4	2	2	8
Roxburgh	1	4	-	5
Midlothian	1	1	-	2
East Lothian	-	2	-	2
Perth	1	1	-	2
TOTALS	13	16	7	36

The farms included in the survey were making silage in a fairly big way - the average acreage of grass silage costed being 29 acres and that of arable silage being 15.1 acres. The majority of the crops costed, sixteen in number, came in the 20-40 acre size group and there were thirteen crops under 20 acres in extent. On only seven farms did the acreage of silage made exceed 40 acres. However it was possible in the 1953 season to include rather more small scale farms than in previous years. The distribution of total farm size is illustrated below.

TABLE III. FARM SIZE : SILAGE COSTS INVESTIGATION, 1953

Acreage of Crops and Grass	No. of Farms Making Silage	
Acres		%
Under 50	2	5.56
51 - 100	1	2.78
101 - 200	1	2.78
201 - 300	5	13.9
301 - 400	11	30.6
401 - 500	6	16.67
501 - 600	5	13.9
601 - 700	4	11.1
Over 700	1	2.78
TOTALS	36	100
Average Total Acreage per Farm	387	

The sizes of the farms concerned are of interest since some idea can be got from them of the numbers of tractors and men likely to be available for silage harvesting. It will be seen that the average size of farm on which silage was costed was 387 acres, most of the farms being between 200 and 500 acres in extent. In the case of the smallest farms only one tractor was available while in the case of one large farm six tractors were available. It would appear from these figures that the range of silage equipment which is now available has developed in such a way as to cater for the needs of most sizes of farms.

SECTION IV. /

SECTION IV.

COSTS OF PRODUCTION

In the following tables, average costs of production per acre are set out, including in the case of grass silage, a share of the cost of establishment of the grass ley. The bases on which these costs were calculated were as follows:-

1. Labour and Power

(a) Manual labour charges were based on the actual rates of wages paid to the workers concerned on each particular farm and include allowances for all perquisites received plus an allowance for sickness and holidays with pay.

(b) Tractor and horse labour charges were made in accordance with the following standard rates:-

	Per Hour
Tractor, wheeled	4/-
Tractor, tracklayer	5/9d.
Horse	1/6d.

2. Overheads

These were charged in accordance with the rates agreed on by the Scottish Conference of Agricultural Economists.

3. Deductions for Grazing and Residual Values of Fertilisers

(a) Grazing : If the field was grazed both before and after cutting for silage, half the cost of growing the grass was charged to grazing and an approp-:riate one-half deduction made in this charge to silage.

If, as was normally the case, the field was only grazed after the silage cut was taken, then two-thirds of the cost of growing the grass were charged to the silage and a deduction of only one-third made in respect of the grazing obtained.

(b) Residual Value of Fertilisers : Deductions for residual values of fertilisers were calculated on the basis of the information given in "Advisory Leaflet No. 24 of the Department of Agriculture for Scotland".

TABLE IV. SILAGE AVERAGE COSTS PER ACRE : 1953 CROP

	Grass Silage	Arable Silage
	£ s. d.	£ s. d.
Power - Man	2. 7. 2	4. 9.10
Horse	-. -. 4	Nil
Tractor	1.19. 7	3.13. 1
Rent	1. 8. -	1.10. 5
Seeds	1. 7. 5	5.12. -
Manures - (including residual values of past dressings, the cost of application and all top dressings)	5. 2. 9	5. -. 4
Overheads	3.17. 4	6. 4. 4
Miscellaneous - (including special equipment depreciation)	1. 3. 5	1. 6. 1
TOTAL	17. 6. -	27.16. 1
Less - Residual Values	1. 5.10	Nil
Less - Share to Grazing	2.15. 2	Nil
NET COST OF SILAGE (up to and including harvesting)	£13. 5. -	£27.16. 1
Number of Records	31	9
Total Acreage	900	136
Average Acreage Costed per Farm	29	15.1
Average Yield per Acre	5.55 tons	9.68 tons
Average Cost per Ton	£2.10. 5	£3. 2. -

