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*Sugar beets -
Cost of
production*

1947 CROP COSTS STUDIES.

1. SUGAR BEET

by

J.D. Nutt

ADDENDUM. UTILISATION OF SUGAR BEET TOPS.

by

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August, 1948.

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* No further copies available.

INTRODUCTION.

The 1947 cropping year was the third successive year in which detailed records were kept of the costs of growing sugar beet in the East of Scotland. In all, fifteen complete records were obtained for the 1947 crops compared with twenty-two in each of the previous two years. Nine of these records came from farms in Fife, the county in which the beet factory is situated at Cupar; two records came from the adjoining counties of Perth and Kinross; two came from Angus and one each from East Lothian and Berwick.

The farms on which the costed crops were grown varied in acreage and type but all of them could be regarded as mainly arable farms with stock feeding, stock rearing or dairying as the principal livestock enterprises. The types of soil on which the beet crops were grown were all described as "loam" but were qualified as heavy, medium or light loams as the conditions on the farms varied. The height above sea level at which these crops were grown ranged from 30 feet to upwards of 500 feet; ten crops were grown at elevations up to 200 feet above sea level, three between 200 and 400 feet and two over 400 feet.

As in previous years, the rental values of the land on which the costed crops were grown were mainly between 20/- and 40/- per acre. One crop was grown on land rented at just under 20/- per acre, eight crops were grown on land rented at between 20/- and 30/- per acre, five crops on land between 30/- and 40/- per acre and one on land at over 40/- per acre. Thus, to quote the Report on the 1946 costs of growing sugar beet, these crops were grown "on a useful type of soil situated on predominantly arable farms at low elevations".

All the fifteen crops under review except three followed cereal crops, either oats or wheat. This suggests that, as has been indicated in previous reports, beet tends to take up part of the usual root break in the farm rotation. The three exceptions were taken after beans, grass and beet respectively. The manuring given to these crops varied considerably. This is only to be expected where conditions on individual farms are bound to differ considerably with consequent variation in the need for manures of one sort or another. All fifteen crops received dressings of compound fertilizer ranging in amount from 5 cwts. to 15 cwts. per acre; two crops received slag, three crops were given top dressings of nitrogenous manures, and three were top-dressed with salt. Eight of the crops were given dressings of dung ranging from 12 to 20 tons per acre and seven crops received dressings of lime of from 20 to 80 cwts. per acre. One or two illustrations may be given to show the variety of manuring met with. One crop received 20 cwts. of lime, 10 cwts. compound manures, 10 cwts. of slag, 5 cwts. of salt and 1 cwt. of nitrogenous dressing per acre; another received 19 tons of dung, 8 cwts. of compound manures and 60 cwts. of lime per acre; a third crop received 10 cwts. of compound manures only and this was the lightest manuring given to any of the fifteen crops.

One final factor which must have had a considerable influence on the growing of sugar beet in 1947 remains to be mentioned - the weather. The abnormal storms of the early part of the year were followed by difficult conditions for working the land which resulted in relatively late sowing and often led to more than usual difficulty in preparing an adequate seed bed. The early part of the growing season was not too kind, particularly with regard to inter-row cultivations, while the month of August was distinguished by brilliant sunshine which must have been of considerable benefit to the crop. The weather during the harvesting period was not in any way abnormal.

COSTS OF PRODUCTION.

The average per acre costs of production of the 1947 crop are given in Table I on page 4 together with the highest and lowest individual costs. The Table also shows the average figures for the two previous years but, before discussing any of the figures in detail, it must be pointed out that, in one respect, the Table differs from the corresponding Tables prepared for the 1945 and 1946 Sugar Beet Costs Reports. The difference is in the costing procedure adopted with regard to the beet tops. Previously, a value had been given to the tops and this value was then added to the actual returns realised for the clean beet to give the total returns per acre. No attempt was made to divide the total costs of growing the crop between the clean beet and the tops. In the present report the value given to the beet tops has been revised and the total cost of growing beet and tops has been divided between the two "joint products". In order to make the figures in Table I comparable, the figures for 1945 and 1946 have been adjusted to conform with the procedure adopted for 1947. The economic importance of sugar beet tops is becoming increasingly recognised and in view of this it is worth while describing the methods which have been used in compiling Table I.

The question of the value to be ascribed to the sugar beet tops is an extremely complicated one. It is generally admitted that the tops and crowns provide a useful and valuable addition to the supplies of home grown succulents for winter feeding or, alternatively, confer considerable benefits to the following crops if ploughed in or fed off where grown. During the autumn of 1947 and the following winter an attempt was made to ascertain the ways in which the tops were utilised by the growers and the values placed on them when used in various ways. The Addendum to this Report summarises the results of this investigation.

The Addendum clearly establishes the great variety of ways in which the tops are used and the wide differences in values which are placed on them. It is emphasised, too, that there are great difficulties in placing these money values on the tops when used for various purposes. If it is assumed that when tops are fed to cattle they are roughly equal in value to the turnips they replace (a practical assessment made by many farmers), then a total value, inclusive of manurial residues, of £10 per acre may be calculated for this purpose.

On/

On the other hand, where tops are folded off with sheep a feeding value, exclusive of manurial residues, of £4 per acre appears to be about the average. If the value of the manurial residues, say 25/- per acre, is added a total value of £5.5/- is obtained. This agrees fairly closely with actual estimates made by growers. Working on these figures it is reasonable to take a figure of £7 per acre as being a measure of the value of an average "crop" of tops. Relating this to the average yield of clean beet for the crops covered by the investigation, the value of the tops works out at approximately 15/- per ton of clean beet.

