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NOTES
ON FARM ECONOMICS

SOME ECONOMIC ASPECTS OF SUGAR BEET GROWING IN THE WEST OF ENGLAND

by

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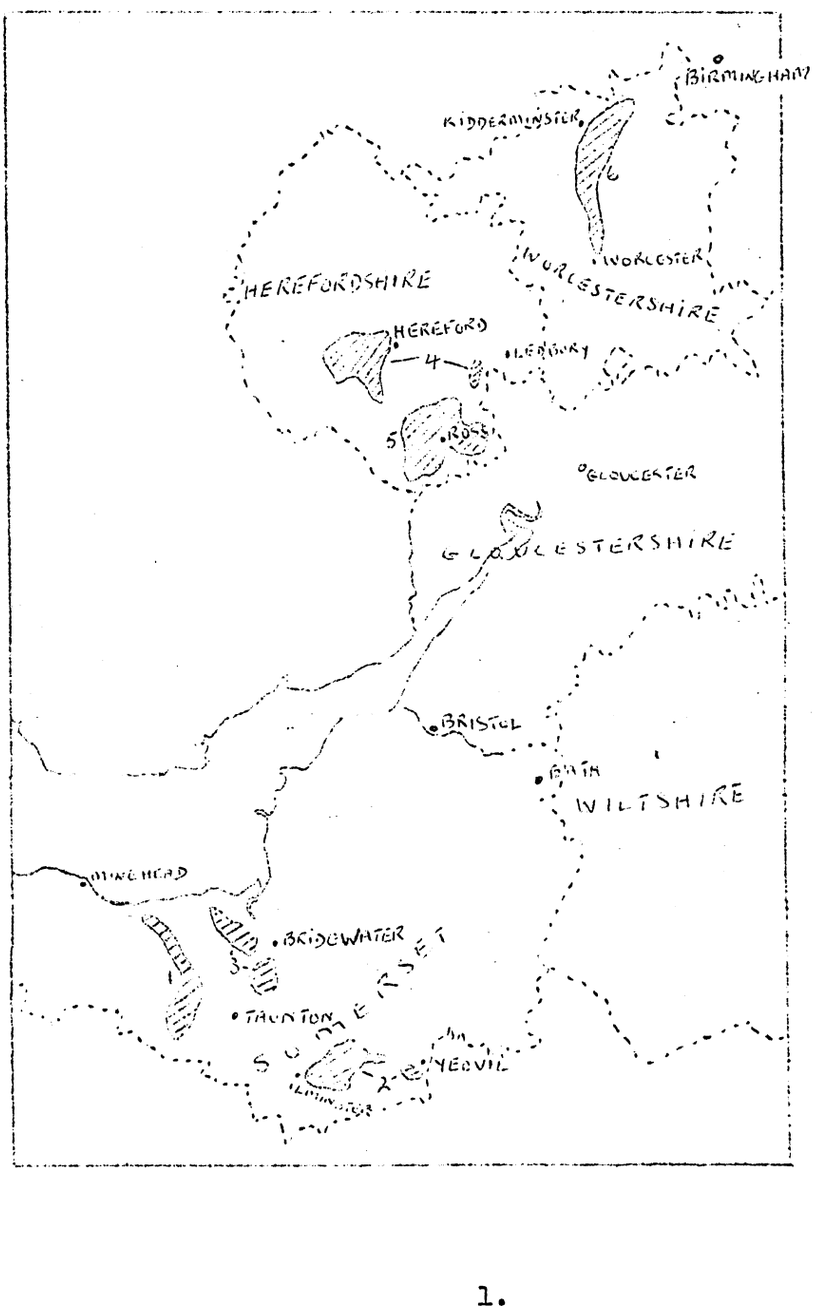
Introduction

An investigation into the economic aspects of growing sugar beet was carried out on 105 farms in the counties of Somerset, Herefordshire and Worcestershire in the year 1956. The total acreage of sugar beet harvested on these farms amounted to 1055 acres.

These farms can be regarded as falling into six distinct areas, three being in Somerset, two in Herefordshire and one in Worcestershire. Fifty-two of the farms were in Somerset and 29 of these were in South Somerset between Yeovil and Ilminster, a large number of which were in and around South Petherton; 11 farms were in the Bridgwater district to the east of the Quantock Hills, mostly around North Petherton. The other 12 farms were in West Somerset in the Vale of Taunton Deane and in the vale between the Quantock and Brendon Hills.