It /

It will be seen that in the case of grass silage the average cost per acre worked out at £13. 5s., the average yield at 5.55 tons per acre and the average cost per ton at £2.10. 5d. The average cost of arable silage was £27.16. 1d. per acre, i.e. more than double the cost per acre of grass silage, whilst the average yield was 9.68 tons per acre and the average cost per ton was £3. 2s. In 1952 the average cost per acre of grass silage was £13. 7. 2d. and the average cost per ton was £2.10.10d. The corresponding figures for arable silage were £28. 9. 2d. and £3. 3. 5d. The average yield per acre was 5.6 tons in the case of grass silage and 9.5 tons in the case of arable silage. A comparison of the two years' results would seem to indicate that there has been very little change in the cost of production of silage. However, the sample of farms was different in 1953 from that costed in 1952 and thus these two sets of figures should be treated with caution when comparisons are being made.

There were considerable deviations from the averages in both cost and yield figures in 1953.

(a) Grass Silage

The highest cost per acre was £22.12.11d. and the lowest £5.16. 9d. It may be wondered why such a large difference exists between the highest and lowest costs per acre. Mainly responsible is the variation in the types of grassland used. For instance, the lowest figure was for permanent grass on which no manure was applied in the current year and for which establishment costs were nil, and the highest figure was for a heavily manured one-year ley in the cost of which there was included a heavy charge for establishment. The highest cost per ton was £4. 8. 2d. and the lowest £1. 8. 2d. The factor which was largely responsible for this variation in cost per ton was the yield per acre which was lowest at 2.2 tons and highest at 10.65 tons.

The relation between costs per ton and yield per acre is illustrated in Table VI. on page 7 of this report, where it is seen that high yields generally result in low costs per ton and low yields in high costs per ton.

(b) Arable Silage

The range in costs per acre in this case was less than that seen in the case of grass silage due to the greater uniformity in the growing and harvesting methods which were used. The highest cost per acre was £37. 6. 3d. and the lowest £19. 1. 9d. The highest cost per ton was £4. 8.10d. and the lowest £1.17. 2d. Again in yield per acre there was less variation than in the case of grass silage, the highest yield being 15 tons per acre and the lowest being 5 tons per acre.

The Distribution of Silage Costs per Acre

There exists considerable differences in the distribution of costs of production over the various items which comprise them in the cases of arable and grass silages. These differences exist in addition to the difference in absolute costs outlined in Table V. To illustrate these differences the following table has been included.

TABLE V. /

TABLE V. DISTRIBUTION OF SILAGE COSTS PER ACRE

	Grass Silage		Arable Silage	
	£ s. d.	% of total cost	£ s. d.	% of total cost
Establishment Costs:				
Labour - Man	-. 4. 2		-.15. 5	
Horse	-		-	
Tractor	-. 5. 5		-.18. 6	
Overheads	-. 6.11		1. 2.11	
Seed	3.12. -		5.12. -	
TOTAL	£4. 8. 6		£8. 8.10	
1. Share to Current Year	£1.13. 7		£8. 8.10	
Basic Costs:				
Rent (including acreage overheads)	2. 5. 9		2. 8. 2	
Manures (non-nitrogenous manures only)	4. 3. 2		4.12.10	
2. TOTAL	£6. 8.11		£7. 1. -	
TOTAL (1 + 2)	£8. 2. 6		£15. 9.10	
Less Residual Value of the Ley	1. 5.10		Nil	
NET ANNUAL COST	£6.16. 8		£15. 9.10	
Less Share to Grazing	2.15. 2		Nil	
TOTAL	£4. 1. 6		£15. 9.10	
Top Dressing (nitrogenous manures only)	1. 4.10		-.13. 3	
3. Nett Cost of Growing	£5. 6. 4	40.1%	£16. 3. 1	58.2%
Harvesting Costs				
Power - Man	2. 5. 8		3.14. 5	
Horse	-. -. 4		Nil	
Tractor	1.17. 7		2.14. 7	
Overheads	2.11. 9		3.17.11	
4. TOTAL	£6.15. 4	51.1%	£10. 6.11	37.2%
5. Miscellaneous Costs	£1. 3. 5	8.8%	£ 1. 6. 1	4.6%
TOTAL COST PER ACRE	£13. 5. -	100%	£27.16. 1	100%

From these figures it is seen that establishment costs in the case of arable silage, being charged to one year only, form a considerably larger proportion of the total costs per acre than they do in the case of grass silage, where costs of establishment are spread over several years. The actual figures for "Share to Current Year" are respectively £8. 8.10d. and £1.13. 7d.

