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*Sugar
beets
Costs &
Production*

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**Costs and Returns from
Growing Sugar Beet on
some Yorkshire Farms
1954**

UNIVERSITY OF LEEDS
DEPARTMENT OF AGRICULTURE: ECONOMICS SECTION

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Price Two Shillings

This report gives the results for 1954 of a 2 year study of the Costs of Growing Sugar Beet in two districts of Yorkshire. Fiftyfour costs come from farms in the Plain of York and thirty from the Wolds and Holderness.

The report has been written by Mr.IAN G.SIMPSON from material collected and tabulated by Mr.D.McINNES. We should like to thank the growers through whose co-operation the investigation was made possible.

W.Harwood Long.

COSTS AND RETURNS FROM SUGAR BEET ON SOME YORKSHIRE
FARMS IN 1954

In 1954 the growing of sugar beet was costed by this department on fifty-eight Yorkshire farms. These farms fall into two groups. Thirtyone of them are in the Vale of York mainly within fourteen miles of the sugar beet factory at Selby. They are located on light soils in an area characterised by intensive arable farming with potatoes, sugar beet and carrots as important crops. The other twentyseven farms are situated either on the Wolds or in Holderness. The Wolds are a chalk area while Holderness is covered for the most part with heavy soils although the costed sugar beet was grown on the areas of rather lighter land within the region. Neither on the Wolds or in Holderness is sugar beet a common crop. On the Wolds crops for sheep folding occupy much of the root break, while the heavy soils have resulted in only a small acreage of roots being grown on most farms in Holderness.

With few exceptions, all the beet grown on the fiftyeight farms was costed. On average nineteen and a half acres was costed on the Vale of York farms and nineteen on those on the Wolds and in Holderness. The average acreage costed per farm was considerably greater than the average grown per farm sending beet, as most of the costed farms did, to the Selby factory(1)

Table 3
Acreage of Sugar Beet Costed per Farm

A c r e s	0-9	10-19	20-29	30-39	40-49	50-59	Over 60
	Number of Farms						
Vale of York	7	13	7	1	2	1	-
Wolds and Holderness	13	4	3	3	2	1	1

The distribution of the acreages costed per farm is shown in Table 3. In the Vale of York group 10 to 19 acres was the most common range compared with 0-9 acres in the Wolds and Holderness group. The larger number of farms on which a small acreage was grown in the latter group, however, was offset by a higher proportion of farms where a large acreage was grown.

On some farms where more than one field of beet was costed, separate costs have been calculated for each field so as to take account of differences in treatment. Thus fiftyfour costs have been calculated for the Vale of York and thirty for the Wolds and Holderness group compared with thirtyone and twentyseven farms in each group respectively.

The weather in 1954 hindered all forms of crop production, sugar beet being affected probably more than most. The summer was cool and sunless. Rainfall was well above average, particularly in August and November. The wet weather in November made harvesting both difficult and unpleasant. The weather also adversely affected yields. Not only was the weight of beet harvested per acre below average but sugar content was abnormally low. As a result cash returns were most disappointing.

(1) In 1954 the average acreage per farm contracted with the Selby Factory was 8.68.

Table ii Costs and Returns from Sugar Beet

	Vale of Y o r k	Wolds and Holderness
Number of Farms	31	27
Acres of Sugar Beet	603½	516
Yield of Clean Beet per Acre	9.t.12.c.	8.t.1.c.
Sugar Content	14.3%	14.3%
Return per Acre	£52.4.6.	£43.18.6.
Net Cost per Acre	£56.3.0.	£56.17.0.
Deficit between Returns and Net Costs per Acre.	£3.18.6.	£12.18.6.

The average yields and returns obtained per acre from the costed beet are given in Table ii. (1) In both groups sugar content worked out at the low figure of 14.3 per cent. A higher yield of clean beet was obtained to the acre from the Vale of York than from the Wolds and Holderness farms, the difference being 31 cwt. The average net cost per acre which was very similar for both groups exceeded the returns from the sale of beet. Owing to the lower yield the deficiency was much larger in the Wolds and Holderness group averaging £12.18.6. per acre as against £3.18.6. in the Vale of York.

Table iii Range in Net Cost per Acre for Growing Sugar Beet

Cost per Acre (to nearest £)	£30-£39	£40-£49	£50-£59	£60-£69	£70-£79	£80-£89
	Number of Costs					
Vale of York	3	14	24	9	3	1
Wolds and Holderness	1	3	12	10	3	1

Table iv Range in the Returns per Acre from Sale of Sugar Beet

Return per Acre (to nearest £)	£10-£19	£20-£29	£30-£39	£40-£49	£50-£59	£60-£69	£70-£79
	Number of Costs						
Vale of York	1	2	7	13	15	13	3
Wolds and Holderness	-	-	8	11	7	3	1

Table v Range in the Margins Between Returns and Net Costs per Acre

Margin per Acre (to nearest £)	Deficit				Surplus		
	£39-£30	£29-£20	£19-£10	£9-£0	£0-£9	£10-£19	£20-£29
	Number of Costs						
Vale of York	1	8	12	13	10	9	1
Wolds and Holderness	2	7	8	9	2	1	1

(1) These yields and returns per acre are calculated on the acreage sown. In some cases harvesting conditions were so bad that a proportion of the beet had to be left in the ground. This has inevitably reduced the yields and returns per acre.

