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Turnips - Cost of production
O.S.

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Turnip Production in the North-East of Scotland

by

Margaret A. Haughs, B.Sc.

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THE NORTH OF SCOTLAND COLLEGE OF AGRICULTURE

AGRICULTURAL ECONOMICS DEPARTMENT

TURNIP PRODUCTION IN THE NORTH-EAST OF SCOTLAND

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TURNIPI PRODUCTION IN THE NORTH-EAST OF SCOTLAND

I INTRODUCTION

A turnip crop survey was carried out in the counties of Aberdeen, Kincardine and Banff covering the 1963 crop. It was felt that this investigation would throw some light on the changes which have taken place in the growing and harvesting of turnips in recent years and also focus attention on the controversy which exists between the turnip growing addicts and the silage growing enthusiasts. Unfortunately a silage costs survey was not carried out during the same year, but as one was completed in 1962 on farms situated in the North of Scotland College of Agriculture area, the figures calculated then can be used for purposes of comparison. It should be noted, however, that the quality of silage was much poorer in 1963 than in 1962.

Turnips have always played an important part in the agricultural economy of the three counties, but in recent years the acreage grown has decreased considerably whilst the number of acres of grass mowed has increased substantially. Prior to the 1939/45 war, and immediately after the war, turnips supplemented by hay were the main foods fed to cattle, but in recent years silage has displaced turnips on many farms, particularly on dairy farms and on farms where store cattle are reared but not fattened.

Table 1
Acreages of Turnips, 1935 - 1963

Year	Scotland	Aberdeen	Banff	Kincardine	Total 3 Counties
	Acres	Acres	Acres	Acres	Acres
1935	350,398	N.A.	N.A.	N.A.	N.A.
1939	307,767	72,543	16,843	12,959	102,345
1945	326,926	71,478	16,396	12,595	100,469
1950	287,434	66,612	15,415	11,384	93,411
1952	276,881	65,309	15,087	11,088	91,484
1954	276,603	65,268	15,252	10,997	91,517
1956	267,941	63,877	14,804	10,785	89,466
1958	256,311	60,030	14,233	9,887	84,150
1960	244,190	58,180	13,757	9,421	81,358
1961	230,829	55,474	13,179	9,064	77,717
1962	219,965	53,496	12,647	8,739	74,882
1963	204,330	49,835	11,843	8,393	70,071
Decrease in acreage 1945 - 1963	122,596	21,643	4,553	4,202	30,398
% Decrease in acreage 1945 - 1963	37.5%	30.3%	27.8%	33.3%	30.2%

N.A. - Not available

Table II

Acreages of Grass Mowed, 1935 - 1963

Year	Scotland	Aberdeen	Banff	Kincardine	Total 3 Counties
	Acres	Acres	Acres	Acres	Acres
1935	575,204	N.A.	N.A.	N.A.	N.A.
1939	559,506	58,501	11,941	11,967	82,409
1945	493,105	43,981	8,743	9,749	62,473
1950	534,846	49,779	10,129	10,283	70,191
1952	548,521	54,036	11,802	11,065	76,903
1954	506,342	50,079	11,175	10,468	71,722
1956	541,818	54,780	12,464	11,460	78,704
1958	575,497	62,586	13,441	12,860	88,887
1960	646,534	69,590	16,266	17,279	103,135
1961	647,371	80,489	18,227	15,330	114,046
1962	664,920	80,226	18,088	15,862	114,176
1963	690,185	84,219	18,657	16,428	119,304
Increase in acreage 1945 - 1963	197,080	40,238	9,914	6,679	56,831
% Increase in acreage 1945 - 1963	39.9%	91.0%	113.4%	68.5%	91.0%

N.A. = Not available

Table I shows the acreages of turnips grown in Scotland and in the three counties concerned in this investigation, while Table II shows the acreages of grass mowed. It would have been interesting to know the exact acreage of grass cut for silage, but acreage figures are not available for each year. Table III gives details of the acreages cut for silage for those years when figures have been issued by the Department of Agriculture and Fisheries for Scotland.

Table III

Acreages of Grass cut for Silage, 1952 - 1958

Year	Scotland	Aberdeen	Banff	Kincardine	Total 3 Counties
	Acres	Acres	Acres	Acres	Acres
1952	44,340	8,586	1,509	1,734	11,829
1954	49,098	7,874	1,628	1,858	11,360
1956	55,719	10,004	2,235	1,979	14,218
1958	78,633	14,450	2,378	2,930	19,758

The total acreage of grass mowed may have been under-estimated because at the time of the completion of the 4th June Agricultural Returns many farmers do not know the exact acreage of grass which will be mowed or will be available for mowing during the summer. The actual acreages of grass mowed is partly dependent on the weather and may be greater than the figures stated in Tables II and III. It can be assumed that much of the increase in the acreage mowed which occurred between 1945 and 1963

has almost certainly been for silage. It is very doubtful if the acreage cut for hay has increased. In fact, the acreage cut for hay has probably decreased except in upland areas. It can be seen from the tables that the acreage of turnips grown in the survey area has decreased by 30.2 per cent since 1945, whilst the acreage of grass mowed has increased by 91.0 per cent.

