Turnips - Cost of production

MAY 1962

ECONOMIC REPORT NO. 74

Costs of Turnip Production in the East of Scotland 1961 CROP

by

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R.62/37

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Some Notes on the Depreciation and Repair Costs of Farm Machinery
Hill and Upland Sheep Production Costs.

Copies of these publications may be obtained on request to the Secretary of the College or the Advisory Economist.

FOREWORD

The reduced popularity of the turnip crop presents a problem. The replacement of this crop by silage is by no means straightforward. In the main, the feeding of silage is restricted to cattle and so long as arable sheep remain as part of the farm economy, turnips may be regarded as an essential crop. Even for cattle feeding a change over from turnips to silage is not a simple one. It can be demonstrated that the costs per unit of producing animal food are lower when silage is made but, on the other hand, the turnip crop will provide a greater yield of animal food units per acre. Actual bulk of feed available may well be a deciding factor in connection with the winter cattle feeding programme and turnips will continue to be grown for this purpose even though the cost per unit of food is relatively high. On the other hand, factors such as the difficulty of mechanising the handling of the crop and the often severe incidence of loss through disease and frost may turn attention to other sources of home-grown feed supplies.

J. D. NUTT
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COSTS OF TURNIP PRODUCTION, 1960

INTRODUCTION

This report gives the results of an investigation into the costs of turnip production in the East of Scotland during 1961 - a year notable for a dry spring and dry early summer. The effect of these adverse growing conditions was to reduce yields generally to a level appreciably below what they were in 1960 when growing conditions were ideal. In the report on that year's turnip crop it was mentioned that there had been a drop in the popularity of turnips during recent years, as reflected in the reduced acreage grown in the area and that the turnip crop was being replaced to some extent by grass silage. This drop in the acreage of turnips continued in 1961 though the acreage of silage and hay remained about the same.*

This reduced popularity of the turnip crop, which incidentally appears to be mainly as a food for cattle, since the feeding of silage to sheep has not extended to any degree, is difficult to understand. It will be shown later in the report that although the cost per cwt. of food produced, measured in protein plus starch equivalents, is greater for turnips, there is a higher yield of food units per acre compared with silage. It was pointed out in the previous year's report that two factors appear responsible for the reduced acreage, first the difficulty of mechanising production and secondly the risk of damage by frost and disease.

The Sample

In all, 26 records were supplied by twenty-three farmers, three supplying two each, for a total of 441 acres, giving an average field size of about 17 acres. An examination of the records showed an even distribution when divided into size groups according to size of field. Although there were fewer costs than were supplied for the 1960 investigation, when there were 34 records, all but one were supplied by the same farmers for both years. Thus a comparison of the results for the two years offers a general indication of any changes in costs and yields.

As was the case in the 1960 investigation, the crops were grown under a wide variety of soil conditions and systems of management. Eleven of the fields were on arable farms (three having dairy herds) and situated on the more fertile soils at relatively low elevations. The other fields were situated at higher elevations with less favourable conditions of soil and climate; thirteen were on stock-rearing farms and two on dairy farms.

The general run of pre-harvest operations were similar in nearly all cases. All but two crops were precision sown and in all but two cases the crops were thinned by hand. Harvesting methods showed greater variation. Twenty-one of the crops were lifted for use off the field; five were fed off by sheep and incurred no harvesting costs as such. Of the twenty-one harvested crops, nine were pulled by hand, eleven were pulled by machine and one crop was handled by a complete harvester.

There were marked variations in the manurial treatment of individual crops. Sixteen of the crops lifted off the field and two of the crops fed off by sheep were given fairly heavy dressings of dung in addition to artificial manures; the other eight crops were given artificials only.

Costs

In view of the general reduction in average yields compared with those for the 1960 crop it might have been expected that there would be some reduction in the harvesting costs per acre. For the same reason, an increase in the average cost per ton might have been expected. These and other aspects of the results for 1960 and 1961 are examined in this section.