These averages conceal the considerable variation in the results obtained from individual farms. The number of "costs" with net costs, returns and margins falling within given ranges is shown in Tables iii, iv, and v. Returns exceeded net costs for two-fifths of the "costs" from the Vale of York and for just under a seventh of those in the Wolds and Holderness group.

Table vi Average Returns per Acre for Cost with Different Margins
(Both Groups Combined)

Margin per Acre of Returns over Net Costs	Number of Costs	Average Return per Acre	Average Yield of Clean Beet per Acre
Deficit		£. s. d.	Tons
£39-£30	3	32.12. 3.	6.4
£29-£20	15	40. 0. 0.	7.3
£19-£10	20	46. 9. 6.	8.6
£9-£0	22	48. 1. 0.	9.2
Surplus			
£0-£9	12	59. 6. 4.	10.7
£10-£19	10	61. 5. 9.	11.5
£20-£29	2	74. 5. 8.	12.8

In Table vi the results for both groups have been taken together and the average yield and cash return per acre calculated for all "costs" with margins falling within given ranges. This table shows clearly that yield was a major factor influencing the net margin between costs and returns. With increasing yields and returns per acre, the ratio of costs to returns improved.

The composition of the total net costs per acre of growing beet is given in detail in Table vii. Although the totals were very similar for both groups of farms, there were appreciable differences between the two for some of the individual items making up these total costs.

Cultivations cost £1.16.6. per acre more on the Vale of York farms than they did on those on the Wolds and Holderness. Most of this difference was accounted for by the higher charge for applying farmyard manure. This operation cost 20/6d an acre more on Vale of York farms than on those on the Wolds and in Holderness. This is a reflection of the greater quantity applied on the first group of farms, a point commented on in detail later. Apart from this cost, most of the other operations listed under cultivations cost only slightly more per acre on the Vale of York farms.

Hand hoeing which covers singling and seconding was by far the greatest expense incurred under the heading of cultivations. On about four-fifths of the acreage this work was paid for at piece rates, the usual rates per acre for singling and seconding being between £7.10.0. and £9.0.0. per acre. Much of the work was done by casual labour but on some farms the regular staff elected to work on piece rates. The cost per acre of hand hoeing paid for at time rates averaged £9.1.0. an acre as against £8.4.0. for that paid for at piece rates.

Table vii

Costs per Acre of Growing Sugar Beet

	Vale of York			Wolds and Holderness		
	£.	s.	d.	£.	s.	d.
Cultivations						
Ploughing	1.	15.	0.	1.	9.	6.
Cultivating	1.	3.	0.	14.	6.	
Harrowing and Rolling		13.	0.	19.	6.	
Applying Farmyard and other organic Manures	1.	18.	0.	18.	6.	
Applying Fertiliser		15.	6.	13.	6.	
Drilling Seed		11.	0.	10.	0.	
Tractor Hoeing	2.	4.	6.	2.	3.	6.
Hand Hoeing	8.	5.	0.	8.	3.	0.
Spraying		2.	0.			6.
Other Cultivations		2.	0.			
Total Cultivations (A)	17.	9.	0.	15.	12.	6.
Harvesting						
Topping and Lifting	8.	13.	0.	8.	6.	0.
Carting off and Loading +	6.	7.	6.	8.	3.	0.
Total Harvesting (B)	15.	0.	6.	16.	9.	0.
Other Costs						
Seed	1.	4.	0.	1.	7.	0.
Farmyard and other organic Manures	7.	18.	0.	3.	1.	0.
Artificial Fertilisers	10.	16.	0.	13.	12.	6.
Lime	1.	8.	6.	12.	6.	
Sprays		9.	0.	3.	0.	
Rent	1.	17.	0.	1.	10.	6.
Haulage of Beet to Factory	4.	6.	6.	6.	12.	0.
Share of General Farm Expenses	5.	10.	6.	5.	5.	0.
Total Other Costs (C)	33.	9.	6.	32.	3.	6.
Total Gross Cost (A + B + C)	65.	19.	0.	64.	5.	0.
less net manurial residues	6.	6.	0.	3.	18.	0.
less deduction for value of tops	3.	10.	0.	3.	10.	0.
TOTAL NET COST	56.	3.	0.	56.	17.	0.

+ includes carting to station where rail transport was used.

The average costs in Table vii for harvesting refer both to lifting and topping by hand and to mechanical harvesting. A comparison of the costs of different harvesting methods is given later. As between the two groups, most of the difference in harvesting costs is accounted for by that in the cost of carting off and loading beet. The higher costs for this item on the Wolds and Holderness farms may at least partially be explained by the fact that a higher proportion of the beet off these farms was delivered to the factory by rail. This often involved hauling the beet a considerable distance from the field to the station, a job which is avoided where road transport is employed, since the beet can generally be picked up at the field side.

Among the items included under other costs, farmyard and other organic manures, lime, sprays and rent, all cost more per acre on the Vale of York farms whereas artificial fertilisers and haulage to the factory cost less than on the Wolds and Holderness farms. For both groups, haulage costs were inflated by the high dirt tare of the beet which averaged 27 per cent for the Vale of York and 33 per cent for the Wolds and Holderness.