Fifty-three farms were in Herefordshire and Worcestershire; 20 of these were situated around Ross-on-Wye, and 17 were in Central Herefordshire mostly to the south and west of Hereford, but this group also includes a few farms to the east of Hereford around Much Marcle. The other 16 farms were in Worcestershire and, with two exceptions, were all between Worcester and Kidderminster and east of the River Severn.

The farms were mostly between 100 and 400 feet above seal level and on fairly level well-drained land. The map below shows the principal areas in which these farms were situated.



1. West Somerset
2. South Somerset
3. Bridgwater
4. Central Herefordshire
5. Ross
6. Worcestershire

Soils

The soils on which the sugar beet was grown were mostly light or medium loams and often sandy. In the Ross area the soils were mostly light sandy loams, red in colour. In Central Herefordshire the soils were generally heavier than in the Ross area being medium loams of a similar deep red colour except in the Much Marcle area where they were brown. In Worcestershire the soils on many farms were light sandy loams but on some of the farms they were heavier, being medium loams. The soils in the Bridgwater area of Somerset were mostly light sandy loams again being red in colour. In West Somerset they were rather heavier being medium loams also red in colour. In South Somerset the soils were yellow brown in colour and varied from light sandy loams to medium/heavy loams. Around South Petherton they are very fertile easy working and of considerable depth and have been referred to as "soil where you could bury a bullock with a spade".

The soils in the Ross and Central Herefordshire areas are derived from the Old Red Sandstone (or Devonian) rocks, except around Much Marcle where they are formed from Silurian rocks. In Worcestershire, Bridgwater and West Somerset they are derived from the New Red Sandstone (Permian and Triassic) rocks, and in South Somerset from Marlstone and Midford Sands of the Jurassic period. The soils in all these areas are of good quality, well drained and easy working, and very suitable for growing sugar beet.

Type of Farm

The type of farm on which the sugar beet was grown was very variable, the size varying from 10 to over 600 acres, but the majority were between 100 and 300 acres. The distribution of farms according to size is shown below.

Under 50 acres:	9 farms	200 - 300 acres:	31 farms
50 - 100 acres:	14 farms	300 - 400 acres:	13 farms
100- 200 acres:	29 farms	Over 400 acres:	9 farms

Of the nine farms under 50 acres, seven of them were in South Somerset.

In all the areas approximately 40% of the farm acreage was tillage, but whilst in the Ross, Central Herefordshire and West Somerset areas there were three times as many acres of cereals as of roots (including brassicas) and twice as much cereals as roots in the Bridgwater area, in the Worcestershire and South Somerset areas the farms grew a greater acreage of roots than cereals.

Sheep were kept on nearly every farm in the Ross and Central Herefordshire areas, on over three-quarters of the farms in the Bridgwater and West Somerset areas, but on only about one-half the farms in the Worcestershire and South Somerset areas. Beef cattle were kept in preference to dairy cattle on the majority of farms in the Worcestershire and Herefordshire areas, but in the West and South Somerset areas the majority of farms had dairy herds.

The table below gives certain particulars about the farms in the various areas.

Table 1.

Type of Farm

Area	Worcester	Central Hereford	Ross	Bridgwater	West Somerset	South Somerset
Average size of farm (acres)	150	220	255	220	310	180
Acreage of roots per 100 acres	22	11	10	14	12	24
Acreage of cereals per 100 acres	21	30	34	26	30	17
Percentage of farms with sheep	56	100	95	82	75	44
Percentage of farms with dairy herds	31	25	8	45	92	83
Percentage of farms with beef cattle but without dairy herds	69	69	92	55	8	7

It should be realised that quite a number of the farms with dairy herds also kept some beef cattle, but these are not recorded in the table above.

The Season

The year 1956 commenced with a wet January followed by a very dry February and March; February was also very cold with severe frosts. Therefore any land that had been ploughed before Christmas reaped the benefit of the February frosts and dry March and worked down to a good tilth very easily. The hard weather in February also helped some of those who applied dung to the fields in small heaps for spreading by hand or heap spreader at a later date, so that on the whole it was a very favourable season for preparing the seed-bed and most of the beet was sown in a good tilth. April had an average amount of rain but was cold so that germination was generally slow. May was very dry and as a result the later sown beet suffered from the drought and this was the principal cause of the failures. Although the proportion of beet that failed was less than 3% of the total acreage sown, all of the failures were drilled in May. June had slightly less than average rain so that conditions for singling were generally quite good. July, August and September were all very wet months so that growth was very good and resulted in above-average yields of beet though below-average sugar content. October was fairly dry and November was very dry but December was wet. Thus beet that was lifted and carted off the field before the end of November had very good harvesting conditions, but where it was still in the ground in December harvesting was much more difficult. The year on the whole was thus a fairly good one for beet growing. A dry Spring made seed-bed preparations relatively easy and a dry Autumn made harvesting generally fairly easy, and the wet Summer produced good yields, so that anyone who sowed their sugar beet early and harvested it early had a very good season, but those that drilled late suffered from drought in May and those that harvested late suffered from very wet conditions in December. The following table shows the average monthly rainfall in each area, and for this we are most