The net cost of growing grass silage was £5. 6. 4d. per acre; for arable silage it was £16. 3. 1d. In the latter case not only was the absolute amount greater but so also was the proportion which it constitutes of the total costs per acre, the actual percentage being 58.2% and that for grass /

grass silage being only 40.1%. Harvesting costs amounted to £6.15. 4d. per acre for grass silage and £10. 6.11d. per acre for arable silage, the proportions of the total costs in these cases being respectively 51.1% and 37.2%. Miscellaneous costs made up 8.8% of the cost of producing grass silage and 4.6% of the cost of producing arable silage.

The importance of a knowledge of the above distribution of costs lies in the fact that proper emphasis can then be put on these factors which make up the total costs in relation to the proportion of total costs which they con-:stitute. For instance, harvesting costs at approximately 51% of the total cost of grass silage are much more important than in the case of arable silage where they constitute only 37% of the total cost. Hence, improvements in harvesting technique will be relatively more important in the case of grass silage than in the case of arable silage.

FACTORS AFFECTING COSTS OF PRODUCTION

(1) Yield per Acre

Other factors being equal, the most important factor influencing the cost per ton of grass silage is the yield per acre, as is seen from Table VI., where the variation in cost per ton with yield per acre in this group of fifteen farms which made silage from three to four year leys in one cut is set out.

TABLE VI. VARIATION OF COSTS WITH YIELDS : GRASS SILAGE
1953 CROP

Yield per acre	Range in Costs per Ton							Total No. of Costs	Average Cost per ton
	20s.-30s.	30s.-40s.	40s.-50s.	50s.-60s.	60s.-70s.	70s.-80s.	Over 80s.		
tons	- - - - - - No. of Costs - - - - - - -								£ s. d.
2 - 3	-	-	-	-	-	-	1	1	4. 8. 2
3 - 4	-	-	-	1	-	1	-	2	3. 3. 2
4 - 5	-	1	-	1	-	-	1	3	2.19. 4
5 - 6	-	1	2	-	-	-	-	3	2. 1. 5
6 - 7	-	1	1	1	-	-	-	3	2. 7. 8
7 - 8	1	1	-	-	-	-	-	2	1.10. 9
Over 8	-	1	-	-	-	-	-	1	1.14. 9
TOTAL	1	5	3	3	-	1	2	15	£2.10. 9

This table gives evidence of the economy of high yields in the case of this group of grass silage costs. The position in the other groups of grass silage costs is not so clearly defined because of the small numbers in each group. In arable silage costs, the position is the same as with the grass silage group - the highest cost per ton, £4. 8.10d., was obtained with the lowest yield per acre - only 5.0 tons; and the lowest costs per ton - £1.18. 2d. and £1.17. 2d. were obtained with the two highest yields per acre - respectively 15 tons and 10.25 tons.

(2) Harvesting Costs

In order to consider the importance of harvesting costs, it is advisable to classify the farms costed into several groups according to the method of harvesting used. Only two farmers used manual labour unaided by any special machinery and this method would seem relatively unimportant. In strong /

strong contrast, twenty-nine farmers did use special harvesting machinery, the main machines used being the buckrake, the green crop loader and the hydraulically operated buckrake. Between these groups there is considerable variation in cost and to show these differences Tables VII.(a) and VII.(b) have been set out, relating respectively to grass and arable silage.