Table IV

Turnip Acreage as a Percentage of Total Acreage Crops & Grass
(excluding rough grazing)

Year	Scotland	Aberdeen	Banff	Kincardine	Total 3 Counties
	%	%	%	%	%
1935	7.6	N.A.	N.A.	N.A.	N.A.
1939	6.7	11.7	10.8	11.2	11.5
1945	7.4	11.7	10.7	11.0	11.4
1950	6.5	10.9	10.0	10.0	10.6
1952	6.3	10.7	9.8	9.6	10.4
1954	6.3	10.6	9.9	9.5	10.3
1956	6.1	10.4	9.6	9.2	10.1
1958	5.9	9.8	9.2	8.4	9.5
1960	5.6	9.5	8.8	8.0	9.2
1961	5.3	9.0	8.5	7.7	8.7
1962	5.1	8.7	8.1	7.4	8.4
1963	4.7	8.1	7.6	7.1	7.9

N.A. = Not available

Table V

Grass Mowed Acreage As a Percentage of Total Acreage Crops & Grass
(excluding rough grazing)

Year	Scotland	Aberdeen	Banff	Kincardine	Total 3 Counties
	%	%	%	%	%
1935	12.5	N.A.	N.A.	N.A.	N.A.
1939	12.3	9.5	7.7	10.4	9.3
1945	11.1	7.2	5.7	8.5	7.1
1950	12.2	8.1	6.6	8.9	8.0
1952	12.5	8.8	7.6	9.6	8.7
1954	11.5	8.2	7.3	9.2	8.1
1956	12.3	8.9	8.1	9.8	8.9
1958	13.1	10.2	8.7	11.0	10.0
1960	14.9	11.3	10.5	14.8	11.6
1961	15.0	13.0	11.6	13.2	12.7
1962	15.4	13.0	11.6	13.5	12.8
1963	16.0	13.6	12.0	13.9	13.4

N.A. = Not available

Tables IV and V give the turnip acreage and the grass mowed acreage as percentages of the total acreages of crops and grass. Since 1945, it can be observed that the turnip acreage has decreased from 7.4 per cent to 4.7 per cent of total acreage crops and grass in Scotland as a whole and from 11.4 per cent to 7.9 per cent in the three counties under consideration in the investigation concerned, whilst the grass mowed acreage has increased from 11.1 per cent to 16.0 per cent in Scotland and from 7.1 per cent to

13.4 per cent of total acreage crops and grass in the three counties.

The number of acres of kale grown in the three counties are not included in the acreages of turnips, but this acreage has increased from only 1,168 acres to 1,208 acres in 1962. It can be seen that kale does not play an important part in the economy of the three counties. Mangolds are of even less importance, only 101 acres having been grown in the three counties in 1962.

II COSTS OF GROWING AND HARVESTING TURNIPS

Details of hours worked and other costings data were supplied by the co-operating farmers. In addition, a questionnaire covering such matters as the reasons for the growing of turnips, the attitude to the making of silage, details of livestock carried, the feeding systems practised and labour utilisation, was also answered. Twenty-three farmers completed the survey and the acreage of turnips costed totalled 565. The crops were grown on a variety of soils ranging from light sandy soil to heavy clay marl, while the height above sea level of the fields ranged from 90 to 1,000 feet.

Physical Data

Various methods of harvesting turnips were studied - turnips not pulled, i.e. grazed by sheep or cattle; turnips harvested by hand; turnips harvested by a mechanical puller, but loaded on to carts or bogies by hand; and turnips harvested completely by mechanical means, i.e. never touched by hand during harvesting. The turnips were costed from the time farmyard manure was applied to the point when the turnips were carted to the steading or the nearest point for feeding to the cattle or sheep. Table VI gives details of the physical data and the number of hours required by man and by tractor for the various methods of harvesting.

The quantity of fertilisers applied per acre varied considerably, but it was found that on average, approximately $5\frac{3}{4}$ cwts. of a concentrated boronated type of turnip manure was used while on 8 farms an average application of 10 cwts. per acre of basic slag was also applied. Farmyard manure was applied on all but three of the farms, whilst lime was only applied to three fields at an average rate of 2 tons per acre.

As precision seeders were used on all farms, the quantity of seed sown per acre did not vary greatly. The varieties of seeds used are too numerous to mention, but the main type of yellow turnip grown was Wallace whilst the most popular variety of swede was Down Major. It should be pointed out that in this particular area yellow turnips and swedes are all classified by farmers as turnips and are more popularly referred to as "neeps". Yellow turnips are used mainly by cattle in the months of October and November, but they may also be grazed by sheep until March, the weather and the amount of frost being limiting factors to their use. Swedes, on the other hand, can be used by cattle throughout the entire winter and it is common for farmers to grow 4 to 5 varieties of Swedes which reach maturity at different times.

Man and Tractor Hours per Acre

The number of man and tractor hours required per acre to grow turnips varied considerably from farm to farm. The highest number of man hours recorded per acre was 51, whilst the lowest figure was 8. This low figure occurred on a farm where no farmyard manure was applied and where the turnips were never singled having been sown at 6" spacing. Hand-hoeing, which was carried out on all of the other farms, occupied from 5 to 20 hours per acre even though a precision seeder was used.