Since/

* D.A.F.S. 1961 June Returns.

TABLE I. AVERAGE COSTS PER ACRE - A TWO YEARS COMPARISON

	Crops Dunged		Crops not Dunged	
	1960	1961	1960	1961
Pre-harvesting				
No. of Costs	21	18	13	8
Total Acreage	357 acres	336 acres	251 acres	104.5 acres
Average Field Size	17 "	18.7 "	19.3 "	13.1 "
Yield per Acre	37 tons	30.5 tons	33.5 tons	30.8 tons
Pre-harvesting Costs per Ton	18/6d.	23/5d.	14/9d	14/11d
COSTS PER ACRE	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Pre-harvesting Costs				
Labour	7: 12: -	7: 2: 9	7: 2: 5	5: 14: 11
Power	2: 8: 2	2: 18: 11	2: 6: 4	2: 11: 10
Depreciation of Special Implements	-: 5: 1	-: 8: 4	-: 6: 9	-: 6: 5
Total Labour and Power	£10: 5: 3	£10: 10: -	£9: 15: 6	£8: 13: 2
Manures (net) : Dung	8: 2: 6	9: 15: 6	-: -: -	-: -: -
Artificials	5: 10: 10	5: 10: 9	5: 10: 7	4: 11: 1
Residues	2: 8: 11	1: 19: 3	2: 8: 11	1: 6: 1
Other costs: (Including Rent, Seeds and Share of Overheads)	7: 16: 2	7: 17: 7	6: 17: 3	8: 7: -
Total Pre-harvesting Costs	£34: 3: 8	£35: 13: 1	£24: 12: 3	£22: 17: 4
% Crops Precision Sown	76%	89%	85%	100%
% Crops Thinned by Machine	-	-	8%	25%
Harvesting				
No. of Costs	20	16	7	5
Total Acreage	334 acres	292 acres	116 acres	54.5 acres
Average Field Size	16.7 "	18.2 "	16.6 "	10.9 "
Yield per Acre	37 tons	31.2 tons	34 tons	29.8 tons
COSTS PER ACRE	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Harvesting Costs				
Labour	8: 8: 3	8: 5: 8	9: 7: 8	7: 16: 11
Power	3: 18: 2	3: 17: 9	3: 19: -	5: 2: 1
Depreciation of Special Implements	-: 4: 10	-: 4: -	-: 3: 8	-: 5: 9
Overheads	8: -: -	7: 10: 9	7: 18: 6	7: 13: 3
Total Harvesting Costs	£20: 11: 3	£19: 18: 2	£21: 8: 10	£20: 18: -
TOTAL COSTS PER ACRE	£54: 14: 11	£ 55: 11: 3	£46: 1: 1	£43: 15: 4
TOTAL COSTS PER TON	£ 1: 9: 8	£ 1: 15: 8	£ 1: 7: 2	£ 1: 9: 4
% Crops Pulled by Machine	55%	56%	41%	40%
% Crops Harvested by Machine	-	-	-	20%

Since the effect of the relatively heavy dressings of dung was to increase total costs per acre to a level noticeably above that for the crops receiving only artificial manure, the crops costed have been divided into those crops which received dung and those which did not.

The costs have also been divided into pre-harvesting and harvesting costs; this enables the costs of the crops eaten off by sheep to be included in the former group, with harvesting as additional costs of those crops lifted off the field. The costs for each group are shown in Table I.