TABLE VII(a). HARVESTING COSTS : GRASS SILAGE
1953 CROP

Harvesting Equipment Used	No. of cases	Yield per Acre	Harvesting Costs *	
			Per Acre	Per Ton
			£ s. d.	£ s. d.
Green Crop Loader	10	5.39	8. 2. 3	1.12. -
Buckrake	8	4.82	7. 3. 4	1.11. 2
Hydraulic Buckrake	9	6.4	7.14. 7	1. 8.10
Manual	2	5.33	8.15. 9	1.13. 1

* Harvesting Costs = Working costs plus depreciation on special silage equipment.

TABLE VII(b). HARVESTING COSTS : ARABLE SILAGE
1953 CROP

Harvesting Equipment Used	No. of cases	Yield per Acre	Harvesting Costs *	
			Per Acre	Per Ton
			£ s. d.	£ s. d.
Binder	4	12.05	10.16.10	-.19.10
Buckrake	2	6.35	9. 7.11	1.11. 5
Hydraulic Buckrake	2	8.82	9. 3. 2	1. 2. 1
Green Crop Loader	1	8.5	11.18. 5	1. 9. 7

* Harvesting Costs = Working costs plus depreciation on special silage equipment.

In Table VII(b). the method in which a binder is used to cut and bind the crop and the sheaves are loaded on to trailer by hand appears to be the least expensive method per ton of made silage. However, yield per acre in this case is very much higher than in the other methods and comparisons are therefore hardly justified. This same comment applies to comparisons between the other three methods of harvesting which were used. Numbers in the case of each method are also too small to allow of any fair conclusion being drawn.

In Table VII(a)., there is less variation in yield, and the number of cases included is reasonably large save in the case of the manual handling method. It would appear from the table that loading by hand is the most expensive process per ton and per acre, and that mechanised loading is less costly both per acre and per ton. There is not much difference between the cost figures of the three mechanised methods although the variations in average yields may well account for this.

(3) The Costs of Establishment

Variation in these occur in the case of grass silage since the "Share to Current Year" of establishment costs depends on the length of the ley. The longer /

longer the ley the smaller is the "Share to Current Year". In the case of permanent grass the "Share to Current Year" is nil, and in the case of one year leys, it is equal to the whole amount of establishment costs. In the 1953 costs the highest "Share to Current Year" was £4. 9. 2d. - a one year ley - and the lowest, apart from permanent grass, was 11/5d. - a seven year ley.

Apart from the effect of "Share to Current Year" the costs of establishment themselves show variation mainly due to different seeds mixture costs. The lowest seeds mixture cost in the case of grass silage was £1.14s. per acre - a one year ley - and the highest was £5 per acre - a permanent grass mixture. In the case of arable silage seeds mixtures the highest cost was £6.17s. per acre and the lowest £3.13. 5d. per acre.

(4) Deductions for Grazing and Residual Values

Since, in these costs, allowances for the above items vary according to the treatment of the grass, variations in grassland management can cause quite considerable differences in the cost of silage. In the case of arable silage no deductions for grazing were made, and residual values were calculated on manurial applications only. In the case of grass silage deductions for grazing varied, sometimes amounting to as much as two-thirds, sometimes to only one-third of the "Net Annual Costs" according to the intensity of grazing. Besides deductions for manurial application, a deduction for the residual value of the grassland is made, amounting to £2. 2s. per acre for first year grass and gradually increasing by annual increments as the grass becomes older, up to about the eighth year, when the residual value - on ploughing up - is reckoned to be £3. 2s. The actual amounts deducted from the "Net Annual Cost" for grazing varied from £4.11. 5d. per acre to 14/7d. per acre with an average deduction of £2.15. 2d. per acre.

(5) Costs of Manuring*

These varied very considerably according to the particular level of fertility etc. encountered on each farm. Wide differences exist and the highest manuring cost for grass silage was £12. 6s. per acre plus a top dressing cost of £1.14s. per acre - a total of £14 per acre. The lowest manuring cost was 10/11d. per acre. In the case of the high manuring cost the yield per acre was 6.5 tons and this dropped to 2.2 tons in the case of the low manuring costs.