Table VI

Turnip Costs - Physical Data

	Turnips not Pulled	Turnips Harvested By Hand	Turnips Harvested By Puller	Turnips Harvested Mechanically	Average of all Turnips Costed
No. of Farms	3	3	13	4	23
No. of Farms growing Turnips after Grass	3	1	1	4	9
No. of Farms growing Turnips after Cereals	-	2	12	-	14
Average yield per acre	26.3 tons	30.7 tons	27.8 tons	35.3 tons	29.3 tons
Total Acreage of Turnips grown	46	50	199	270	565
Av. Acreage of Turnips grown per Farm	15.3	16.7	15.3	67.5	24.6
Av. Quantity of Boronated Fertiliser applied per acre	7.0 cwts.	7.0 cwts.	5.5 cwts.	5.4 cwts.	5.8 cwts.
No. of Farms that applied F.Y.M.	1	3	12	4	20
No. of Farms that applied Basic Slag	1	3	4	-	8
No. of Farms that applied Lime	-	1	1	1	3
Av. Quantity of Seed sown per acre	1.0 lbs.	0.9 lbs.	0.9 lbs.	1.0 lbs.	0.9 lbs.
<u>AVERAGE NO. OF MAN HOURS PER ACRE</u>	<u>Man Hours</u>	<u>Man Hours</u>	<u>Man Hours</u>	<u>Man Hours</u>	<u>Man Hours</u>
Carting & Spreading F.Y.M.	4.7	14.0	12.3	13.5	11.7
Ploughing	3.0	3.0	3.2	3.0	3.1
Cultivations	4.5	7.0	4.0	3.5	4.4
Applying Manure	1.6	2.0	1.9	1.4	1.7
Ridging	1.2	1.0	1.0	1.0	1.0
Sowing Seed	1.2	1.0	1.0	1.0	1.1
Row Crop Work	2.5	3.0	2.2	2.1	2.3
Hoeing	4.3	17.2	14.2	15.2	13.5
SUB-TOTAL	23.0	48.2	39.8	40.7	38.8
Harvesting	-	48.2	16.7	9.1	17.4
TOTAL	23.0	96.4	56.5	49.8	56.2
<u>AVERAGE NO. OF TRACTOR HOURS PER ACRE</u>	<u>Tractor Hours</u>	<u>Tractor Hours</u>	<u>Tractor Hours</u>	<u>Tractor Hours</u>	<u>Tractor Hours</u>
Carting and Spreading F.Y.M.	4.0	11.3	10.2	11.5	9.7
Ploughing	3.0	3.0	3.2	3.0	3.1
Cultivations	4.5	7.0	4.0	3.5	4.4
Applying Manure	1.6	2.0	1.9	1.1	1.7
Ridging	1.2	1.0	1.0	1.0	1.0
Sowing Seed	1.2	1.0	1.0	1.0	1.1
Row Crop Work	2.5	3.0	2.2	2.1	2.3
SUB-TOTAL	18.0	28.3	23.5	23.2	23.3
Harvesting	-	23.1	15.6	9.2	13.5
TOTAL	18.0	51.4	39.1	32.4	36.8

Harvesting hours varied considerably depending on the method of harvesting. The highest number of hours required to harvest one acre was 59 on one farm where turnips were pulled by hand, while the lowest was 5 hours on another farm where a mechanical harvester was used and where the field involved was near the steading and very little time was involved in carting the turnips. Casual labour was employed on one farm only to hoe turnips and no casual labour was used for harvesting.

Turnip Costs per Acre

Table VII shows the average manual labour costs and tractor costs of growing and harvesting turnips per acre. The majority of the growing costs, including ploughing, applying manure, ridging, sowing seed and row crop work were very similar for each farm. The cost of carting and spreading F.Y.M. varied according to the quantity applied. Cultivations also showed some variation depending on the amount of work required in the way of discing, harrowing and rolling, to arrive at a suitable tilth for ridging and sowing. As indicated in the section on Man and Tractor Hours per Acre, the hoeing and harvesting hours varied considerably with the result that manual labour costs varied in a similar way.

Table VII
Manual Labour and Tractor Costs Per Acre

	Turnips not Pulled	Turnips Harvested By Hand	Turnips Harvested By Puller	Turnips Harvested Mechanically	Average of all Turnips Costed
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
<u>MANUAL LABOUR COSTS PER ACRE</u>					
Carting & Spreading F.Y.M.	1: 4: 6	3:13: 6	3: 4: 7	3:10:10	3: 1: 8
Ploughing	-:15: 9	-:15: 9	-:17: -	-:15: 9	-:16: 5
Cultivations	1: 3:10	1:16: 9	1: 1: 2	-:18: 5	1: 3: 1
Applying Manure	-: 8: 4	-:10: 6	-: 9: 9	-: 7: 2	-: 9: 2
Ridging	-: 6: 6	-: 5: 3	-: 5: 2	-: 5: 3	-: 5: 4
Sowing Seed	-: 6: 5	-: 5: 3	-: 5: 5	-: 5: 3	-: 5: 6
Row Crop Work	-:12:11	-:15: 8	-:11: 4	-:11: 2	-:12: 1
Hoeing	1: 2: 9	4:10: 3	3:14: 6	3:19:11	3:10: 9
SUB-TOTAL	6: 1: -	12:12:11	10: 8:11	10:13: 9	10: 4: -
Harvesting	-: -: -	12:13: 1	4: 7:10	2: 7:10	4:11: -
TOTAL	6: 1: -	25: 6: -	14:16: 9	13: 1: 7	14:15: -
<u>TRACTOR COSTS PER ACRE</u>					
Carting & Spreading F.Y.M.	-:17: -	2: 8: 2	2: 3: 2	2: 8:11	2: 1: 5
Ploughing	-:12: 9	-:12: 9	-:13: 9	-:12: 9	-:13: 4
Cultivations	-:19: 4	1: 9: 9	-:17: 1	-:14:10	-:18: 8
Applying Manure	-: 6: 9	-: 8: 6	-: 7:11	-: 4:10	-: 7: 4
Ridging	-: 5: 3	-: 4: 3	-: 4: 2	-: 4: 3	-: 4: 4
Sowing Seed	-: 5: 2	-: 4: 3	-: 4: 5	-: 4: 3	-: 4: 5
Row Crop Work	-: 9: -	-:12: 9	-: 9: 2	-: 9: 1	-: 9: 7
SUB-TOTAL	3:15: 3	6: -: 5	4:19: 8	4:18:11	4:19: 1
Harvesting	-: -: -	4:17:11	3: 6: 8	1:18: 8	2:17: 2
TOTAL	3:15: 3	10:18: 4	8: 6: 4	6:17: 7	7:16: 3