It is not claimed that this figure of 15/- per ton of clean beet is anything more than a reasonable estimate of the value of beet tops. In fact, the investigation has, if nothing else, conclusively shown the necessity for carefully controlled enquiries into, and the costing of, the utilisation of sugar beet tops under practical farming conditions. Until more precise data are available this figure of 15/- per ton of clean beet will be taken as representing the value of the tops to the grower.

Having made this decision there is still a further step which must be taken. Is the value of the tops to be considered as a reduction of the total cost of growing clean beet in the sense that it is an inescapable by-product and any money value it may have is incidental to the growing of the beet? Or are the tops to be considered as a worthwhile product in themselves? The second alternative is considered to be the more correct and, therefore, the total cost of growing the crop - beet and tops as "joint products" - must be allocated between the two. There is no precise method of determining how this allocation should be made and, in default of any better method, it may be justifiable to adopt the method widely used in the costing of corn crops and divide the total costs per acre in proportion to the values per acre of the joint products. Using the average yield of clean beet for the crops covered by the enquiry into the utilisation of the tops, the average price per ton of clean beet as ascertained in the beet costing investigation and the value of the tops at 15/- per ton of clean beet, the following values per acre may be calculated.

Value of Clean Beet per Acre	£64. 15. 7
Value of tops per acre	6. 18. 6
	<hr/>
	£71. 14. 1
	<hr/>

In round figures the values of clean beet and tops are in the ratio of 9 to 1 and in this report the costs of growing the crop as a whole have been divided in these proportions. The average cost of growing an acre of clean beet in 1947 is, therefore, £35.4.5d and the average cost of growing the tops per acre is £3.18.3d.

TABLE I.

TABLE I. COSTS OF PRODUCTION PER ACRE.

Size of field costed - acres	Average Costs.			1947 Costs.	
	1945.	1946.	1947.	Highest.	Lowest.
	9	10	10	4 $\frac{1}{2}$	10
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1. <u>Labour and Power</u>					
(a) <u>Cultivations</u>					
Manual Labour	7. 1. 9	7.12. 6	8.16. 7	14. 6. -	3. 5. 3
Horse	1. 5. 1	1. 1.10	1. 6. 2	16. -	5. 4
Tractor	1. 6. 5	1.10. 6	1. 9. 9	2.16. 8	1. 1. 3
Contract	1	19.10	1. 8. -	- . - . -	10. 6
<u>Less</u> Cleaning Residues	-1. - . -	-1. - . -	- .19. 4	-1. - . -	-1. - . -
Net Cultivations	£8.13. 4	£10. 4. 8	£12. 1. 2	£16.18. 8	£4. 2. 4
(b) <u>Harvesting</u>					
Manual Labour	7. 8. 5	4.13. 9	3.17. 4	10.16. 5	1. 8. 8
Horse	1. 4. 1	14. 5	12.10	7. 9	14. 6
Tractor	12. 4	13. 8	10.11	2. 6. 8	- . - . -
Contract	3.11	2.14. -	2.18. 6	- . - . -	5.10. -
Carriage	3. 1	17.10	- . - . -	- . - . -	- . - . -
Total Harvesting	£9.11.10	£9.13. 8	£7.19. 7	£13.10.10	£7.13. 2
TOTAL LABOUR AND POWER	£18. 5. 2	£19.18. 4	£20. - . 9	£30. 9. 6	£11.15. 6
2. <u>Seed</u>	1. - . -	1. 1. 7	1. - . 4	11. 5	1. - . 8
3. <u>Manures</u>	8.10. 7	8.17. 1	8.16.11	9. - . 9	6.15.11
4. <u>Rent</u>	1.12.10	1. 9. 2	1. 9. 8	1.15. -	1. 3. 6
NET DIRECT COSTS	£29. 8. 7	£31. 6. 2	£31. 7. 8	£41.16. 8	£20.15. 7
5. <u>Overheads</u>	6.10. 9	7. 5.10	7.15. -	12.12. 3	4.18. 2
TOTAL NET COSTS	£35.19. 4	£38.12. -	£39. 2. 8	£54. 8.11	£25.13. 9
TOTAL NET COSTS per acre:- (a) Beet [‡]	32. 7. 5	34.14. 9	35. 4. 5	49. - . -	23. 2. 4
(b) Tops [‡]	3.11.11	3.17. 3	3.18. 3	5. 8.11	2.11. 5

[‡] Calculated by allocating 9/10ths of the Total Net Costs to the Beet and 1/10th to the Tops.

The average cost of growing an acre of sugar beet i.e. beet and tops, in 1947 was £39. 2. 8d. which is only slightly higher than the figure of £38.12/- for the previous year. This represents an increase of only $1\frac{1}{2}\%$ in the total cost of growing the crop. The main items of cost were cultivations £12.1.2d. per acre, harvesting £7.19.7d per acre, seed £1.-.4d per acre, manures £8.16.11d. per acre, rent £1.9.8d. per acre and overheads £7.15/- per acre. The relative importance of these costs is indicated by expressing these figures as percentages of the total cost. Thus, cultivations accounted for 30.7%, harvesting 20.4%, seed 2.6%, manures 22.6%, rent 3.8% and overheads 19.9% of the total. The high cost of overheads as compared with other costs is due to the method of calculating the cost of this item and is very largely the result of the high cost of manual, horse and tractor work involved and on which the cost of overheads is calculated.

The figures for the highest and lowest costs per acre in 1947 emphasise the wide variation in costs which may be met with. These variations are the results of a large number of interacting factors such as differences in the type of soil, a high or low standard of manuring and cultivations, climatic conditions, the incidence of disease, elevation at which the crop is grown, the place in the rotation and, by no means the least important, the technical ability of the grower. As it is, the highest cost worked out at £54.8.11d. per acre as compared with the lowest cost of £25.13.9d. per acre, the former being more than twice as high as the latter.