SECTION V.

PRACTICAL TECHNIQUES ADOPTED IN SILAGE PRODUCTION

In the previous report in this series, which referred to the 1952 silage crop, this section, dealing with the methods used in growing, harvesting and utilising both grass and arable silage, was set out in considerable detail. As very few changes have occurred in 1953 in these particular aspects of silage making it is proposed in the present report to deal solely with these changes and to refer the reader seeking further information to the 1952 report. The major change apparent in silage making in 1953 was the inclusion in the survey of a number of farms where a front-mounted buckrake fitted to a hydraulic loader unit was used for the task of collecting the grass from the swathe and loading it on to trailers. This method involves the use of rather more tractor power than the green crop loader requires but in comparison with the latter it has proved capable of higher throughput. Table VIII. below illustrates the amount of man hours and tractor hours required with the main methods used.

TABLE VIII. /

* Manuring costs figures stated include residual value of part fertiliser applications.

TABLE VIII. (a) HARVESTING DATA : GRASS SILAGE
1953 CROP

Harvesting Method Used	No. of Farms	Acreage Costed per Farm	Yield per Acre	Tonnage Costed per Farm	Man Hours	Tractor Hours	Horse Hours
			tons	tons	- - - Per Acre - - - -		
Buckrake	8	19.6	4.8	89	13.7	9.3	-
Green Crop Loader	10	27.4	5.4	138	16.4	7.9	0.5
Hydraulic Buckrake	9	28.6	6.4	175	15.0	9.4	-
Manual	2	45.5	5.3	267	18.0	10.4	-

TABLE VIII. (b) HARVESTING DATA : ARABLE SILAGE
1953 CROP

Harvesting Method Used	No. of Farms	Acreage Costed per Farm	Yield per Acre	Tonnage Costed per Farm	Man Hours	Tractor Hours	Horse Hours
			tons	tons	- - - Per Acre - - - -		
Binder	4	14.6	12.0	184	30.7	14.2	-
Buckrake	2	10.7	6.4	62	19.1	12.5	-
Hydraulic Buckrake	2	23.2	8.8	205	16.4	11.7	-
Green Crop Loader	1	10.0	8.5	85	28.4	12.0	-

Table VIII.(b) shows that where arable silage is made the farmers in the survey do seem to use the method involving a binder to quite an extent although other machines have been used rather more commonly than in previous years. However, while no general conclusions can be drawn from the above table regarding the relative efficiency of individual methods due to the smallness of the sample, it would appear that the method using the buckrake - whether of the ordinary type or hydraulically operated - uses considerably less man-:power per acre than does the binder method. In addition it must be pointed out that the sample is also unsatisfactory in the differing yields per acre - 12.0 tons in the case of the binder harvested group, 6.4 tons in the case of the buckrake group and 8.8 tons in the case of the hydraulic buckrake group. When these are taken into consideration the above comparison becomes rather less unfavourable towards the binder method.

In the case of grass silage there is again a variation in the average yields of the individual methods but the degree of variation is smaller than with arable silage. Handling the grass by hand is not very popular - only two of the twenty-nine farmers surveyed using this method. The number of man and tractor hours required per acre - respectively 18.0 and 10.4 - compares unfavourably with the mechanised methods. The ordinary buckrake uses fewer man hours per acre than the green crop loader and the hydraulic buckrake method is intermediate between the two. There is not much difference in the number of tractor hours per acre in the two buckrake methods and both exceed the figure required by the green crop loader method. However, differences are fairly small in comparison with previous years and when the effect of the varying yields is also taken into consideration it is hardly possible to draw any hard and fast conclusions on the relative efficiency of the various methods as far as consumption of man and tractor hours is concerned.