The turnip costs per acre and per ton are given in Table VIII. Seed costs did not vary from farm to farm, but the cost of manures did, depending

on the type and quantity applied. The majority of the farms costed were owner-occupied and, in these cases, the farmer was asked to give his estimate of the current rental value of the land, whereas on tenanted farms the actual rent paid per acre was taken. Surprisingly the rent paid by most of the tenanted farms was very low, the average being £1:15s. per acre and most of the tenanted farms were on above average quality land.

The costs of production to harvest were greatest in the hand harvested group and lowest on the farms where turnips were not pulled. In the two groups, turnips harvested by puller and turnips harvested mechanically, the total costs of production to harvest were very similar. Harvesting costs affected the total costs per acre considerably, the costs of harvesting being £28 where turnips were harvested by hand and only £9 where turnips were harvested mechanically. However, it must be pointed out that the distance which the turnips have to be carted from the field to the steading can vary considerably thus influencing the cost of harvesting.

The average yield of the turnips costed was 29.3 tons per acre which may be considered higher than the normal average. However, a sample of the crop on each farm was weighed and it is believed that the figure of 29.3 tons is realistic for the crops costed. The highest yield recorded was 40 tons and the lowest 20 tons per acre. The average total costs per ton of turnips which were not pulled was £1, but the costs ranged from 10s.9d. to £1: 8:11d. Where turnips were harvested by hand, the range was from £2: 3: 5d. to £2: 8: 7d.; where harvested by puller, from £1: 6: 8d. to £2: 5: 1d.; and where harvested mechanically, the costs ranged from £1: -: 6d. to £1: 9: 5d. per ton.

Table VIII

Turnip Costs Per Acre and Per Ton

Costs per Acre	Turnips not Pulled	Turnips Harvested By Hand	Turnips Harvested By Puller	Turnips Harvested Mechanically	Average of all Turnips Costed
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
<u>COSTS OF PRODUCTION TO HARVEST</u>					
Rent	3: -: 2	3: 6: 3	2: 8: 3	2: 6: 10	2: 11: 10
Manures	5: 10: 11	7: 8: 8	5: 11: -	5: -: 1	5: 14: -
Seed	-: 7: -	-: 6: 3	-: 6: 5	-: 7: -	-: 6: 7
Manual Labour Costs	6: 1: -	12: 12: 11	10: 8: 11	10: 13: 9	10: 4: -
Tractor Costs	3: 15: 3	6: -: 5	4: 19: 8	4: 18: 11	4: 19: 1
Overheads	7: 11: 6	12: 14: -	10: 12: 6	10: 12: 4	10: 9: 7
TOTAL	26: 5: 10	42: 8: 6	34: 6: 9	33: 18: 11	34: 5: 1
<u>COSTS OF HARVESTING</u>					
Depreciation	-: -: -	-: -: -	-: 14: 6	1: 6: 5	-: 12: 10
Manual Labour Costs	-: -: -	12: 13: 1	4: 7: 10	2: 7: 10	4: 11: -
Tractor Costs	-: -: -	4: 17: 11	3: 6: 8	1: 18: 8	2: 17: 2
Overheads	-: -: -	10: 15: 7	5: 16: 7	3: 7: 3	5: 6: 1
TOTAL	-: -: -	28: 6: 7	14: 5: 7	9: -: 2	13: 7: 1
TOTAL COSTS PER ACRE	26: 5: 10	70: 15: 1	48: 12: 4	42: 19: 1	47: 12: 2
YIELD PER ACRE	26.3 tons	30.7 tons	27.8 tons	35.3 tons	29.3 tons
<u>COSTS PER TON</u>					
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Costs of Production to Harvest	1: -: -	1: 7: 8	1: 4: 8	-: 19: 3	1: 3: 5
Costs of Harvesting	-: -: -	-: 18: 5	-: 10: 4	-: 5: 1	-: 9: 1
TOTAL COSTS PER TON	1: -: -	2: 6: 1	1: 15: -	1: 4: 4	1: 12: 6