The diagram on page 6 shows how the highest and lowest costs per acre differ from the average.

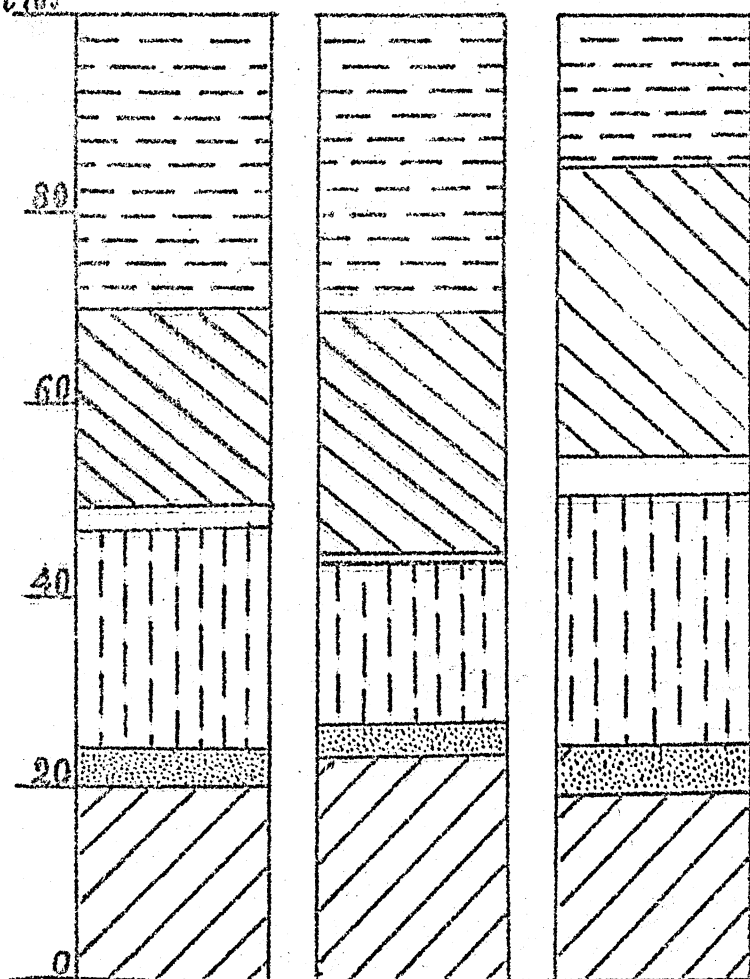
Comparing the highest cost with the average cost it will be seen that the high level of total costs has had the effect of reducing one of the more stable elements of cost - seed - to a much smaller proportion of the total. This is not, however, true of the other stable element - rent. In this case the high-cost crop was grown on land at a rental appreciably higher than the average rental value and thus the rent of the highest-cost crop takes up 3.2% of the total as compared with the average of 3.8%. The higher rent may, indeed, indicate one explanation of the higher costs as high rents are paid for land which will respond to more intensive working and manuring. In this particular case, the cost of cultivations per acre is much higher than the average and this has also resulted in the cost of overheads being much higher. The cost of manuring, however, is only slightly above the average. The cost of harvesting which, to some extent is dependent on the variable factor of yield, is much higher than would have been expected as the yield proved to be only slightly heavier than the average. Thus, the distribution of the costs for the highest-cost crop indicates a reasonable share for cultivations but too high a share has been spent on harvesting. Overheads bulked rather more heavily than they should. The cost of manuring has taken up a rather smaller proportion than the average.

Without/

DISTRIBUTION of COSTS per ACRE - 1947

<u>AVERAGE</u>	<u>HIGHEST</u>	<u>LOWEST</u>
<u>£39-2-0</u>	<u>£54-8-11</u>	<u>£25-13-9</u>
<u>(8ton 2½cwt)</u>	<u>(8ton 17cwt)</u>	<u>(3ton 2½cwt)</u>

Per Cent 100



LEGEND

- Cultivations [Hatched pattern]
- Harvesting [Diagonal hatched pattern]
- Seed [White box]
- Manures [Vertical hatched pattern]
- Rent [Dotted pattern]
- Overheads [Diagonal hatched pattern]

Without discussing all the circumstances which gave rise to high costs per acre for cultivation and harvesting (particularly the latter) the figures suggest that unless more expense is incurred for manures or the cultivation and harvesting costs reduced, these costs must be regarded as out of balance. In addition to this it is, of course, possible that the whole range of costs on the high-cost crop are too heavy in relation to the yield obtained - as in fact proved to be the case. The general reaction to such a scale of costs must be that, since the cost of manures per acre is not excessive compared with the average and the costs of seed and rent are stable, serious attention must be given to reducing the costs of cultivating and harvesting; a reduction in the cost of overheads would follow automatically. This high-cost crop is an example of the fact that high costs in farming need not necessarily result in high output and returns.