grateful to those people, many of whom were not connected with farming, who supplied the monthly totals that they had recorded.

Table 2.

The Average Monthly Rainfall in 1956

	Somerset			Herefordshire		Worcester-shire
	West	South	Bridgwater	Central	Ross	
	ins.	ins.	ins.	ins.	ins.	ins.
January	3.4	3.7	2.9	3.4	3.3	3.2
February	0.3	0.1	0.2	0.4	0.4	0.4
March	0.8	0.7	0.6	0.8	0.7	1.1
April	1.8	1.1	1.4	2.3	2.7	1.5
May	0.4	0.5	0.4	0.4	0.5	0.5
June	1.4	1.9	1.2	2.1	1.8	1.9
July	2.3	2.2	2.0	4.5	3.9	3.3
August	2.3	4.0	2.5	3.5	2.9	4.7
September	5.1	4.4	4.1	2.9	3.6	2.6
October	2.1	1.8	1.9	1.2	1.5	1.6
November	0.7	0.6	0.7	0.9	0.9	0.8
December	4.3	3.7	3.7	3.0	4.3	2.7
Total	24.9	24.7	21.6	25.4	26.5	24.3

Method of Costing

The investigation was carried out by the "survey" method, and farmers were not required to keep detailed costing records, although quite a number of them did so.

The farms were visited every three or four months, as far as possible immediately after the completion of each stage of operations e.g. after sowing, after the completion of summer cultivations and after harvesting. There was of course a preliminary canvassing visit made beforehand.

At each visit the various operations that had taken place together with the actual or approximate time taken to perform each operation were recorded, and, in addition, various other information concerning the growing of sugar beet was also obtained. The cost of growing sugar beet was then calculated by the following methods.

(a) Manual labour was charged at a standard rate per hour on all farms for all work other than piece-work. This standard rate was calculated to represent the cost per hour to the farmer of an adult man in regular employment, and takes into account holidays with pay, sickness, the farmer's share of national insurance, free cottages and other perquisites, and men paid above the regulation minimum wage. This rate varied during the year due to increases in the regulation wage rates, and the following rates were used (i) up to January 1956: 3s. 3½d. per hour. (ii) February to September 1956: 3s. 5½d. per hour. (iii) October 1956: onwards: 3s. 7¼d. per hour. Work done by the farmer and members of his family was charged at the same rates as for paid labour.

Hours worked by women and boys were converted to equivalent man hours on a proportional cost basis e.g. standard wage of a woman over 21, from February to September 1956 was 102s. per week whilst that of an adult man was 135s., therefore hours worked by women over 21 were converted to man hours by multiplying by 102/135 and similarly for boys and girls. The equivalent man hours were then charged at the rates shown above. Work done during overtime was charged at the regulation overtime rate. Piece-work was charged at the actual rate paid on each farm.

(b) Tractors were charged at a standard rate of 3s. 9d. per hour for all work done up to November 1956 and at 4s. 0d. per hour from December 1956 onwards. This increased rate was used to allow for the higher fuel costs imposed during the Suez crisis. Horse work was charged at a standard rate of 1s. 6d. per hour and farm lorries at 9d. per mile, contract work being charged at cost.

(c) The cost of manures in all cases represents the net cost remaining after residues have been brought forward or were carried forward. Farmyard manure was charged at a gross cost of 15s. 0d. per ton and this cost was spread over three crops, one-half to the first crop, one-third to the second crop and one-sixth to the third crop, so that where F.Y.M. was applied to the beet crop 7s. 6d. per ton was charged to the beet crop and 7s. 6d. per ton carried forward to the next two crops. If F.Y.M. was applied to the crop previous to the beet crop a net cost of 5s. 0d. per ton was charged to the beet (7s. 6d. per ton being brought forward and 2s. 6d. per ton carried forward to the crop after the beet).