In a comparison of the pre-harvesting costs per acre for each group in 1960 with those for 1961 it may be seen that for those crops receiving dung, total labour and power rose only slightly, being up by 4/9d per acre. Total pre-harvesting costs, chiefly due to heavier dressings of dung in 1961, rose by £1: 9: 5 per acre to £35:13: 1, and with the average yield falling by 6.5 tons to 30.5 tons, pre-harvesting costs per ton rose from 18/6d. to £1: 3: 5. In contrast, the cost of labour and power for those fields receiving artificial manures only showed a marked drop, being lower by £1: 2: 4 per acre, at £8: 13: 2. This reduction in cost was partly due to the increased percentage of crops precision sown and mechanically thinned (for eating off by sheep this system of thinning gives satisfactory results), greater by 15% and 17% respectively. Total pre-harvesting costs fell by £1:14:11 per acre to £22:17: 4 and with yields dropping by 2.7 tons to 30.8 tons per acre, pre-harvesting costs per ton showed little change.

Total harvesting costs per acre for the group which received dung showed a relatively small drop of 13/1d. per acre, despite a drop of 5.8 tons in the average yield to 31.2 tons per acre. Examination of the records has shown that one of the main reasons for this was the steeper nature of the fields and the longer average haul to the storage point. Due mainly to changes in the sample, the harvesting costs per acre for the group receiving no dung were lower by 10/10d. per acre, despite a drop in the average yield of 4.2 tons from 34.0 tons to 29.8 tons per acre. The average harvesting costs would also be affected by the inclusion of one crop completely harvested by machine. (Table V)

Total costs per acre for the harvested groups show that those receiving dung increased by 16/4d. to £55:11: 3. The total cost per ton was 6/-d., higher at £1:15: 8. The total cost per acre for the other group receiving no dung, in contrast, fell by £2:5: 9 to £43:15: 4 and the cost per ton was 2/2d. higher at £1: 9: 4.

The main points brought out from these results are the effect of climatic conditions in appreciably reducing yields, the relatively small variation in total costs per acre and the difficulty in reducing harvesting costs when yields are lower.

Range of Costs

The ranges in the pre-harvesting and harvesting costs per acre were quite large. For example, in 1961 the pre-harvesting costs for those crops receiving dung ranged from £28:12: -d. to £47: 2: -d. and for those receiving no dung from £21: 4: -d., to £28:12:-d. The corresponding figures of harvesting costs for all crops harvested were from £12:18: -d. to £31:9:-d. per acre and from £11:15:-d. to £27: 1: -d. per acre. The percentage distribution of the pre-harvesting costs per acre for each group and the harvesting costs per acre for all the harvested crops (it was not considered necessary to show separate harvesting costs for the two groups) for both years are shown in Table II.

TABLE II/

TABLE II. PERCENTAGE DISTRIBUTIONS OF PRE-HARVESTED AND HARVESTING COSTS PER ACRE - TWO YEARS FIGURES

A. Pre-harvesting Costs - Crops Dunged							
Costs per acre	£24.9 and under	£25-£29.9	£30-£34.9	£35-£39.9	£40-£44.9	£45 and over	Total
Per Cent	3	23	26	36	10	2	100

B. Pre-harvesting Costs - Crops Not Dunged						
Costs per acre	£15 - £19.9	£20-£24.9	£25 - £29.9	£30 - £34.9	£35 and over	Total
Per Cent	24	24	42	5	5	100

C. Harvesting Costs - All Harvested Crops						
Costs per acre	£10 - £14.9	£15 - £19.9	£20 - £24.9	£25 - £29.9	£30 and over	Total
Per Cent	10	42	32	14	2	100

It may be seen that the large majority of crops receiving dung had pre-harvesting costs ranging from £25 to £40 per acre. The corresponding figures for those receiving artificials only, were from £15 to £30 per acre. The harvesting costs per acre were concentrated within a narrower range from £15 to £25 per acre.

Thus, under normal conditions of production and management, total costs per acre for those crops receiving both dung and artificial manures could be expected to fall within the £40 to £65 per acre cost range and for those receiving artificials only from £30 to £55 per acre.