The lowest-cost crop was grown at a total cost of only £25.13.9d. per acre, i.e. two-thirds of the average cost and less than half the highest cost. The cost of seed per acre was approximately equal to the average and thus this item takes up a rather greater share of the smaller total cost; the rental value per acre was lower than the average resulting in rent only taking up a slightly greater share of the total, 4.6%, than the average of 3.8%. The actual costs per acre of the low-cost crop were all lower than the average but there are some interesting points. Cultivations only cost about one-third of the average per acre and take up a much smaller share of the total, 16.0% as compared with an average of 30.7%. Though the cost of manuring is relatively low per acre at just over three-quarters of the average it takes up a rather greater share of the total, 26.4% as against 22.6%. The remaining costs, harvesting and overheads, have been greatly influenced by the variable factor of yield. For this crop the yield of clean beet worked out at 9 tons 2½ cwts. per acre which was approximately 10% higher than the average, with the result that the harvesting cost took up 29.8% of the total compared with an average of 20.4%. Since the harvesting consists of manual, tractor and horse work the cost of overheads was increased accordingly, and its share of the total was only just lower than the average. This crop may, in fact, be taken as an illustration of the fact that under certain sets of conditions low costs may produce heavy crops and good returns. But, unless the cultivations were carried out under ideal conditions which make the working of the seed bed possible at very low cost, the distribution of the costs as shown in the diagram suggests that a cultivation cost as low as £4.2.4d. per acre is abnormally low and might very well lead to poor results. It is also possible that the cost of manuring might be higher to ensure a good crop if conditions were less favourable.

Some of the points already mentioned are emphasised when the financial results of growing sugar beet are examined. In the following Table various aspects of these results are shown.

TABLE II. /

TABLE II. AVERAGE YIELDS, RETURNS AND PROFITS PER ACRE.

	AVERAGES			1947	
	1945	1946	1947	Highest	Lowest.
	T. c. q.	T. c. q.	T. c. q.	T. c. q.	T. c. q.
Yield per acre - Clean Beet	9 15 2	7 3 3	8 2 2	8 17 -	9 2 2
Sugar Content	15.6%	15.7%	17.1%	17.6%	17.0%
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cost per acre - Clean Beet [‡]	32. 7. 5	34.14. 9	35. 4. 5	49. - . -	23. 2. 4
Cost per ton - Clean Beet [‡]	3. 6. 2	4.16. 8	4. 7. 1	5.10. 9	2.10. 8
Cost per acre - Tops	3.11.11	3.17. 3	3.18. 3	5. 8.11	2.11. 5
Return per acre - Clean Beet	41.12. 6	31.19. 6	44. 4. 9	48. 6. 6	48.15. 6
Return per acre - Tops [∅]	7. 6. 7	5. 7.10	6. 3. 6	6.12. 9	6.16.10
Profit per acre - Clean Beet	9. 5. 1	-	9. - . 4	-	25.13. 2
Profit per acre - Tops	3.14. 8	1.10. 7	2. 5. 3	1. 3.10	4. 5. 5
Loss per acre - Clean Beet	-	2.15. 3	-	13. 6	-

[‡] Calculated by allocating 9/10ths of the Total Net Costs to the Clean Beet and 1/10th to the Tops.

[∅] Calculated at the rate of 15/- per ton of Clean Beet.

The figures for the three years, 1945 to 1947, show the general changes which have taken place in the yields, costs and returns per acre. The importance of yield as the factor which largely determines the final results is obvious from the average figures. Total costs per acre of clean beet have not varied to any marked extent but the average yield fell from $9\frac{3}{4}$ tons in 1945 to $7\frac{1}{5}$ tons in 1946. The following year saw an increase to rather less than $8\frac{1}{2}$ tons to the acre. Increases in the contract price also enter into the picture but the net result has been that with a high yield in 1945 a total profit of £12.19.9d. per acre for beet and tops was realised; in 1946 a loss of £2.15.3d. per acre was incurred on the clean beet. This was partially offset by a profit of £1.10.7d. per acre on the tops after the costs had been divided between the clean beet and the tops. The 1947 beet crop showed an average profit of £9.0.4d. per acre for the beet and £2.5.3d. for the tops, making an overall profit of £11.5.7d. per acre.

The importance of yield, and also of the sugar content, is shown when the figures in Table II for the highest and lowest costs in 1947 are studied. The high-cost crop only achieved a slightly higher yield than the average but the sugar content was also higher at 17.6%. The crop produced a return of £48.6.6d. per acre for clean beet which, while appreciably higher than the average return of £44.4.9d. per acre was slightly lower than the return from clean beet, £48.15.6d., from the low cost crop with its higher yield but lower sugar content. It has already been pointed/

pointed out that figures of the actual costs incurred in growing the crop do not tell the whole story by any means. It is the combination of many factors, some entirely outside the farmer's control, which ultimately decide the profitability or otherwise of any crop. As far as the figures for the three years may be taken as a guide, and assuming that adjustments are made to keep prices in step with costs, then an average yield of 7 tons per acre will do little more than cover the costs of growing. This is shown by the following figures based on the average cost per acre in each year of growing the whole crop of beet and tops and the average return in each year per ton of clean beet plus the estimated figure of 15/- per ton for the tops in each year.

	<u>1945</u>	<u>1946</u>	<u>1947</u>
	£ s. d.	£ s. d.	£ s. d.
Total cost of crop per acre	35.19. 4	38.12. -	39. 2. 8
Return for a 7-ton crop:-			
Clean Beet	29.16. 1	31. 2.10	38. 2. 2
Tops	5. 5. -	5. 5. -	5. 5. -
	<hr/>	<hr/>	<hr/>
TOTAL	£35. 1. 1	£36. 7.10	£43. 7. 2
	<hr/> <hr/>	<hr/> <hr/>	<hr/> <hr/>

Yields of more than 7 tons per acre may be expected to produce a profit always provided that the greatest efficiency is maintained particularly with regard to cultivations and manuring.

VARIATIONS IN COST, YIELDS, RETURNS AND PROFITS.