In the case of artificial manures the cost again is a net cost. With straight phosphatic and potassic manures two-thirds of the actual cost was charged to the beet and one-third carried forward to the succeeding crop, and similarly one-third of the cost of any of the manures applied to the previous crop was charged to the sugar beet. Compound manures composed of nitrogen, phosphate and potash were treated in the same manner as the straight phosphatic and potassic manures. In the case of straight nitrogenous manures and also salt, the whole cost was charged to the sugar beet. Crop residues consist of the manurial value of long leys or folded roots which precede the sugar beet crop. The manurial value of these crops was discussed with the farmers and expressed in terms of an equivalent amount of F.Y.M. and was then charged over three years in the same way as F.Y.M. This was not an important item generally though it was quite important on certain farms.

(d) The costs of seed and sprays were the actual cost of these items.

(e) The cost of machinery depreciation and repairs does not include tractors since allowance for depreciation and repairs of tractors is included in the hourly charge. But in the case of other machinery used the purchase price and sale or scrap value and also an estimate of period of life of the implement were ascertained. Thus the annual depreciation charge of each implement could be calculated; to this was added the average annual cost of repairs, and this total annual charge was spread over the average annual acreage on which the implement was used. Thus the average cost per acre for any implement or machine could be calculated. In practice this information was only collected for implements and machines associated chiefly with sugar beet and other root crops and included such items as dung loaders and spreaders, root drills, steerage hoes, cultivators etc., beet lifters, toppers, harvesters and elevators. But ploughs, harrows, rollers and general cultivating machinery together with carts and trailers were covered by a standard charge of 30s. 0d. per acre on all farms.

(f) Field costs cover rent, liming and hedging, fencing and ditching. The rent per acre was calculated from the total rent or rental value of the farm after making deductions for the value of the farm buildings, farmhouse, cottages etc. The cost of lime per acre was calculated from the average annual cost of liming on the whole farm. As lime is applied for the benefit of the farm as a whole rather than for one specific crop, it is more realistic to treat it in this manner, also the sugar beet field may not have been limed recently and then the relevant information would not be readily available. Hedging, fencing and ditching were charged at a flat rate of eleven shillings per acre on the Herefordshire and Worcestershire farms, and at thirteen shillings per acre on the Somerset farms where the size of the fields were generally rather smaller.

(g) Crop failures represent the costs incurred on any sugar beet which failed, and were of no benefit to the succeeding crop. These costs include the cost of the seed, the cost of all operations that would not normally have been done for the succeeding crop, and a proportion of the cost of manures, e.g. if a piece of sugar beet which failed was ploughed up and the land was then sown to swedes, any operations done for the sugar beet that were considered to be part of the normal operations for swedes were charged to the swedes, the remaining operations to sugar beet that were considered superfluous were charged as crop failure. Similarly in the case of manures the farmer was asked what proportion of those applied to the sugar beet would be of benefit to the swedes, and this together with the cost of applying them was charged to the swedes, and the balance to the crop failure. In most cases the crop failure was recognised before singling, and another crop was sown in good time, so that quite a high proportion of the costs on the sugar beet could be borne by the succeeding crop.

Since the cost of crop failure was only a very small item, it was felt that it would be better to base the costs per acre on the acreage harvested rather than on the acreage sown, and figures shown in this report are based on the acreage harvested unless stated to the contrary.

Returns and Margin

The sales of beet refer to the gross value of the sugar beet at the factory. Any deductions made for rail transport have been included in the operational costs.

The value of the beet tops was estimated on each farm in consultation with the farmer concerned. This value depended on the use to which they were put. If they were fed to cattle or sheep, their feeding value was compared with that of a crop of kale at a standard cost of £20 per acre: thus if a farmer considered the beet tops to be worth half as much as a crop of kale, the beet tops would be valued at £10 per acre. If however the beet tops were ploughed in, they were then compared with their equivalent of F.Y.M. valued at a standard cost of 15/- per ton; thus if the farmer considered the beet tops to be equivalent to a dressing of 10 tons of F.Y.M. per acre, then their value would be £7.10s.0d. per acre.

The margin per acre does not take into account any allowance for general farm overheads, as it was felt that any attempt to allocate these to the sugar beet crop would be unrealistic.

Summary of Costs, Returns and Margin per Acre

A summary of the costs, returns, and margin per acre in each of the six areas of Somerset, Herefordshire and Worcestershire is shown in Table 3.