Some Factors Affecting Costs

In turnip production as in the production of other crops a farmer usually aims at obtaining the highest yield at the lowest possible cost consistent with good husbandry and good quality of produce. He has thus to consider, amongst other things, what cultivations are necessary to obtain the required tilth, the extent to which it is possible to reduce the costs per acre and per ton by increased mechanisation of the various operations and also how far it is possible to increase yields per acre and hence reduce the cost per ton by increased rates of manuring.

Yields

It was shown in the 1960 investigations that although manure costs and total costs per acre increased with yields, the increase in total costs was offset by the greater increase in yields, thus giving a reduced cost per ton. This relationship is also true for the 1961 investigation, as shown in Table III. This gives the costs for the 16 harvested and pitted crops which received both dung and artificial manures in the crop year grouped into two lots - those crops yielding 32.9 tons or less per acre and those yielding 33 tons or more per acre.

TABLE III/

TABLE III. THE RELATION BETWEEN YIELDS AND COSTS PER ACRE

Sixteen Dunged Crops Harvested and Clamped		
Yield Groups	Low Yield	High Yield
No. of Crops	11	5
Average Yield	29 Tons	36 Tons
Average Field Size	20 Acres	14 Acres
Costs per Acre:	£ s. d.	£ s. d.
Cultivations	10:18: 4	10: -:11
Harvesting	11:11: 6	13: 9:10
Depreciation of Special Equipment	-: 8: 7	-:16: 3
Manures (Net) :	£ s. d.	£ s. d.
Dung	9:16: 9	10: -:10
Artificials plus Residues	7: 8: 2 17: 4:11	8:17: 2 18:18: -
Miscellaneous Costs	15: 4: 5	15: 9: 3
TOTAL COST PER ACRE	£55: 7: 9	£58:14: 3
AVERAGE COST PER TON	£ 1:18: 1	£ 1:12: 7
% Crops Precision Sown	82%	100%
% Crops Pulled by Hand	45%	40%

It may be seen that for an increase in yield from 29 tons to 36 tons per acre, total costs rose by £3:6: 6 to £58:14: 3 per acre but the cost per ton dropped from£1:18: 1 to £1:12: 7. Total manure costs, the greater part of which was the increased cost of artificial manures plus residues, also increased being up by £1:13: 1. Total costs of vultivations for the high yield crops were lower by 17/5d., due in part to the higher proportion of crops sown by precision seeder which enabled a saving in thinning costs to be made. Harvesting costs, as might be expected on account of the substantially heavier yield, were higher by £1:18: 4.

Manuring Policy

In the previous section it was shown that yields tended to vary with increased costs of artificials plus residues. This is in contrast to the effect of substantial dressings of dung when applied in addition to normal dressings of artificial manure. Heavy applications of dung do not increase yields in proportion to the increased cost involved. For example, it may be seen in Table I that the harvested group which received both dung and artificial manures costing, plus residues, £17: 5: 6 per acre (the cost of dung amounting to £9:15: 6), yielded 30.5 tons per acre. In contrast, the group receiving artificial manures only costing, with residues £5:17:2 per acre, yielded 30.8 tons. A similar relationship was observed in the 1960 investigation.

Could it be that the application of substantial dressings of dung plus artificial manures has resulted in over-manuring or is the manurial value of dung not completely available to the growing crop, benefiting instead the succeeding ones? The latter appears to be the case, as is borne out from an examination of the previous manuring and cropping of those fields which received artificial manures only. This showed that the majority of these crops received dung within the previous two years. Most of the others followed directly after three or four years of grass, thus benefiting from valuable grass residues.

Thinning Costs/

Thinning Costs

On account of the relatively high number of labour hours per acre incurred when turnips are thinned by hand, even when precision sown (18.6 labour hours per acre was the average time shown in the 1960 investigation), some farmers cut out the operation completely by sowing at 6" intervals. The success of this operation however depends on ideal conditions at sowing, else poor germination will considerably reduce the yield per acre. Although none of the crops in this investigation were sown in this manner, two, which were eaten off by sheep, were medhanically thinned. Table IV shows the total labour and tractor hours per acre for the secondary cultivations of these two crops alongside those for the other three crops eaten off by sheep.