Some of the variations in average yields, costs etc. from year to year and the same aspects of the highest and lowest costs in 1947 have been discussed in the previous sections of this Report. There were, however, considerable variations within each yearly sample of costs. The following sets of figures illustrate these variations for each of the three years under review.

RANGE OF COST OF PRODUCTION PER ACRE.

	<u>£20 -</u>	<u>£25 -</u>	<u>£30 -</u>	<u>£35 -</u>	<u>£40 -</u>	<u>Over</u>	
	<u>£25</u>	<u>£30</u>	<u>£35</u>	<u>£40</u>	<u>£45</u>	<u>£45</u>	<u>Total</u>
No. of crops 1945	-	4	6	8	2	2	22
" " " 1946	1	5	4	2	4	6	22
" " " 1947	-	2	-	8	3	2	15

Although/

Although the general tendency of costs to increase as the years went by must be partially responsible for the greater proportion of the crops being grown at costs towards the higher end of the range the major concentration of costs was in the £35-£40 group. This group contained the greatest number of crops in 1945 and the concentration of the 1947 crops in this group reverses the situation shown by the 1946 grouping. In 1946 there was a much greater spread of costs but the figures for the three years suggest that a cost per acre in the neighbourhood of £40 may be regarded as normal.

RANGE OF YIELDS OF CLEAN BEET PER ACRE.

	<u>Under</u> 5 tons	5 - <u>7½ tons</u>	7½ - <u>10 tons</u>	10 - <u>12½ tons</u>	Over <u>12½ tons</u>	<u>Total</u>
No. of crops 1945	-	4	8	8	2	22
" " " 1946	5	6	10	1	-	22
" " " 1947	1	4	7	3	-	15

Yields in 1947 varied from just under 5 tons to the acre to a yield of 11 tons 5 cwts. and there was a greater proportion of the crops in the relatively high-yield groups. Neither the grouping of the individual yields nor the overall average yield in 1947 were, however, up to the standard of 1945. When the yields for the three years are averaged a figure of 8 tons 9 cwts. is obtained which may be taken as representative of the average yield under varying conditions. If the estimate previously given of 7 tons of clean beet (plus the accompanying tops) as being the yield required to meet average costs is true, then the margin between this yield and the average quoted above, i.e. 1 ton 9 cwts. of beet plus tops, represents the average margin of profit which might be expected. In practice it would be necessary to reduce this margin **due to** extra costs arising from handling the heavier crop.

The average sugar content in 1947, 17.1%, was higher than in either of the previous years and ranged from 16.4% to 17.8%. There is little doubt that the exceptionally fine weather in August of that year was largely responsible for these high figures.

RANGE OF TOTAL RETURNS PER ACRE.*

	<u>Under</u> £25	£25 - <u>£35</u>	£35 - <u>£45</u>	£45 - <u>£55</u>	Over <u>£55</u>	<u>Total</u>
No. of crops 1945	-	4	4	8	6	22
" " " 1946	5	2	6	9	-	22
" " " 1947	-	2	3	5	5	15

* The returns include the value of the tops calculated at 15/- per ton of clean beet in each year.

Even/

Even allowing for changes in the basic price the above figures clearly show the combined importance of yield per acre and percentage sugar content. In 1946 the very slightly higher sugar content when compared with that of 1945 did not prevent the much lower yields from pulling the distribution of the total returns per acre down into the lower groups. In the following year with a higher average yield and a much higher sugar content the returns per acre have been pulled up into the higher groups.

RANGE OF TOTAL LOSSES OR PROFITS PER ACRE.

	<u>LOSSES</u>				<u>PROFITS</u>				
	Over <u>£20</u>	£20 - <u>£10</u>	£10 - <u>£0</u>	<u>Total</u>	£0 - <u>£10</u>	£10 - <u>£20</u>	£20 - <u>£30</u>	Over <u>£30</u>	<u>Total</u>
No. of Crops 1945	-	2	1	3	7	3	6	3	19
" " " 1946	2	2	8	12	5	5	-	-	10
" " " 1947	-	-	3	3	4	4	3	1	12

The figures for 1947 show that, after the gloomy picture presented by the 1946 figures, the possibilities of sugar beet as a profit making crop are much brighter though hardly yet up to the standard of 1945. It cannot be emphasised too often that it is the combination of all the factors involved which determine whether or not there shall be a margin of profit and the figures for the three years show the results of changes in conditions, particularly those of weather and, to a lesser extent, price which are outside the control of the farmer. He may decide to carry out more or less cultivations for the crop, to apply more or less manures, but he cannot decide what weather conditions shall prevail, or alter the prices he will receive.

The general conclusion which may be derived from the study of these three years' results is that, given reasonable growing and harvesting conditions, there is every possibility that sugar beet should show a return to the farmer who is prepared to work and manure his land efficiently. The return may not be as great as that which could be expected from an alternative sale root crop, say potatoes, but in view of the national importance of the crop, its undoubted value to succeeding crops and its convenience value in producing a useful succulent for feeding and, also, in ensuring the supply of additional feed in the way of pulp, there can be little doubt that this crop is well worth its place as part of the root break.

A BASIS FOR ESTIMATING FUTURE COSTS.

The reports which have been written on the costs of growing sugar beet during the past three years have been inevitably historical in character in that they have been concerned with conditions of working, actual costs and returns applicable/

applicable to past seasons. These are of considerable interest and importance to beet growers and to the agricultural industry generally, but "Queen Anne is dead!" What of the future? Is it possible to devise some means of using the information gathered over these last three years in the estimation of future costs of growing this crop? This section of the report is concerned with an attempt to make use of the available figures in this way.

The costs of growing the crop may be roughly divided into two sections, the cost of manual, horse and tractor work and the cost of seed, manures, rent and the cost of overheads which is, in the main, calculated from the costs in the first section.