Two deductions have been made from the gross costs. The first is for net manurial residues. This represents the value of the residues carried forward to the succeeding crops from the manures applied to the beet less the value of manures brought forward from the preceding crops and charged to the beet. The value of net manurial residues set against the costs was considerably smaller in the Wolds and Holderness group than in the Vale of York. This was primarily due to the smaller amount of farmyard manure applied, of which half the cost is charged to crops following the beet.

An arbitrary amount of £3.10.0. an acre has been deducted from the gross cost to allow for the value of the sugar beet tops. Although these tops have an appreciable manurial value if ploughed or alternatively can provide valuable fodder for stock, it is difficult to assess their value fairly. It has been suggested on the basis of experiments carried out at the Norfolk Agricultural Station at Sprowston that tops either ploughed in or folded off by sheep give increases in the yields of the following crops equivalent to those obtained by applying 2 cwts of superphosphate, 1 cwt of sulphate of ammonia and $\frac{1}{2}$ cwt of muriate of potash to the acre. The cost of such a dressing including application would be rather over 50/- an acre. It would not seem unreasonable to credit tops ploughed in at a similar value. But on the other hand tops are almost certainly worth more than 50/- an acre as stockfood. For instance, an acre of tops used for sheep folding may replace half an acre of turnips costing perhaps £9 to grow. Since quite a high proportion of the tops from the costed beet were fed to stock particularly on the Wolds and Holderness farms (see Table viii), it was felt it would not be unreasonable to credit the tops at a figure rather in excess of their manurial value.

Table viii Utilisation of Sugar Beet Tops on the Costed Farms

	Vale of York		Wolds and Holderness	
	Acres	Per Cent	Acres	Per Cent
Ploughed in	244 $\frac{1}{2}$	40.5	109	21.1
Fed to Cattle	109 $\frac{1}{2}$	18.1	35	6.8
Fed to Sheep	72 $\frac{1}{2}$	12.0	184	35.6
Some Ploughed in and some fed to stock.	177	29.4	188	36.5
	603 $\frac{1}{2}$	100.0	516	100.0

The value of sugar beet as a cleaning crop is even more problematical than the value of tops and no credit has been allowed in Table vii for cleaning values.

Table ix Primary Costs per Acre for Cultivations and Harvesting

	Vale of York			Wolds and Holderness		
	Applying Organic Manures	Other Cultivations	Harvesting.	Applying Organic Manures	Other Cultivations	Harvesting.
	£.s.d.	£.s.d.	£.s.d.	£.s.d.	£.s.d.	£.s.d.
Manual Labour	18.6.	11.1.6.	9.19.6.	11.0.	10.11.6.	9.16.6.
Horse	-	1.0.	3.0.	-	.6	.6
Tractor	13.6.	3.0.0.	3.6.6.	6.0.	2.11.0.	4.13.0.
Contract	4.0.	3.0.	12.0.	-	7.0.	7.6.
Implement Depreciation & Repairs	2.0.	1.5.6.	19.6.	1.6.	1.4.0.	1.11.6.
T o t a l	1.18.0.	15.11.0.	15.0.6.	18.6.	14.14.0.	16.9.0.

The cultivation and harvesting costs subdivided in Table vii according to operation, have in Table ix, been divided into primary costs for manual labour, tractor, horse and contract work and implement depreciation and repairs.

Table x Acreage of Sugar Beet Harvested by Different Methods

Method of Harvesting	Vale of York		Wolds and Holderness	
	Acres	Per Cent of Total.	Acres	Per Cent of Total.
Hand	395½	65.5	207½	41.0
Farmer's Own Machine				
(a) Small Machines	11	1.8	35½	7.0
(b) Large Machines	156½	26.0	234½	46.4
Contractor's Machines	40½	6.7	28½	5.6
	603½	100.0	506 +	100.0

+ plus 10 acres not lifted

Mechanical Harvesting

Table x shows that in spite of the difficult season a third of the beet on the Vale of York farms and six-tenths of that on those in the Wolds and Holderness group was harvested with the aid of mechanical beet harvesters. The main part of the mechanically harvested acreage was dealt with by the larger type of machine performing both topping and lifting simultaneously. These were mainly Peter Standen or Catchpole machines. The acreage harvested by the smaller machines was dealt with by Roerslev toppers used with Fordson lifters. On two farms the roots were topped by hand but lifted mechanically by the Fordson machine. The contractor's machines were all of the larger type.

If conditions had been more favourable a higher proportion of the beet would undoubtedly have been harvested mechanically. Besides the twentyfour farmers who operated their machines in 1954 another fifteen possessed machines but made no use of them in that year. Moreover, on some of the farms where the machines were used they dealt with only a proportion of the acreage of beet on the farm. In fact a third of the beet on such farms was harvested by hand.

The data on the relative costs of harvesting beet in 1954 is of particular interest in that it gives some guide as to what occurs under conditions which it is to be hoped will not recur frequently. A farmer considering the purchase of a beet harvester needs to take into account its probable performance in a difficult season as well as that in a more normal one. The savings in harvesting costs secured in most years may be small comfort to a farmer who finds in a bad season that he is unable either to use his machine or to obtain the labour for hand lifting.