Table IX

Distribution of Farms According to Turnip Costs per Acre

Total Costs Per Acre	Turnips not Pulled	Turnips Harvested By Hand	Turnips Harvested By Puller	Turnips Harvested Mechanically	All Farms
Under £20	1				1
£20 to less than £30	1				1
£30 " " " £40	1				1
£40 " " " £50			6	4	10
£50 " " " £60			7		7
£60 " " " £70		1			1
£70 and over		2			2
Total	3	3	13	4	23

Distribution of Farms According to Turnip Costs per Ton

Total Costs per Ton	Turnips not Pulled	Turnips Harvested By Hand	Turnips Harvested By Puller	Turnips Harvested Mechanically	All Farms
Under £1	1				1
£1: -: - to less than £1: 5: -	1			2	3
£1: 5: - " " " £1: 10: -	1		3	2	6
£1: 10: - " " " £1: 15: -			2		2
£1: 15: - " " " £2: -: -			4		4
£2: -: - " " " £2: 5: -		1	3		4
£2: 5: - and over		2	1		3
Total	3	3	13	4	23

Table IX sets out the distribution of farms according to the turnip costs per acre and per ton and it can be seen that 17 farms are in the £40 to £60 per acre costs group and 12 farms in the £1: 5: - to £2: -: - per ton costs group.

1963 was certainly a good year for the turnip crop and the recorded yield of 29.3 tons on the costed farms was considerably above the average level of yield shown in the figures issued by the Department of Agriculture and Fisheries for Scotland in Agricultural Statistics. Table X gives the average yields of turnips in the three counties and Scotland for various years up to 1962.

Table X
Yields of Turnips per Acre, 1935 - 1962

Year	Scotland	Aberdeen	Banff	Kincardine
	tons	tons	tons	tons
1935	16.2	N.A.	N.A.	N.A.
1939	16.1	13.4	15.0	13.5
1945	16.7	13.7	14.9	12.9
1950	16.6	16.6	16.6	14.8
1952	18.6	18.2	20.4	15.0
1954	18.7	19.3	19.4	15.8
1956	18.6	17.3	16.4	17.6
1958	18.5	17.9	18.6	13.3
1960	20.1	18.1	19.8	16.9
1962	20.5	17.6	19.5	17.7

N.A. = Not Available

As the yields per acre were high on the farms costed, it was decided to set out the turnip costs per ton in the form of a sliding scale. The growing costs per acre have been taken as being constant at £34: 5: 1 per acre (i.e. at the actual average costs of production per acre to harvest) and in the case of turnips harvested by puller and turnips harvested mechanically, the depreciation has been kept as a constant cost per acre. The harvesting costs have been varied according to the yield per acre on the assumption that it takes, for example, half the time to harvest a 15 ton crop of turnips as it does to harvest a 30 ton crop. This assumption may not be quite true in practice, but for the purpose of constructing estimates this assumption is a fair one. Table XI sets out the estimated total turnip costs per ton according to yield on the basis of the method detailed above.

Table XI
Estimated Total Turnip Costs per Ton According to Yield

Yield per Acre	Turnips not Pulled	Turnips Harvested By Hand	Turnips Harvested By Puller	Turnips Harvested Mechanically
tons	£ s. d.	£ s. d.	£ s. d.	£ s. d.
10	3: 8: 6	4: 6: 11	3: 18: 9	3: 15: 6
15	2: 5: 8	3: 4: 1	2: 16: 6	2: 11: 9
20	1: 14: 3	2: 12: 8	2: 4: 10	1: 19: 11
25	1: 7: 6	2: 5: 11	1: 17: 10	1: 12: 10
30	1: 2: 10	2: 1: 3	1: 13: 2	1: 8: 1
35	-: 19: 7	1: 18: -	1: 9: 10	1: 4: 8
40	-: 17: 1	1: 15: 6	1: 7: 4	1: 2: 1