Perhaps /

Perhaps one of the most important aspects of silage making is the desirability to restrict the length of the harvesting period to some ten days or so at maximum to ensure that the most satisfactory silage is obtained. If the harvesting period exceeds this number of days the feeding value of the grass ensiled at the latter end can be considerably lower than that ensiled at the beginning of the process. In practice, it is rarely possible to achieve this object except on farms where there is relatively little silage to be made in comparison with the labour and power which is available for harvesting. Where the maximum quantity of silage which the staff can handle is being made the period is usually considerably longer than ten days. The average length of the harvesting period was about 15 days. Thus, it is of the utmost importance to consider the output which can be expected of the various methods of harvesting. In the following table the figures for throughput per loader hour are set out along with the average size of team which was used with each method.

TABLE IX. OUTPUT DATA : GRASS SILAGE : 1953 CROP

Harvesting Method Used	No. of Crops	Output per Loader Hour	Team Size	
			Men	Tractor
		tons *		
Buckrake	8	1.18	3.5	2.0
Green Crop Loader	10	1.88	5.1	2.9
Hydraulic Buckrake	9	3.00	5.7	3.3

* estimated in terms of made silage

It appears probable that where the necessary labour and power are available to keep the hydraulic buckrake working to capacity this method can have a very much greater throughout per hour than either of the other two methods. In practice, there usually have been at least five men and three tractors in the team although in one case this method was used where only three men and two tractors were used. However, in this case, the throughput per hour was only 1.56 tons indicating that the loader could not be used to full capacity with this size of team.

In the cases where green crop loaders were used the average number of men in the team was 5.1 and the number of tractors 2.9. This is about the same size team as required by the hydraulic buckrake but is considerably larger than that required with the ordinary buckrake method in which only 3.5 men and 2.0 tractors were required on average. In practice it would appear that where only a small team is available and the ordinary buckrake is used throughput per machine hour can be maintained at as high a level as with a larger team also using buckrakes. However, in the case of the hydraulic buckrake especially, and to a rather less extent with the green crop loader, there is a certain, fairly large, minimum size of team required to prevent the throughput of either machine being seriously reduced. In the case of the hydraulic buckrake it has been suggested that at least five men, and preferably six, along with three to four tractors appears to be the minimum size for maximum throughput. Smaller teams than this can work with green crop loaders and obtain satisfactory throughput but in practice again the typical team would be about five men and three tractors.

On such a comparison of team size requirements it is obvious that neither the green crop loader nor the hydraulic buckrake is so suitable for the small scale farmer as is the ordinary buckrake. Where the larger teams are available it would appear that, other factors being equal, for maximum throughput the hydraulic buckrake should be preferred to the green crop loader.

SECTION VI. /

SECTION VI.

CHOICE OF SILAGE CROP

In deciding which type of silage should be used a variety of con-:siderations will influence the farmer's choice such as the type of animal which has to be fed, the comparative costs of production of different types of silage and so on. Brief references are made to these below.

Type of Animal to which Silage is Fed

On the farms included in the survey arable silage is grown mainly for feeding to rearing and fattening animals from which very high production is not demanded. Of the nine farmers making arable silage four had dairy farms but on three of these four cases grass silage also was made and this was fed to the cows while the arable silage was reserved for young stock. The other five farmers, **depending on arable silage alone, were all engaged in fattening cattle,** having no dairy cows at all.

Of the thirteen dairy farmers included in this survey nine made grass silage alone, one made arable silage alone and three made both grass and arable silage. These figures suggest a preference on the part of dairy farmers for grass silage, but some of the farmers who fatten cattle show a preference for arable silage. The reasons for these preferences are probably two-fold:-

1. Grass silage is, as a rule, of higher protein content than arable silage - a factor of importance when highly productive dairy cows have to be fed on home-grown foods to the greatest possible extent.

2. The dairy farmer, more than other types of stock farmers, has to have his stock numbers fairly constant throughout the year. This means that by providing enough grazing for the summer months of July and August, he usually finds himself with a considerable amount more grass in the flush months of May and June than he can cope with by grazing. As an alternative to wasting this grass its conservation for winter use is very attractive to him.