Table xi Costs per Acre of Harvesting Sugar Beet by Different Methods

	H a n d	Farmer's Own Machine		Contractor's Machine
		Small	Large	
	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Ploughing Out	1.10. 0.)			
Lifting, Topping & Knocking	8.18. 6.)	9. 8. 0.	5.18. 0.	8. 1. 0.
Carting and Loading	6.15. 0.	11. 7. 0.	7. 8. 0.	4.15. 0.

The average costs of harvesting beet where different methods were employed are given in Table xi. It might be expected that carting and loading costs would be lower where the large machines were used since in some cases these load straight into trailers. In fact, there does not appear to be any clear relationship on the farms costed between the method of lifting and topping and the cost of carting and loading. Probably other factors such as soil condition and length of haul had a greater influence.

The highest costs for lifting and topping were incurred where the job was done by hand and the lowest costs where the farmers' own large machines were used. Lifting, topping and knocking by hand like singling and seconding was generally paid for at piece rates. The rates varied to some extent with the weight and condition of the crop but were most frequently between £8 and £10 per acre.

The average cost per acre for lifting and topping with small machines was considerably increased by a great deal of time spent in additional topping and cleaning by hand on one farm. If the costs from this farm are excluded, the average for lifting and topping with these machines falls to £7.9.0, an acre which compares more favourably with the cost of £10.8.6. for performing these operations by hand.

Table xii Primary Costs per Acre of Lifting & Topping Sugar Beet by Three Methods

	H a n d	Small Machines +	Large Machines
	£. s. d.	£. s. d.	£. s. d.
Manual Work	9. 9. 0.	3. 12. 6.	1. 12. 6.
Horse		3. 0.	
Tractor	16. 6.	2. 1. 6.	1. 13. 6.
Implement Depn.)	3. 0.	1. 1. 0.	1. 18. 6.
Implement Repairs)		11. 0.	13. 6.
T o t a l	10. 8. 6.	7. 9. 0.	5. 18. 0.

+ One cost where high manual labour changes for additional topping and cleaning incurred excluded from average.

The primary costs for the three methods of lifting and topping not involving the use of contractor's machines, are given in Table xii. This shows the considerable saving in manual labour costs achieved through the use of machines. It also shows what a large proportion of the cost of operating mechanical harvesters is accounted for by depreciation and repair charges.

Unfortunately it is not possible to assess accurately the cost of depreciation until a machine is sold off the farm or scrapped. For the purposes of this investigation it has been assumed that the purchase price of the machines will be entirely written off in eight years. This may seem a short period but obsolescence as well as physical deterioration has to be taken into account. It is by no means certain that the design of beet harvesters is yet stabilised and it is therefore possible that existing machines will become out of date fairly rapidly. In this connection it is interesting to note that most of the larger machines costed by this Department in an investigation undertaken in 1950 needed two operators, one on the tractor and one on the machine, and cost about £550 when new. In 1954 most of the similar machines costed needed only the tractor driver to operate them and cost in the region of £350.

The economies obtained by the use of the mechanical harvesters depend largely on the acreage harvested annually. Given a life of a fixed number of years, the larger the acreage harvested each year the smaller are depreciation and other fixed costs per acre. On the basis of the figures given in Table xii, it appears that a farmer growing only ten acres of beet annually could justify the purchase of one of the larger machines. (1) The annual depreciation charge on a £350 machine written off in eight years is £44. To this £8.15.0. might be added to allow for interest on capital invested (this is not included in Table xi). Depreciation and interest would then total £52.15.0. a year equivalent to £5.5.6. per acre if spread over ten acres. Using the costs for manual labour, tractor work and repairs given in Table xi, this gives a total cost per acre of £9.5.0. for topping and lifting compared with the average of £10.8.6. where the jobs are performed manually, a saving of £1.3.6. per acre. This saving does not of course allow for any economies in carting off which could be expected from using the machine. Also it is possible that where only ten acres of beet are grown, it may be more economical to use the small independent topping and lifting machines which cost less to buy than the complete harvesters. Higher labour costs are incurred where these small machines are used but up to a certain acreage these are offset by lower depreciation costs per acre. The costed acreage harvested by the small machines in this investigation was not large enough to provide a reliable guide to their performance. For this reason no attempt has been made to calculate the acreage range within which it would be more economical to use small machines rather than a large one. The larger machines by reducing the number of operations involved in harvesting make for easier working in the field and may thus be preferred by many farmers even when costs are rather higher.

- (1) In an article entitled "Some Suggestions for Determining the Economic Use of Machinery" (Journal of Proceedings of the Agricultural Economics Society. x. No.1 June 1952), Miss Morag Mathieson suggests largely on the basis of the results obtained in 1950 investigation referred to above, that it would be worthwhile to use a complete harvester rather than to lift and top by hand where more than 24 acres of sugar beet were harvested annually. It is now possible to suggest that such a machine would be justified on a smaller acreage since the design of beet harvesters has been improved and their price reduced while manual labour is more expensive. Also it was thought desirable in the present circumstances to write off the cost of the harvesters in a rather longer period than the five years chosen by Miss Mathieson.