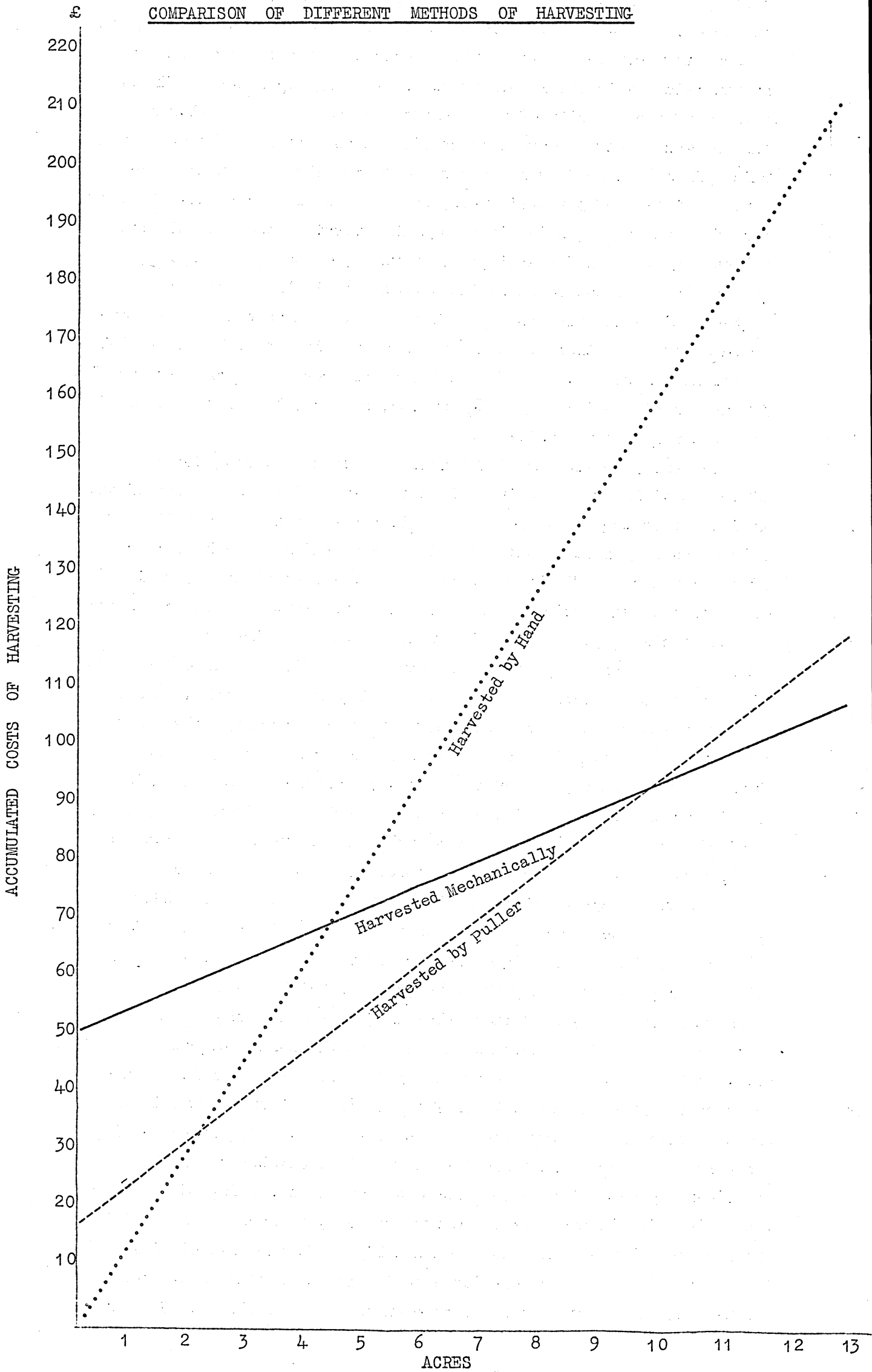
It can be seen from an examination of Table XI that the costs per ton of a 15 ton crop of turnips not pulled is equivalent to a 25 ton crop harvested by hand, a 20 ton crop harvested by puller and approximately a $17\frac{1}{2}$ ton crop harvested mechanically. The percentage difference in costs per ton between the various methods of harvesting is greater at higher yields than at lower yields, e.g. in the case of turnips harvested by hand, the cost per ton is 24 per cent higher than when harvested mechanically at a yield of 15 tons per acre whereas the cost per ton is 47 per cent greater at a yield of 30 tons per acre. On this basis alone, it might be considered advisable to change over to a mechanical means of harvesting, if higher yields are normal on a particular farm where hand harvesting is practised.

Comparison of Different Methods of Harvesting Turnips

Graph I gives a comparison of the different methods of harvesting turnips. The average purchase price of a puller is £120. When this figure is depreciated by 15 per cent the cost of depreciation per year is £18. The cost of a mechanical harvester is £340, giving a depreciation of £51 per year. This figure may be rather low because a puller or a harvester may not last for approximately seven years and no account is taken of the cost of repairs during that period. It was decided to omit overhead costs when calculating the figures for the graph, because owing to the method used to allocate overheads, turnips harvested by hand have to carry a far larger share than may be experienced in practice. However, on adding the depreciation to the manual labour and tractor costs of harvesting per acre, it can be seen from the graph that a puller might be justified when only $1\frac{3}{4}$ acres of turnips are grown when compared with hand-pulling and carting, whereas a mechanical harvester might be justified when $3\frac{3}{4}$ acres of turnips are grown. On the other hand, when comparing a puller with a mechanical harvester, it can be seen that a mechanical harvester would only be justified when approximately $9\frac{1}{2}$ acres of turnips are grown. The initial cost of a mechanical harvester may deter many small farmers from buying this implement, but there should be no reason why a harvester or even a puller could not be purchased on a co-operative basis, thus saving man labour and drudgery during the winter-time.

III TURNIPS VERSUS SILAGE?

The co-operators, on being asked for their reasons for preferring to grow turnips rather than silage, gave a variety of answers. The main comment was that more cattle and sheep could be kept on the same number of acres during the winter and that more cattle could also be kept on the grass in summer. The farmers who were engaged in fattening cattle stated that turnips were far superior to silage for finishing cattle. One farmer gave no excuses for growing turnips rather than silage, but stated that "you can't learn an old dog new tricks". Most farmers thought that turnips were a more economical proposition than silage and that they were more nutritious and beneficial as a stock feed. It should be remembered in evaluating their answers that all of the farmers had more experience in the



growing of turnips than silage and also that turnips are traditional in the area. Most of the farmers considered that the turnip crop was a more risky enterprise than silage, both with regard to crop failure and in relation to its liability to frost damage in winter. In the opinion of the majority of the farmers, the cereal crop following turnips was likely to have a lower yield than cereals grown after grass. This opinion was held by farmers who followed the traditional six-course rotation of 3 years' grass, cereals, turnips, cereals. However, some farmers are beginning to change this rotation and the rotation followed by them is 3 years' grass, turnips, cereals, cereals. In the opinion of these farmers, the cereal crop is likely to have a higher yield after turnips than after grass, because when cereals are grown after grass there is a greater risk of "lodging", but this risk is eliminated when turnips follow the grass crop before growing cereals. If farmers discontinued growing turnips, arable silage could, if desired, take its place in the rotation.