TABLE IV. SECONDARY CULTIVATIONS PER ACRE UNDER DIFFERENT SYSTEMS

Crops Eaten Off by Sheep

Method of Thinning	No. of Crops	Secondary Cultivations	Hours per Acre		Cost
			Labour	Tractor	£ s. d.
Thinned by Machine	2	Thinning	1.4	1.4	-:13: 5
		Hoeing	0.7	-	-: 3: 2
		Total	2.1	1.4	£-:16: 7
Thinned by Hand	3	Inter-row	1.7	0.7	-:11: 6
		Thinning	12.1	-	2:19: 4
		Total	13.8	0.7	£3:10: 0

The crops thinned by machine showed a saving in labour hours amounting to 11.7 though there was an increase of .7 in the total tractor hours. The total saving in cost amounted to £2:14: 3 per acre.

Harvesting

As previously mentioned, nine of the crops harvested and pitted were pulled by hand, eleven were pulled by machine and one was completely harvested by machine. The labour and tractor hours as well as the yield and cost per acre for harvesting under each system are shown in Table V.

TABLE V. HARVESTING UNDER DIFFERENT SYSTEMS

LABOUR AND TRACTOR REQUIREMENTS PER ACRE

Method of Harvesting	No. of Crops	Total Harvesting Time		Yield	Cost of Labour and Tractor Work per Acre
		Labour	Tractor		
		Hours	Hours	Tons	£ s. d.
Pulled by Hand	9	40	16	31.0	12:19: 6
Pulled by Machine	11	32.6	20.3	30.7	12: -: 8
Completely Harvested by machine	1	23.2	23.2	34.2	10: 8: 10

The total/

The total labour and tractor hours per acre for the nine crops pulled by hand were 40 and 16 respectively and the cost £12:19: 6 per acre. In comparison with these figures the labour and tractor hours per acre for the eleven crops pulled by machine were less by 7.4 hours and more by 4.3 hours respectively and the cost lower by 18/10d per acre. The labour and tractor hours per acre for the single crop harvested by machine also showed a big reduction in labour hours compared to those pulled by hand, less by 16.8 hours, but there was an increase of 7.2 in the tractor hours. The cost was lower by £2:10:8 per acre.

Field Size

Normally, for certain field operations, a large field will require fewer labour and tractor hours per acre than a small one on account of economies arising from the scale of operations. This is shown in Table VI which gives a comparison of the labour and tractor hours for harvesting eight of the smaller fields and a similar number of the larger ones; both groups received dung. The two groups had approximately the same average length of haul to the clamp and relatively similar field conditions. A comparison of the labour and tractor hours for the pre-harvesting operations has not been shown on account of an appreciable variation in the different operations carried out in each group.

TABLE VI. FIELD SIZE AND LABOUR AND POWER REQUIREMENTS PER ACRE 16 HARVESTED CROPS

	Smaller Fields		Larger Fields	
No. of Crops	8		8	
Average Size	11.1 acres		25.4 acres	
Average Yield	32.5 tons		30 tons	
	Labour	Tractor	Labour	Tractor
Harvesting	40.6 hrs.	19.8 hrs.	30.1 hrs.	15.2 hrs.
% Crops Pulled by Machine	50%		63%	

It can be seen that the labour and power requirements for harvesting the larger fields were 10.5 hours and 4.6 hours fewer than for harvesting the smaller ones. Although some of the reduction in labour and tractor hours can be attributed to the lower yield and the increased proportion of crops in the larger group that were pulled by machine, less by 2½ tons and more by 13% respectively, some of the saving in labour and power was also due to economies resulting from harvesting on a larger scale.