Other considerations besides the actual monetary saving in harvesting costs must be taken into account, however, when the purchase of a machine is contemplated. For instance, could the capital required for its purchase be more profitably used elsewhere? Will the use of a machine actually result in a reduction of the farm labour bill (as it will if casual labour is used for harvesting) or alternatively will the lower labour requirements for the sugar beet enable greater production to be obtained from other enterprises? Is the non employment of casual labour for beet harvesting likely to cause difficulties in obtaining similar labour for singling? If reliance is placed on a machine, can labour be obtained for hand lifting when as in 1954, conditions may prevent it being fully utilised? Taking into account these and other considerations, there can be little doubt however, that the large savings in labour costs obtained through the use of beet harvesters, make them one of the most valuable machines on many farms.

The costs for manual and tractor work in connection with the use of mechanical harvesters given in Table xii are almost certainly higher than they would have been in a normal year since the rate of working was slow. The large machines took an average of 6.4 hours to harvest an acre while the separate toppers covered an acre in 4.1 hours and the separate lifters in 7.2 hours. The cost of lifting and topping by hand was also undoubtedly increased by the difficulties of the season.

Cultivation Practices

In the following paragraphs details are given of some of the practices adopted in the cultivation of sugar beet on the costed farms. No attempt is made to correlate the adoption of certain practices with the net returns obtained by growers. A very large number of trials aimed at discovering the most satisfactory techniques for sugar beet cultivation have been conducted under the auspices of the British Sugar Beet Research and Education Committee. These trials have been carried out under controlled conditions and the results obtained from them necessarily have a much greater validity than any that might be obtained on the limited sample of costed farms on which conditions varied greatly. The results from many of the trials are summarised in the Ministry of Agriculture Bulletin No.153 "Sugar Beet Cultivation."

Table xiii Crops Preceding Sugar Beet

Preceding Crop	Number of Cots	
	Vale of York	W o l d s and Holderness
Corn	41	27
Roots	8	1
Peas	1	-
Seeds	4	2

Details are given in Table xiii of the crops which preceded sugar beet on the costed farms. As might have been expected, beet was usually grown after a corn crop although on a number of Vale of York farms it was preceded by another root crop, usually potatoes.

Table xiv Costs per Acre for Manures and Fertilisers

	Vale of York		Wolds & Holderness	
	Organic Manures Applied	No Organic Manures Applied	Organic Manures Applied	No Organic Manures Applied
	£. s. d.	£. s. d.	£. s. d.	£. s. d.
Applying Farmyard and other Organic Manures	2.16. 6.		3. 7. 0.	
Farmyard and Other Organic Manures	11.14. 0.		11. 1. 6.	
Applying Fertiliser	13. 6.	18. 0.	14. 0.	13. 6.
Artificial Fertiliser	10. 5. 6.	11.18. 0.	10. 1. 0.	15. 0. 0.
Manurial Residues Brought forward from previous crops.	2.11. 0.	4.19. 0.	1. 2. 0.	2. 2. 0.
Total Gross Cost less Manurial Residues carried forward to following crops.	28. 0. 6.	17.15. 0.	26. 5. 6.	17.15. 6.
	10. 4. 6.	4.12. 6.	9.16. 6.	3. 7. 0.
TOTAL NET COST	17.16. 0.	13. 2. 6.	16. 9. 0.	14. 8. 6.

Table xv Application of Fertilisers and Manures

A. Vale of York Group

	Organic Manures Applied (34 costs)			No Organic Manures Applied (20 costs)		
	Average per Acre for all costs.	No. of costs where applied.	Average per acre where applied.	Average per Acre for all costs.	No. of costs where applied.	Average per acre where applied.
	cwts		cwts	cwts		cwts
Compound Fertiliser	10.1	30	11.5	12.1	19	12.6
Nitro Chalk or Sulphate of Ammonia	0.5	7	2.5	0.6	7	1.8
Kainit	0.5	4	4.0	0.7	3	5.0
Salt	2.7	20	4.5	2.1	10	4.2
	tons		tons			
Farmyard Manure	9.8	25	13.3			
Shoddy	0.5	8	2.0			
Sewage Sludge	0.2	3	25.0			

Table xv (continued)

B. Wolds and Holderness Group

	Organic Manures Applied (12 costs)			No Organic Manures Applied (18 costs)		
	Average per acre for all costs.	No. of costs where applied.	Average per acre where applied.	Average per acre for all costs.	No. of costs where applied.	Average per acre where applied.
	cwts		cwts	cwts		cwts
Compound Fertiliser	10.2	11	11.1	12.9	18	12.9
Superphosphate	0.7	1	8			
Nitro Chalk or Sulphate of Ammonia	0.4	3	1.5	1.2	9	2.5
Muriate of Potash	0.2	2	1.5	0.1	1	2.0
Kainit Salt	2.0	3	8.0	1.0	3	6.3
				2.2	7	5.6
Farmyard Manure	tons 11.0	12	tons 11.0			

In order to illustrate the manurial practices adopted, the costs from each of the two groups have been subdivided into those which received organic manures and those which did not. Details of the costs for manures and fertilisers in each sub-group are given in Table xiv while the actual applications received are outlined in Table xv.