The beef producer or cattle rearing farmer, on the other hand, very often wants to keep his acreage of grassland and fodder crops to a minimum so that he can grow as much cash crop as possible. In addition, he very often carries more stock in Autumn and Spring than he does in Summer and can do with very much less grazing in July and August than can the dairy farmer. His flush of grass in Spring is probably used up in fattening on the grass those animals which were not finished in the courts, but which are graded before the summer shortage of grass occurs. Even with this relative shortage of grass, enough is usually available for the reduced numbers of breeding and young stock now remaining.

For wintering his stock this type of farmer may prefer arable to grass silage since the former will give him about double the quantity of fodder per acre, compared with the latter, and so save a considerable acreage for cash crops. To him, the poorer protein quality of the former will not matter as the demands for protein made by the rearing and fattening animal are considerably less than those made by the dairy cow. The important factor to him is the Starch Equivalent and in arable silage the average figure for Starch Equivalent is 12.8%* (vetches and oats mixture) compared with average Starch Equivalent for short grass silage of 12%* and for medium grass silage of 7.9%*.

Comparative Costs of Production

Choice may also be influenced by a comparison of costs of production since arable silage at an average cost of £3. 2s. per ton is 11/7d. dearer than grass /

* Figures from Watson and More "Agriculture".

grass silage at £2.10. 5d., but again it must be stressed that when relative costs are considered the quality of the silage, based on feeding value, must also be taken into account. For instance, the dairy farmer will be comparing silage samples on the basis of Protein Equivalent for which the cost per unit will probably be in favour of grass silage production; the rearing or fattening stock farmer will be making his comparison on the basis rather of Starch Equi-:valent and, in this case, the figures will probably be in favour of arable silage production, in spite of the higher cost of production per ton.

In addition to considering direct costs such as the above, one must also remember to take into account indirect costs which are apt to rise in sub-:stituting one crop for another. For instance, if grass silage is compared with arable silage on the basis of yield of nutrients per acre, it is seen that arable silage can produce considerably more nutrients per acre than grass silage. Thus the substitution of grass silage for arable silage may mean that acreage which would otherwise be available for cash cropping has to be diverted to fodder cropping with consequent loss of income. This loss of income on reduced cash crop sales can be considered as an indirect cost chargeable, in this case, against grass silage.

An additional disadvantage which arises in the case of arable silageis the fact that it does not lend itself so well to mechanisation as does grass silage. For instance, in the buckrake methods - both ordinary and hydraulic - there is a tendency to lift a considerable quantity of soil along with the crop and this leads to the spoiling of the silage. With grass silage this is not so and is possibly another reason why many farmers prefer grass to arable silage.

ACKNOWLEDGMENT

Grateful acknowledgment is hereby made of the help of those farmers and others whose co-operation with the staff of the Economics Department made this report possible. Particular mention must be made of the help given by County Advisers who, by making suggestions regarding the content of this report, have been of very considerable assistance.

APPENDIX

(1) Establishment Costs

These are the costs of labour, power and seed used in the sowing down of the crop, plus appropriate overheads. In the case of grass silage the ley concerned may be down for several years and only part of the total establish-:ment costs are charged to the current year. This is the "Share to Current Year" and is calculated thus:-

$$\text{Share to Current Year} = \frac{\text{Total Establishment Costs}}{\text{Length of Ley (in years)}}$$

In the case of the arable silage costs which appear in Table V. the total establishment costs are charged to the current year.

(2) Basic Costs

These are made up of items charged solely to the current year and necessary for the production of the crop and include rent, residual value of manures applied in previous years, the appropriate share of manures applied in the current year (excepting nitrogenous manures : See "Top Dressing") and overheads charged where applicable.

(3) Top Dressing

The amount of this is shown as a separate item, the item of "Top Dressing" referring to application of nitrogenous manures only which were applied in the current year.

(4) Harvesting Costs

The items included in harvesting costs are solely those of the labour and power used plus appropriate overheads.

(5) Miscellaneous Costs

Under the heading are included the depreciation of equipment or capital structures used solely in connection with the silage crop (e.g. crop loader, silage pits, etc.) and miscellaneous items of cost such as molasses, binder twine, repairs to pits, etc.