Farmers were also asked for their opinions regarding the question of the feasibility of growing silage instead of turnips. Most of them admitted that they would be prepared to convert existing buildings for silage and many stated that very little conversion would be required. It would not be difficult to change the pattern of rotation, while the shed for storing turnips, in most cases, could be converted to a store or into a silage pit. The only turnip machinery which could be released would be the precision seeder and a puller or harvester. In the case of those farmers not already equipped for the job a forage harvester and bogies, etc. would have to be purchased if silage-making was embarked upon. On those farms where silage was grown as well as turnips the average yield of silage was 7 tons per acre. Manurial treatments to grass for silage seemed to be fairly liberal, the average application being 4 cwts. of a concentrated compound. Only two farmers thought that any of their regular employees could be released by substituting silage for turnips, but another six farmers considered that if wages continued to increase a change over to silage would be justified.

Turnips have a far higher labour requirement than silage. In the six months prior to sowing the turnips, i.e. October to March, approximately 15 hours of manual labour are expended in ploughing and carting and spreading farmyard manure. In the spring and summer months, i.e. April to September, approximately 24 hours of manual labour are required. This figure includes 14 hours to hoe turnips, but in the future, this process may eventually be discarded. The hours required to harvest the crop the following winter, i.e. October to March, vary considerably according to the method of harvesting, being 48 hours or approximately six man days to harvest by hand, 17 hours to harvest by puller and 9 hours to harvest mechanically. In the case of silage the labour requirements are restricted to the summer months, i.e. March to August, the total man hours per acre on the farms costed in 1962 being

These figures suggest that more livestock units were kept per acre on farms growing turnips than on farms growing turnips and silage. Approximately 1.3 acres were required to keep a livestock unit for a year.

Although good quality silage is sufficient by itself to feed store cattle or even to fatten advanced stores, the quantity of turnips which would have to be consumed to achieve the same ends would be practically a physical impossibility. Therefore turnips have to be supplemented with some other form of feeding, such as hay and draff. The majority of the farmers in the survey, besides feeding turnips and hay or turnips and silage, supplemented their feeding with draff and cereals or draff and a concentrate mixture.

Possibly the only practical way in which silage and turnips can be compared is on the basis of the cost per ton of starch equivalent. In the case of feeding cattle, the quantity of digestible crude protein in turnips and silage can be ignored because turnips supply sufficient digestible crude protein to rear and fatten cattle. However, in the case of dairy cows digestible crude protein has to be taken into consideration because, although turnips themselves might be sufficient to maintain a dairy cow, good quality silage should have enough digestible crude protein to maintain and also to produce up to two or even three gallons of milk. This fact alone makes it very difficult to try to compare the two methods of feeding. Tables XIII and XIV do, however, indicate which system might be the most profitable method of feeding on the basis of cost per ton of starch equivalent at different levels of yield of turnips and silage.

Table XIII

Cost per Ton of Starch Equivalent at Varying Levels of Turnip Yield

Yield per acre	Yield per acre of Starch Equivalent at 8%	Cost per ton of Starch Equivalent			
		Turnips not Pulled	Turnips Harvested By Hand	Turnips Harvested By Puller	Turnips Harvested Mechanically
tons	tons	£ s. d.	£ s. d.	£ s. d.	£ s. d.
15	1.2	28:10:10	40: 1: -	35: 6: 3	32: 2:10
20	1.6	21: 8: 2	32:18: 4	28: -: 5	24:19:11
25	2.0	17: 2: 9	28:13:11	23:12:11	20:10: 5
29	2.3	14:17: 4	26: 9: 7	21: 7: 8	18: 3: 6
35	2.8	12: 4: 9	23:15: -	18:13: -	15:10: 4
40	3.2	10:13: 6	22: 3: 9	17: 1: 8	13:16: -

Table XIV

Cost Per Ton of Starch Equivalent at Varying Levels of Silage Yield

Yield per acre (based on consolidated and <u>not</u> fresh material)	Yield per acre of Starch Equivalent at 10%	Cost Per ton of Starch Equivalent	Yield per acre of Starch Equivalent at 14%	Cost per ton of Starch Equivalent
tons	tons	£ s. d.	tons	£ s. d.
5	0.5	24:15:10	0.7	17:14: -
7	0.7	22: - : -	1.0	15: 8: -
9	0.9	20:10: -	1.25	14:15: 3
11	1.1	19:10: -	1.5	14: 6: -
13	1.3	18:16: 8	1.8	13:12: -