The costs of manual labour, horse and tractor work are affected by the varying conditions under which beet is grown - the vagaries of the season, the type of labour available, soil type, yield of beet and tops, and the actual price which has to be paid for labour and the costs of working horses and of tractor work. All these factors will vary from year to year and from farm to farm, but the figures for the three years' costings do give a reasonable indication of the extent to which labour, horses and tractors have to be employed in growing the crop. The overall averages of these requirements are as follows:-

LABOUR and POWER REQUIREMENTS per ACRE.

	<u>Cultivations and manuring</u>			<u>Harvesting</u>		
	Hours	£	s. d.	Hours	£	s. d.
Man Labour	70			39		
Wcman "	14			10½		
Boy "	<u>5</u>			<u>5</u>		
Total Manual	89			54½		
Horse	19			14		
Tractor	9½			4½		
Contract Work:-						
Manual		- .19.	-		2.12.	3
Machine		- . 3.	6		- . 3.	3

Given these figures as a basis for estimating, it should be possible to draw up an estimate of the requirements for a particular farm. The first question would be whether the conditions on the farm are such that more or less labour than the average is likely to be required, and the hours of total manual work can be increased or decreased accordingly. Similarly the hours of horse and tractor work could be modified. In this way a reasonable estimate of the hours of work under varying conditions can be built up. There then remains the question of the actual cost of the work. In this Report the costs of all types of manual labour have been calculated on the actual rates of wages paid to the workers. The farmer, therefore, when/

when estimating his probable cost of manual labour need only multiply the hours decided upon by the actual rates he will be paying his own workers. In doing this he will, of course, need to divide the total hours of manual work between the different types of workers (men, women or boys) he is likely to employ.

The costs of horse and tractor work used in this Report are the average costs per hour based on the most recent information available for such costs in the East of Scotland. The costs used for the 1947 costs were horse labour 1/3d. per hour, wheeled tractor work at 3/- per hour and track-laying tractor work at 4/6d. per hour. These are average figures and the costs applicable to any particular farm may be more or less than these figures and the farmer will need to decide what his own costs are likely to be in the light of his own circumstances.

The remaining items of cost in the first section are made up of contract costs for cultivating and harvesting. Costs such as these may or may not be incurred by any individual farmer, but, since they represent part of the total costs of growing beet, they can only be replaced by the additional work on the part of the farmer's own workers and machinery. On an average these costs represent an additional charge of, say, £4 per acre.

An example of estimating the probable cost of cultivating and harvesting may now be given. A farmer is contemplating growing 10 acres of beet and considers that under the conditions obtaining on his farm his working costs are likely to be higher than the average by some 10 per cent. He is uncertain whether he will be able to employ any of the "cheaper" types of workers - women or boys - and, to be on the safe side, decides to base his estimates wholly on man labour at a cost of 2/1d. per hour. He considers that, owing to mechanisation of the farm work, his organisation of tractor and horse work has resulted in obtaining the maximum usage of his wheeled tractors, but, as is often the case, it is no longer possible to get the maximum usage of the horses he must still keep. He therefore decides that the figure of 3/- per hour is a reasonable one for his tractors, but that he must increase the figure for horse work to 1/6d. per hour.

His estimate of the probable costs of cultivating and harvesting 10 acres of beet will be as follows.

Cultivations/

	<u>Cultivations and Manuring per acre</u>				<u>Harvesting per acre</u>			
	<u>Hours</u>	<u>Rates</u>		<u>Cost</u>	<u>Hours</u>	<u>Rates</u>		<u>Cost</u>
		<u>per hour</u>	<u>£ s. d.</u>			<u>per hour</u>	<u>£ s. d.</u>	
Total manual labour, say	90				55			
Plus 10%	9				5			
Total, say	<u>100</u>	2. 1	10. 8. 4		<u>60</u>	2. 1	6. 5. -	
Horse work, say	20				15			
Plus 10%	2				<u>1½</u>			
Total, say	<u>22</u>	1. 6	1.13. -		<u>17</u>	1. 6	1. 5. 6	
Tractor work	10				5			
Plus 10%	<u>1</u>				<u>½</u>			
Total, say	<u>11</u>	3. -	1.13. -		<u>6</u>	3. -	-.18. -	
		<u>per acre</u>				<u>per acre</u>		
Contract work		£	s. d.		£	s. d.		
Plus 10%		1. 2. 6			2.15. 6			
Total		<u>-. 2. 3</u>			<u>-. 5. 6</u>			
		1. 4. 9				3. 1. -		
		Total	14.19. 1		Total	11. 9. 6		
		<u>£149.10.10</u>				<u>£114.15. -</u>		

The second section of costs now remains to be dealt with. Two of the items, rent and seed, will be known within narrow limits. The cost of seed comes within the terms of the contract, and, knowing the rent of his farm, the farmer can apportion the rent for the field in question. The former may be taken at £1.5/- per acre, and the latter at £1.15/-; both these are slightly above the present average costs of these items. The costs for 10 acres would be £12.10/- and £17.10/- respectively.

The net costs of the manures which will be applied to the crop will depend entirely on the farmer's decision in the light of his knowledge of the field in question and may be assumed to be not less than the average net cost in 1947, say £9 per acre or £90 for 10 acres.