Higher costs for artificial manures were incurred for beet which received no organic manure but these were not as great as the charges made for organic manures on those fields to which they were applied. In both of the Wolds and Holderness sub-groups the value of the manurial residues carried forward from preceding crops to the beet, was lower than in the corresponding Vale of York sub-groups. This suggests that beet was grown on land on the Wolds and in Holderness which was not in such good heart as that in the Vale of York.

Organic manures, mainly farmyard manure, were applied to well over half of the Vale of York costs, but only to two-fifths of those in the Wolds and Holderness group where moreover dressings were appreciably lighter. In addition, a higher proportion of the undunged fields in the Vale of York had received farmyard manure within the two preceding years than was the case on the Wolds and in Holderness. Sugar beet grown on Vale of York farms usually receives second priority after potatoes for what farmyard manure is available, whereas on the Wolds and Holderness it is often applied to the seeds preparatory to ploughing for wheat.

In both groups 2 or 3 cwt more artificial fertilisers per acre were applied to land which received no organic manures compared with that which did. Most of the artificial manures applied were in the form of compounds, National No.1 (7.7.10½) being most favoured. Dressings were liberal and were in fact rather above those recommended in the bulletin "Sugar Beet Cultivation", referred to above.

It has been shown that salt has a marked effect on the weight of sugar obtained per acre of beet. Salt or Kainit (which is rich in salt as well as potash), was applied in 37 out of 54 Vale of York costs. It was not so popular however on the Wolds and in Holderness where it was applied in only 13 out of the 30 costs and more use could probably have been made of it there.

Many of the growers applied lime before sowing sugar beet; lime was applied in 29 out of the 54 Vale of York costs. In many of the other costs lime had been applied to a previous crop. Not surprisingly less lime was used on the Wolds and in Holderness where it was applied on only 9 out of 30 costs.

Table xvi Seed Rates per Acre for Sugar Beet

Seed Rate per Acre pounds	Number of Costs	
	Vale of York	Wolds and Holderness
7	-	3
8	3	3
9	1	1
10	22	4
11	3	4
12	9	7
13	5	-
14	5	3
15	5	3
16	-	-
17	1	1
18	-	1

The rate of seeding tended to be low. Table xvi shows that the most popular rate among Vale of York farmers was ten pounds to the acre whereas those on the Wolds and in Holderness tended to sow at a rather heavier rate. Only a few growers used as much as fifteen pounds to the acre which is the recommended rate for natural seed. The use of rubbed seed was uncommon.

Table xvii Width Between Rows of Sugar Beet

Width of Rows inches	Number of Costs	
	Vale of York	Wolds and Holderness
19	2	5
20	3	4
21	7	-
22	28	9
23	-	-
24	14	11
25	-	1

The widths between the rows which were adopted are given in Table xvii. Rows 22 inches apart were the most popular.

Table xviii Date of Drilling Sugar Beet

Date of Drilling Week beginning	Number of Costs	
	Vale of York	Wolds and Holderness
April 1st	8	3
8th	1	1
15th	19	5
22nd	1	4
29th	5	3
May 6th	2	2
13th	1	1
20th	-	3

Dates of sowing are given in Table xviii for all the costs where drilling was completed in one operation. Costs where drilling took place on two separate dates have been excluded. Farmers on the Wolds and in Holderness on the whole tended to drill rather later than those in the Vale of York and this may have had some effect in reducing their yields.

The Economies of Growing Sugar Beet

If the margins obtained between costs and returns in 1954 were typical few farmers would wish to grow sugar beet. The year 1954, however, was not typical. The unfavourable margins obtained in that year were due primarily to the poor returns per acre caused by the combination of low yields of beet per acre and a low sugar content. High costs incurred on account of the difficult harvesting conditions were of less importance. If, for instance, in the Vale of York group, average harvesting costs were a third lower in a normal season and haulage costs a £1 an acre less owing to a lower dirt tare, the total saving would only be £6 an acre out of a total cost of £56 per acre.

Table xix Average Yield, Sugar Content & Value per Acre at 1954 Prices of Sugar Beet Grown for the Selby Factory. 1947 to 1954.

Year	Average Yield of Clean Beet per Acre Tons	Sugar Content Per Cent	Value per Acre at 1954 prices		
			£.	s.	d.
1947	8.1	17.0	52.	7.	0.
1948	8.6	15.8	51.	16.	0.
1949	12.7	15.6	75.	1.	6.
1950	11.7	15.7	69.	19.	0.
1951	10.9	15.9	65.	15.	0.
1952	9.2	15.6	54.	12.	6.
1953	12.9	15.6	76.	13.	6.
1954	8.8	14.2	47.	13.	6.

Under a system of fixed prices, the returns per acre from sugar beet are liable to vary more from year to year than those from most other sale crops since quality as expressed by sugar content as well as yield has a marked effect in determining the cash return per acre. In Table xix, average yield per acre and sugar content of the beet grown for the Selby factory in each of the eight years from 1947 to 1954 is given. From these figures the average return per acre in each year at 1954 prices has been calculated. If these returns are compared with the average

net costs per acre as determined in 1954 less say a deduction of £6. for abnormal costs due to the bad season, it becomes apparent that with the yields and sugar contents obtained in the four years 1947, 1948, 1952 and 1954 little or no profit margin would have been left for the growers. However, with the yields and sugar contents obtained in the other four years, 1949, 1950, 1951 and 1953, the margin of costs over returns would have been substantial. (1)

It appears, therefore, that sugar beet is rather a chancy crop to grow. It is nevertheless a useful crop on many farms particularly where eelworm limits the potato acreage or where the tops and pulp can be profitably used for feeding stock. High yields in terms of sugar per acre, however, are essential if the profits obtained are to justify the considerable expenses incurred in its production.