In calculating the costs per ton of starch equivalent of turnips, the turnip cost figures shown in the sliding scale in Table XI have been used. Similarly in calculating the cost per ton of starch equivalent of silage, the 1962 silage cost figures* were varied according to the yield of silage. Two percentages relating to the yield per acre of starch equivalent of silage have been used, one at a level of 10 per cent which was the average starch equivalent for silage in this region for 1963 and the other at 14 per cent which represents a very good sample of silage. The yield of 5 tons per acre of silage is the figure issued by the Department of Agriculture and Fisheries for Scotland for this region and at this yield level it can be seen that the cost per ton of starch equivalent for 10 per cent quality silage is equal to a crop of turnips not pulled yielding slightly less than 20 tons. It would also be equal to a 35 ton crop of turnips harvested by hand, to a 20 to 25 ton crop harvested by puller and approximately to a 20 ton crop harvested mechanically. As 7 tons of silage and 29 tons of turnips were the average yields achieved by the farmers in the survey, it can be seen that in comparison with the average quality silage only turnips harvested by hand have a higher cost per ton of starch equivalent, but in relation to the very good quality silage only the turnips not pulled have a lower cost of starch equivalent.

* Economic Report No. 108, Enterprise Cost Series, 1962.

IV CONCLUSIONS

From the foregoing paragraphs, it can be seen that the turnip crop is still an expensive crop to grow. However, it is believed that there may be a resurgence in the popularity of turnips because of the introduction of more efficient mechanical harvesters. Growing costs may also be decreased considerably as a result of the advancement of pre-emergence spraying techniques. When these techniques have been perfected, the time may come when all turnips will be sown at 6" - 8" spacing and no hoeing will be required - only some inter-row cultivations. This could decrease the cost of growing considerably. Small farmers may object to the capital expense of buying a mechanical harvester, but there is no reason why a group of five to six farmers could not invest in such an implement. The turnip crop is not one which has to be harvested at a particular time of year and as up to 4 to 5 acres can be harvested in one day, it should be relatively easy to share a harvester. The storing of turnips is not favoured in the area studied and most farmers only store about a fortnight's to a month's supply as an insurance against bad weather. However, turnips are stored quite successfully in other parts of the country and there is no apparent reason why this policy could not be followed in the three counties.

It is very difficult to generalise regarding the turnips versus silage controversy. Possibly more cattle can be kept per acre where turnips are grown but this might involve the use of other feeds as well. If only poor to moderate yields of poor quality silage are achieved (i.e. under 7 tons at below 10 per cent starch equivalent) and high yields of turnips (i.e. over 30 tons) are obtained, the cost per ton of starch equivalent would be less in the case of turnips. However, if high yields of good quality silage can be achieved, the cost per ton of starch equivalent derived from silage is considerably less than that from turnips. If turnip yields of 30 tons per acre and over are achieved then there may well be justification for turnips to be grown in preference to silage. Some farmers along the Banffshire coast and in the Howe of the Mearns, Kincardineshire, have, as a general rule, yields of this magnitude and this is probably the reason why silage has never gained popularity in these districts. Because so much depends on the general farm policy, it is very difficult to give any true guide as to whether to grow silage or turnips. If labour is available and this labour cannot be put to alternative use, turnips may well be the crop to grow. On many feeding farms, the cattlemen are responsible for the pulling and carting of turnips as well as attending to the stock and these men are also available to hoe turnips and help with hay-making when otherwise they might be under-employed. It might be argued that if two cattlemen are kept, one might be dispensed with and fewer cattle kept during the winter, but the majority of farmers like to see the buildings well stocked during the winter and would therefore be unwilling to do this. Again many farmers consider that

a high output per acre is desirable and where good yields of turnips are achieved the output per acre is definitely greater than where silage is grown, but whether the margin per acre is higher will depend on the yields of the crops and the relative efficiency of the feeding of the cattle.

It may be possible to arrive at a compromise when both silage and turnips can be grown. A few farmers in the Aberdeen area who unfortunately have not been costed, grow a 1-year silage mixture which is cut in the middle of May. This field is then ploughed up and yellow turnips sown before the end of May. This means that approximately six tons of silage are made per acre and the turnips yield 18 to 20 tons per acre. This practice could perhaps be more extensively used, particularly on smaller farms in order to make more use of land by taking two crops off one field in a year.

APPENDIX

SOME NOTES ON COSTINGS METHODS

Labour

Man Labour	5/3d. per hour
Tractor Labour	4/3d. " "

Overhead Costs

Per £ Direct Man Labour	7/-d.
Per Hour of Tractor	
Equivalent Labour	5/6d.
Per Acre	40/-d.

Farmyard Manure

Only the cost of carting and spreading farmyard manure was taken account of, the value of F.Y.M. not being considered. No credit has been allowed for manurial residues.

Artificial Manures

The value of manurial residues has been ignored, the value of all manures being allocated to the crop costed.

Depreciation

All turnip harvesting equipment was depreciated at the standard rate of 15 per cent.

Grazing Livestock Units

The normal standards were used to calculate the stocking rates on the farms studied.

Starch Equivalent and Digestible Crude Protein

All values were obtained from "Rations for Livestock", Bulletin No. 48 of the Ministry of Agriculture, Fisheries & Food, but advice was also given by the Chemistry Department, the County Advisory Service, and the Animal Husbandry Department of the North of Scotland College of Agriculture.