The remaining item of cost is that of the overheads which must be allowed for. This cost may be calculated quite reasonably by using the method which was employed in calculating the overhead costs for the 1947 crop - i.e. by making a charge of/

of 5/- for every £ cost of direct manual labour; a charge of 3/- for each combined hour of horse and tractor work (tractor hours plus the horse hours divided by four) and a charge of 9/- per acre. The cost of overheads per acre in this illustration would be:-

	<u>Cost of manual work</u>	<u>Overhead Cost</u>
	£ s. d.	£ s. d.
A. Farm Workers	16.13. 4	
Contract Workers	<u>3.18. 4</u>	
Total	<u>20.11. 8</u>	<u>5. 2.11</u>

	<u>Power Hours</u>	<u>Overhead Cost</u>
		£ s. d.
B. Horse	$\frac{39}{4} = 10$	
Tractor	<u>17</u>	
Total	<u>27</u>	<u>4. 1. -</u>

C.	<u>Acres</u>	
	<u>1</u>	<u>-. 9. -</u>

Total Cost of Overheads per Acre = £9. 12. 11

The overhead costs for 10 acres would be £96. 9. 2
Thus the total anticipated costs would be as follows-

<u>Costs</u>	<u>Per Acre</u>	<u>10 acres</u>
	£ s. d.	£ s. d.
Cultivating and manuring	14.19. 1	149.10.10
Harvesting	11. 9. 6	114.15. -
Seed	1. 5. -	12.10. -
Manures	9. -. -	90. -. -
Rent	1.15. -	17.10. -
Overheads	<u>9.12.11</u>	<u>96. 9. 2</u>
Total	<u>£48. 1. 6</u>	<u>£480.15. -</u>

It/

It has been customary to make some allowance for the fact that the beet crop confers some benefit to the rotation as a cleaning crop. This benefit has been assessed at £1 per acre in the costings reports and this would have the effect of reducing the above total costs to £47.1.6 and £470.15/- respectively.

Having arrived at an estimate of his costs the farmer must then ask himself what tonnage of clean beet and what percentage sugar content can be expected under what he would regard as normal growing conditions on his farm. Supposing he can reasonably expect an 8 ton crop and that the sugar content is not likely to be below the basic figure of 15.5%, then his returns would work out as follows -

	£	s.	d.
Clean Beet, 8 tons (15.5% sugar) at 105/- per ton	42	-	-
Tops at 15/- per ton of clean beet	6	-	-
	<hr/>		
Total return per acre	48	-	-
	<hr/> <hr/>		

Basing the returns on these not too optimistic yields the crop would just clear itself. Any higher yield or sugar content would add to the profit margin and there is, of course, the additional convenience benefit arising from the farmer's right to purchase so much pulp for feeding.

The illustration which has been worked out shows that even where conditions are not so good as the average, sugar beet will at least pay for the growing. Under average or better than average conditions there should be a sufficient margin of profit to warrant the inclusion of this crop as part of the root break.

ACKNOWLEDGMENT.

Grateful acknowledgment is made of the help given by the farmers who have co-operated in this investigation over the past three years by keeping the necessary records and furnishing the other information required. The unfailing courtesy shown by them when visited is also greatly appreciated. Each collaborating farmer has received a statement of his own costs and it is hoped that this information and the foregoing report may in some measure repay them for the essential part they have taken in the work.

ADDENDUM - UTILISATION OF SUGAR BEET TOPS.

An investigation was carried out in the autumn and winter of 1947 by the Economics Department of the Edinburgh and East of Scotland College of Agriculture into the uses of, and to place, if possible, a value on the feeding and manurial qualities of sugar beet tops. Certain farmers in the east and south-east of Scotland were circularised and the very good response of thirty-nine co-operators was obtained. From the information given by the farmers in the circular and from experiences and opinions given verbally by the farmers to members of the staff who visited them in this connection, this report has been compiled. In the circular, details were asked of the acreage, variety, weight of clean beet and the manuring of the 1947 beet crop, as well as details of the previous cropping and manuring of these same fields from 1943 onwards. On the same sheet particulars of the uses to which the beet tops were put was asked for, subdivided into numbers and types of stock, length of feeding period, proportion used and the weight and value of the tops utilised. Particulars of any additional feeding given to the stock receiving the tops was also asked for.

It should be pointed out at once that the weather which prevailed during 1947 could scarcely have been more deleterious to the sugar beet crop. First, the prolonged severity of the snowstorms in the early months of the year retarded spring cultivations thus reducing the length of the growing season. This was followed by a prolonged drought during the height of the growing season which factor more than any other reduced the yield of beet and tops as compared with a normal year. Rain did fall in the early autumn but arrived rather late to be of full benefit to the crop. On top of all these unforeseen misfortunes a sharp frost in mid-November greatly reduced the feeding value of the tops lying in the fields after harvesting, so it will be seen that season 1947 produced a yield and value of tops much below the average.

Nearly all the arable counties in the College area were included in our sample of thirty-nine co-operating farmers. Fifeshire, of course, contained the majority viz., 18; 7 were from East Lothian; 4 each from the county of Angus and East Perthshire, and 3 from Berwickshire. Of the remainder, 2 were resident in Midlothian and one in the county of Roxburgh. From the above it will be seen that our sample was a very representative one for the area covered by the College.

From the information available it was not always possible to calculate the weight of beet tops produced per acre, but where this was possible i.e. in 19 cases the weight of tops averaged out at 7 tons 2 cwts. per acre compared with an average weight of clean beet of 9 tons per acre for the same 19 crops. The overall average weight of clean beet per acre for the entire 39 crops was slightly higher than the above viz;- 9 tons $4\frac{3}{4}$ cwts.

The/

The uses to which the beet tops were put by the 39 co-operators were many and varied but can be subdivided into five main groups.