Six Investigations into Sugar Beet Costs

Sugar beet has been costed by this Department in six different years since 1944. A comparison of the results obtained in these years is of interest. For the purpose of this comparison only the results from light land farms in the Vale of York have been used. The results for the six years are summarised in Table xx.

Table xx Summary of the Results for Six Years Investigations into Sugar Beet Costs on Mainly Light Land Farms in Yorkshire.

Year	Gross Cost per Acre.+			Return per Acre.			Margin of Returns over costs per Acre			Yield of Clean Beet per Acre.	Sugar Content
	£.	s.	d.	£.	s.	d.	£.	s.	d.	Tons.	Per Cent.
1944	33.	19.	0.	37.	3.	0.	+ 3.	4.	0.	8.9	15.7
1945	34.	14.	0.	51.	11.	0.	+16.	17.	0.	11.5	16.2
1946	36.	5.	0.	48.	16.	0.	+12.	11.	0.	10.6	15.1
1948	43.	3.	0.	50.	10.	6.	+ 7.	7.	6.	9.5	15.6
1949	45.	1.	0.	77.	12.	0.	+32.	11.	0.	14.2	15.8
1954	59.	13.	0.	52.	4.	6.	- 7.	8.	6.	9.6	14.3

+ No credits have been allowed for either cleaning values or tops in the gross costs given in this table.

In this table the margin of returns over cost shown for 1954 differs from that in Table ii since in the former table no credit is allowed for the value of tops. The financial results obtained in 1954 were the worst for any of the six years although the yield of beet per acre was lower in 1944. The indices in Table xxi show that whereas between 1944 and 1949 costs of production rose at a similar rate to that of the guaranteed price for sugar beet with 15.5 per cent sugar content, in the period between 1949 and 1954 costs appear to have risen more rapidly than the price. If this is so a higher yield is now necessary before a profit can be achieved.

- (1) It may be objected that in making the above comparisons no account has been taken of the higher harvesting costs incurred when yields are heavy. While this is true, it is not believed that taking these extra costs into account would materially alter the general picture. Harvesting and haulage costs account for only a third of the total costs and there is some evidence to indicate that harvesting costs at least do not rise proportionately with yield.

Table xxi Indices for Labour Costs per hour, Labour and Total Costs per Acre and for the Price of Sugar Beet.

Y e a r	Standard Hourly Rates for Manual Labour used in Sugar Beet Costs.	Actual Total Cost of Manual Labour per Acre.	Total All Costs per Acre.	Price per ton of Sugar Beet (15.5 per cent Sugar content)
1944	100	100	100	100
1945	103	106	102	106
1946	121	106	107	107
1948	137	121	129	128
1949	153	125	137	128
1954	195	140	177 (159+)	144

+ After deducting £6 per acre for abnormally high harvesting and haulage costs.

The hourly costs for manual labour have increased even more rapidly than total costs but the actual cost of manual labour per acre has not gone up at a similar rate. It is evident that farmers have considerably reduced the man labour used for growing beet and have thus partially offset the steep rise in wage rates. This is confirmed by the figures given for man hours per acre in Table xxii. (1)

Table xxii Estimated Labour Requirements per Acre for Sugar Beet

	1944	1946	1948	1949	1954
Man Hours	185	175	168	158	142
Tractor Hours	10	10	18	21	28
Horse Hours	46	38	18	17	3

Figures for 1944 to 1949 from Table IIv page 96 Farmers Report No.119 "Economic Aspects of Yorkshire Farming"

In 1954, fortythree fewer man hours were required per acre than in 1944. If conditions in 1954 had been better and allowed a greater use to be made of mechanical harvesters, the difference would undoubtedly have been larger. The reduction in manual labour requirements has been achieved by greater mechanisation. The impact of mechanisation is reflected in the sharp drop in horse hours from 46 to 3 accompanied by a less than proportionate rise in tractor hours from 10 to 28 per acre, although the combined cost of horse and tractor work has risen as a result of this changeover.

The more widespread use of mechanical harvesters accompanied by use of machines to assist in thinning (these were not used to any extent on the costed farms), should enable still further economies to be made in the amount of manual labour needed to grow sugar beet.

- (1) Owing to the amount of work done at piece rates, it was not possible to record the actual man hours per acre. The figures given for man hours in Table xxi were obtained by dividing the total cost of manual labour by the hourly rates charged for adult male labour. Although the figures for man hours per acre obtained in this way are only approximate, this fact does not alter the validity of the year to year comparisons.