Total Labour and Power

It was shown in Table I that the pre-harvesting and harvesting costs per acre for both groups in 1960 and 1961 showed relatively little change, apart from the marked reduction in the pre-harvesting costs for those crops which received no dung in 1961 and which was due, in some degree, to increased mechanisation. Bearing in mind that one of the crops in the group not dunged

was/

harvested completely by machine in 1961, it is of interest to see how the respective times for labour and power per acre varied for the two years. These are shown in Table VII.

TABLE VII. TOTAL LABOUR AND POWER PER ACRE
A TWO YEARS COMPARISON

	Crops Dunged				Crops Not dunged			
	1960		1961		1960		1961	
	Hours		Hours		Hours		Hours	
	Lab.	Tract.	Lab.	Tract.	Lab.	Tract.	Lab.	Tract.
Pre-harvesting	40.3	17.0	40.0	19.1	33.2	10.5	29.5	10.1
Harvesting	37.5	17.4	35.3	17.5	43.3	14.8	35.2	22.6
TOTAL	77.8	34.4	75.3	36.6	76.5	25.3	64.7	32.7

It may be seen that for the crops receiving dung there was relatively little variation in the number of hours for labour and power in the pre-harvesting and harvesting operations. Pre-harvesting tractor hours increased by no more than 2.1 hours per acre in 1961; labour hours in harvesting decreased by 2.2 hours per acre. Over all the operations there was a reduction of only 2.5 labour hours per acre in 1961 for a total of 75.3 hours but tractor work rose by 2.2 hours to 36.6 hours per acre. The crops not dunged showed rather greater variations in their requirements for labour and tractor work. Pre-harvesting operations showed a reduction of 3.7 labour hours. Harvesting operations showed a reduction of 8.1 labour hours but tractor work showed an increase of 7.8 hours per acre. These changes in the labour and power for the latter group of crops can be partly attributed to the greater degree of mechanisation of these crops which tended to reduce the labours and increase the tractor hours per acre. Over all the operations total labour fell by 11.8 hours to 64.7 hours and total tractor hours increased by 7.4 hours to 32.7 hours per acre.

Feeding Value of Turnips

Although turnips are normally considered as a succulent crop of low dry matter content, necessary for feeding along with roughages such as hay and straw, the total yield of food value, measured in terms of the total protein plus starch equivalent per acre, is greater than for grass silage. However, the cost per cwt. is higher. Tqble VIII shows the weight and cost of protein plus starch equivalents per acre for each of the groups of crops compared with the corresponding costs and yields for an acre of grass silage grown in 1960 (figures for the latter are based on the details contained in the North of Scotland College Report No.93). The protein and starch equivalents for turnips have been taken as .6 lb. and 6 lb. per 100 lb. respectively. The corresponding figures for grass silage (short grass) were 2 lb. and 12 lb. respectively.

Table VIII/

TABLE VIII. PRODUCTION OF FOOD UNITS PER ACRE
TURNIPS AND GRASS FOR SILAGE

Item	1961 Turnip Crop		Grass for Silage
	Crops Dunged	Crops Not Dunged	1960 Crop
Total Cost per Acre in Pit or Clamp	£55:11: 3	£43:15: 4	£19:13: 6 *
Yield per Acre	31.2 tons	29.8 tons	7.6 tons
Total Protein plus Starch Equivalents	41.1 cwt.	39.3 cwt.	21.2 cwt. ≠
Total Cost per Cwt., Protein plus Starch Equivalents	£ 1: 7: -	£ 1: 2: 3	£ -:18: 7

* After deduction of £2:2/- for grazing costs.

≠ Silage only.

The cost per cwt. of food units from an acre of silage works out at 18/7d. which is considerably below the cost per cwt. from an acre of harvested turnips at £1:7/- and £1:2/3d. A more comprehensive comparison would be to compare the cost per cwt. of food units from an acre of turnips with the corresponding cost based on the total production, silage plus grazing, from an acre of grass. Silage plus grazing should produce a yield of 26.5 cwt. of food units at a cost of 16/5d. per unit, allowing for the additional costs of the grazing. On the other hand, the yield of food units per acre for the turnip crops receiving dung was 41.1 cwt. and for those receiving no dung, 39.3 cwt. Both these amounts are about 50% greater than the yield from an acre of silage plus grazing.