	<u>Crops</u>
(a) Number fed to cattle only	15
(b) " " " sheep "	11
(c) " " " cattle and sheep in varying proportions	6
(d) " ploughed in 100%	2
(e) Other uses	5

Of the last five one fed his beet tops to cattle, sheep and pigs; the other four ploughed in part of the crop and fed the remainder to cattle and/or sheep in varying proportions.

Dealing first with those tops fed to cattle, owing to the variations in the ages and types of cattle and the still greater variations in the qualities and quantities of additional feeding given, too much importance should not be placed on the average figures given below. For an average weight of beet tops of 6 tons $4\frac{1}{2}$ cwts. per acre for 15 crops totalling 110 acres in all, an average of 333 cattle feeding days per acre was obtained, giving the average amount of tops fed per beast per day of 42 lb. The majority of the cattle receiving the tops were fattening cattle two to three years of age though in four cases dairy cows, both milking and dry and, in one case, a herd of breeding cows with calves received tops as part of their feeding. Most of the farmers feeding tops to their cattle carted them off the field and fed them on the grass or in courts. In every case additional feeding was given in varying amounts. Sometimes only straw or hay was added to the tops, but the more common practice was to feed beet pulp, or bruised oats and draff and a few turnips to balance the ration in addition to hay or straw.

Of the twenty-one farmers who fed beet tops to sheep in varying proportions only nine used any additional feeding. In the majority of cases the sheep were folded on the beet land thus decreasing the labour involved in the utilisation of the tops and increasing the manurial value to the next crop in rotation. The most common practice was to feed the tops to feeding hogs or to breeding ewes. In very few cases was it possible to calculate the actual weight of tops fed to the sheep, but the average number of sheep days per acre was 640. This figure seems to be rather small when compared with the cattle figure of 333 cattle feeding days per acre, but it must be remembered that a much larger proportion of the cattle received additional feeding than the sheep while in the many cases where the sheep were folded on the beet land, tops were fed ad lib., whereas in the case of cattle definite amounts were fed to them daily.

Extra/

Extra feeding given to the sheep usually took the form of bruised oats or dried beet pulp and bruised oats mixed. In three cases farmers let their sugar beet tops to other farmers for feeding to sheep at a cost of 8d. or 9d. per head per week for lambs and feeding hoggs up to 1/- per head per week for fully grown sheep. Another farmer let his tops for feeding sheep at 30/- per acre.

Of the remaining farmers who utilised their beet tops other than feeding them to cattle and/or sheep two ploughed in the whole of their tops. In the opinion of one of the two, his stock, both cattle and sheep, lost condition when fed beet tops, so after twelve years' experience he has decided that he will derive most benefit from ploughing his tops in. The benefit to the following crop he estimated at three to four bags of grain per acre. The other farmer who ploughed in all his tops estimates their value as equal to a dressing of fully five tons per acre of dung. Other reasons for ploughing in a proportion of the crop were (a) the use of a mechanised beet harvester on a farm growing a large acreage of beet, had partly covered the tops with soil thus reducing their feeding value and (b) to improve the body of a light loam soil in preparation for a crop of winter barley,

Several farmers were able to place a money value against the value of the tops by various means. For example, one farmer who fed his tops to cattle, sheep and pigs calculated the value of the feeding stuffs saved by the introduction of beet tops into the ration. This worked out at £80 saved for a 10 acre field of beet i.e. £8 equals the feeding value of the tops taken off 1 acre without deducting anything for labour used in carting the tops from the field to the stock. This value, however, was much higher than the average which, from the information available, worked out at £4.11.11d. per acre. This figure includes both feeding value and manurial value of the tops and correlated with the figure of 7 tons 2 cwts., being the average weight of beet tops per acre, gives a value of 12/11d. per ton of tops. When correlated with the weight of clean beet per acre i.e. 9 tons $4\frac{3}{4}$ cwts., per acre the value of the tops works out at 9/11 $\frac{1}{2}$ d. per ton of clean beet. The great majority of the farmers were convinced of the value of the tops both when fed or ploughed in and all agreed that the stock liked them, but care had to be exercised in feeding them especially to young stock. There were no deleterious effects if fed to dairy cows in conjunction with turnips provided the tops were fed as long before milking as possible. Many farmers had great trouble in making their workers realise the feeding value of beet tops - the workers treated them like turnip shaws and drove their carts diagonally across the rows of beet tops when leaving the field, thus greatly reducing their feeding value. On most farms the beet tops were useless for feeding after the sharp frost in mid-November whereas in a normal season use would have been made of them for feeding up to Christmas or the New Year.

Great difficulty was experienced in extracting much useful information from the details of manuring of the sugar beet crop and of the cropping and/

and manuring of the previous four years' crops in the same fields. In nearly every case the rotation was pretty intensive due largely to war-time and post-war needs and the manuring of the 1947 sugar beet crop was in most cases heavy. It is interesting to note that the field which had by far the lowest yield of clean beet per acre viz. 3 tons 9 cwts. per acre had received very light dressings of artificials previous to 1947 and no lime at all during the last five years.

To conclude, the tops of the sugar beet crop provided a very useful addition to the supply of home-grown foods for stock-feeding just at the time of year before the turnip crop has completed its full growth. In this report we have purposely neglected to quote many figures regarding weights of tops fed etc., because in nearly every case these are estimations. The average on the other hand has often been quoted as this will be fairly accurate. We had hoped to compare the feeding value of beet tops with that of turnips but because of the variety of types and ages of animals fed and the variation in types and quantities of additional feeding given, this has been found impossible. A comparison between the two could only be determined accurately by actual feeding trials. It is unfortunate that the year chosen for this small investigation should have been a somewhat indifferent year regarding yields both of sugar beet and of tops because of the weather.