S U M M A R Y

1. In 1954 sugar beet was costed on 31 light land farms in the Vale of York and on 27 farms on the Wolds and in Holderness.
 2. Owing to the weather harvesting was difficult and returns poor. The average yield of clean beet was 9 tons 12 cwts per acre on Vale of York farms and 8 tons 1 cwt on those from the Wolds and Holderness. Sugar content averaged 14.3 per cent for both groups.
 3. Average net costs per acre in the Vale of York and Wolds and Holderness groups were £56.3.0. and £56.17.0. respectively. The returns per acre from the sale of beet were £52.4.6. and £43.18.6. per acre. Therefore in both groups costs exceeded returns. The deficit was £3.18.6. per acre in the Vale of York and £12.18.6. per acre in the Wolds and Holderness group.
 4. The more favourable margins secured between costs and returns on some farms were largely due to above average yields.
 5. The bad conditions prevented the use of a number of mechanical beet harvesters and restricted the use of others. However, where these machines were used they considerably reduced both the actual cost and the manual labour requirements of beet harvesting.
 6. These savings were sufficiently great to justify the purchase of the larger type of harvester even where only a small acreage of sugar beet is grown.
 7. Sugar beet was generally grown after a corn crop.
 8. Manuring of the costed beet was on the whole generous. A higher proportion of the beet grown on the Vale of York farms received farmyard or other organic manures than on the Wolds or in Holderness. Larger dressings of artificial fertilisers were applied to those crops which did not receive organic manures. Both lime and salt or Kainit were commonly applied to the sugar beet.
 9. Seeding rates tended to be low and were rarely as high as the recommended rate of 15 pounds of natural seed to the acre.
 10. The most common widths between rows were 22 or 24 inches.
 11. A comparison was made of the average yields per acre and sugar content of the beet grown for the Selby factory over the eight years from 1947 to 1954. From this data, the average return in each year was calculated at 1954 prices. In only four of the years would this return substantially exceed the cost of production as calculated in 1954, in the other four years there would be little or no margin. This emphasises the importance of obtaining a high output in terms of sugar per acre if sugar beet is to justify the considerable expenses incurred in its production.
 12. The results obtained in the 1954 investigation were the worst of any of six years since 1944 in which sugar beet has been costed by this Department.
 13. A comparison of the costs obtained in the six years shows that the increasing cost of manual labour has been partially offset by a substantial reduction in labour requirements in hours per acre. Since 1944 tractors have almost entirely replaced the horse in the sugar beet fields.
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APPENDIX. A.

The following tables summarising the results from both groups are included for the purpose of comparison with similar tables issued by other agricultural economics centres. The data relates to 58 farms providing 84 records on 1119½ acres.

Table. A. Summary of Average Costs per Acre

Item of Cost:	£.	s.	d.
Labour	21.	12.	0.
Tractor	7.	8.	5.
Horse		2.	9.
Contract Services		18.	2.
Machinery Depreciation and Repairs	2.	12.	0.
Other Fuel		-	
Seed	1.	5.	5.
Fertilisers and Manures			
Applied	18.	16.	5.
plus Residuals Added	2.	14.	2.
less Residuals carried Forward	7.	18.	2.
Net Fertiliser & Manures Charge	13.	12.	5.
Sundries		4.	5.
Rent	1.	14.	0.
Share of General Farm Expenses	5.	8.	0.
Marketing Costs	5.	1.	5.
Gross Cost at Delivery Point	59.	19.	0.
Credit Value of Beet Tops	3.	10.	0.
NET COST AT DELIVERY POINT	56.	9.	0.

Table. B. Yield, Costs, Returns and Margins

Yield of Clean Beet per Acre	8.82 Tons					
	Per Acre	Per Ton				
	£.	s.	d.	£.	s.	d.
Sales of Clean Beet	48.	1.	0.	5.	8.	10.
Cost at Delivery Point	56.	9.	0.	6.	8.	0.
Margin	-£8.	8.	0.		-19.	2.

APPENDIX. B.

Notes on Methods Used in the Calculation of the Costs

Manual Work

Work done by adult men on time rates was charged at 3/1d per hour. Other manual labour excluding that engaged on piece work was charged at corresponding rates.

Tractors

Medium tractors were charged at 4/6d per hour and Heavy tractors at 4/10d per hour.

Lorries

Lorries used in the fields were charged at 6/- per hour.

Horses

Horses were charged at 1/3d per hour.

Implement Depreciation and Repairs

With the exception of sugar beet harvesters, depreciation and repairs were estimated on the basis of standard per acre rates for each machine. For sugar beet harvesters, separate per acre rates were calculated for each individual machine on the basis of the actual costs incurred. The annual depreciation charge was obtained by dividing the purchase price of the machine by eight. The charge per acre was then calculated by dividing this figure not by the acreage harvested in 1954 but by an adjusted acreage figure calculated as follows:-

$$\text{adjusted acreage} = \frac{2a + b}{3}$$

where a = acreage harvested by the machine in a normal season
and b = acreage harvested by the machine in 1954

This adjusted acreage was used in the calculation of the per acre cost of depreciation in order to avoid charging an unduly high rate per acre in 1954 on account of the acreage harvested by machine being below normal.

Farmyard Manure

A charge of £1 per ton was made for farmyard manure.

Residual Manurial Values

These were calculated from the table produced by the Scottish Standing Committee.

General Farm Expenses

A sum equivalent to one quarter of the cost of manual labour was charged against the beet to cover a share of the general expenses incurred in running the farm which cannot be allocated to specific enterprises.

Averages

Weighted averages are used throughout.