The balance of advantage on a cost basis would thus appear to be in favour of the silage crop but this is offset by the lower output necessitating a greater acreage of crop for a given output of food as measured in terms of protein plus starch equivalents.

ACKNOWLEDGMENT

Grateful acknowledgment is made of the help given by the farmers co-operating in the investigation who supplied the various records and other information and for the considerate and courteous attention given to the investigator on the occasion of his visits.

SUMMARY

1. Records were supplied for 26 fields totalling 441 acres giving an average field size of about 17 acres. All but one of the records were supplied by the same farmers for two years.

2. Twenty-one crops were harvested and five eaten-off by sheep. Sixteen harvested crops received dung plus artificials and five, artificials only. Of the five crops eaten off by sheep, two received dung plus artificials and three artificials only.

3. The crops were divided into two groups, those receiving dung plus artificials and those receiving artificials only. Costs per acre for each group were divided into pre-harvesting costs and harvesting costs. These costs and other data are compared for both the 1960 and 1961 crops.

4. Pre-harvesting costs per acre for the groups receiving dung and artificials rose by £1:9:5 per acre to £35:13:1; for the group receiving artificials only these costs fell by £1:14:11 to £22:17:4. Harvesting costs per acre for each of the groups showed little variation between the years.

5. Total costs per acre for the harvested crops receiving dung and artificials rose by 16/4d. to £55:11:3. Yields dropped by 5.8 tons to 31.2 tons and as a result total costs per ton rose by 6/- to £1:15:8. For the group receiving no dung, total costs per acre fell by £2:5:9 to £43:15:4; but yields dropped from 34 tons to 29.8 tons and total costs were 2/2d. higher at £1:9:4 per ton.

6. Two of the five crops eaten-off by sheep were thinned by machine. These had 11.7 fewer labour hours per acre but 0.7 more tractor hours for secondary cultivations than did the other three crops thinned by hand and cost £2:14:3 per acre less.

7. The eleven crops pulled by machine had 7.4 fewer labour hours per acre for harvesting but 4.3 more tractor hours than had nine harvested crops pulled by hand. The cost per acre was 18/10d. less. The one crop harvested by machine had 16.8 fewer labour hours and 7.2 more tractor hours than had those pulled by hand and the cost was lower by £2:10:8 per acre.

8. The total labour and tractor hours per acre for the harvested crops receiving dung and artificial manures were very similar to those in the 1960 investigation, being 75.3 and 36.6 hours as against 77.8 and 34.4 hours respectively. The other harvested group, receiving artificials only, showed a much wider difference in the average total labour and tractor hours per acre, due partly to the increased proportion of crops harvested completely by machine. Total labour decreased by 11.8 hours to 64.7 hours and the total tractor time increased by 7.4 hours to 32.7 hours.

9. The total food production from an acre of turnips, expressed as the total protein plus starch equivalent per acre, was more than that for grass silage but the cost per cwt. was greater.

COSTING PROCEDURE

Manual Labour

All labour including the farmer's own was charged at the hourly rates on the farm.

Tractor Work

Charged at 4/6d. per hour for wheeled and 12/- per hour for track-laying tractors.

Manures and Manurial Residues

(a) Dung was charged at 17/- per ton plus cost of application.
(b) Artificial manures were charged at cost plus cost of application.
(c) Manurial residues brought forward and carried forward were calculated at standard rates.

Other Crop Costs

These include the cost of spray material.

Rent

Charged at the rental for arable land on the farm.

Overheads

Charged at the rates agreed by the Scottish Conference of Agricultural Economists. Charges for interest on tenant's capital or for managerial work have not been included.