Table 3

Costs, Returns and Margin per Acre

	Somerset			Herefordshire		Worcester-shire
	West	South	Bridgwater	Central	Ross	
COSTS	£	£	£	£	£	£
Manual Labour:						
Hour Work	44.03	29.32	28.04	24.10	12.99	12.53
Piece-work	0.59	5.98	4.64	5.83	13.85	11.13
Total	44.62	35.30	32.68	29.93	26.84	23.66
Tractor	5.04	5.58	4.87	6.22	5.56	4.96
Horse	0.78	0.80	0.08	0.07	0.11	0.12
Farm lorry	-	0.04	0.09	-	0.73	0.38
Contract	12.48	14.83	14.81	14.76	14.33	8.08
Total Operational Costs	62.92	56.55	52.53	50.98	47.57	37.20
Manures: F.Y.M. etc.	4.88	4.37	6.29	4.69	3.59	3.55
Artificials	6.35	5.75	6.97	8.73	7.85	8.56
Crop Residues	0.45	1.01	0.79	-	0.33	0.02
Total	11.68	11.13	14.05	13.42	11.77	12.13
Seed	1.15	1.15	1.15	1.05	1.16	1.16
Sprays	0.15	0.12	0.48	0.32	0.17	0.32
Machinery, Depreciation and Repairs	2.26	2.67	3.55	2.48	2.96	2.54
Field Costs	2.58	4.10	3.80	3.26	3.12	3.75
Total Material Costs	17.82	19.17	23.03	20.53	19.18	19.90
Crop Failures	0.51	0.34	-	0.69	0.28	-
TOTAL COST	81.25	76.06	75.56	72.20	67.03	57.10
Sales of Sugar Beet	92.08	103.06	99.27	81.95	96.74	89.92
Value of Beet Tops	9.50	7.89	10.07	8.95	8.81	8.19
TOTAL RETURNS	101.58	110.95	109.34	90.90	105.55	98.11
MARGIN	20.33	34.89	33.78	18.70	38.52	41.01
Number of Farms	12	29	11	17	20	16
Average acreage per Farm	7.25	10.98	8.25	5.56	9.64	17.36
Yield of clean beet (tons)	14.1	16.1	15.8	12.7	14.3	13.4
Sugar content %	15.9	16.0	15.9	16.3	16.5	16.2

NOTE: F.Y.M. also includes Shoddy, Sewage Sludge and Leather Waste.

Table 3 above shows that the difference in costs per acre between each area can be attributed almost entirely to differences in the cost of manual labour. This shows quite a remarkable variation, the cost of manual labour on the West Somerset farms was nearly £21 per acre more than on the Worcestershire farms. The other costs show very little variation between the different areas, except for contract work on the Worcestershire farms, which was much less than in any other area; this is quite easily explained since contract work is composed largely of the cost of transporting the sugar beet from the farm to the factory and besides being so much nearer to the factory, several of the Worcestershire farms carted their beet to the factory with their own lorries or tractors and trailers, and the distance from farm to the factory was no further than the distance of some of the Somerset farms from their nearest railway station.

The returns which are very largely influenced by the yield of sugar beet per acre showed a variation of over £20 per acre between the central Hereford farms where the average yield of clean beet was under 13 tons per acre, and the South Somerset farms where the average yield of beet was over 16 tons per acre. However, the margin per acre in four areas fell within a fairly small range. The two areas with a low margin per acre were West Somerset which had high labour costs and Central Herefordshire which had low yields.

In order that the results of one large farm should not influence the results of the area to any great extent, the results for each farm were reduced to a "per acre" basis before averaging, so that the figures for each farm have equal weight irrespective of the acreage of beet grown.

On the West Somerset farms where the labour costs were so high, nine of the twelve farms had labour costs of over £40 per acre and three of these nine farms had labour costs of over £50 per acre. On the Worcestershire farms, however, where the labour costs were low, only two of the sixteen farms had labour costs of over £30 per acre and five of the farms had labour costs of under £20 per acre. No farms in any Somerset areas had labour costs of under £20 per acre, and no farms in the Ross and Worcestershire areas exceeded £40 per acre in labour costs.

Farms with total costs of under £60 per acre occurred in every area, and two farms had total costs of under £50 per acre. Farms with total costs of over £90 per acre occurred in all the Somerset areas, and in Central Herefordshire one farm had total costs of just over £100 per acre. Fourteen farms had sales of beet amounting to over £120 per acre. Eight of these farms were in the South Somerset area and included one farm with sales of beet amounting to over £150 per acre from a yield of 25 tons per acre. Altogether eight farms produced more than 20 tons of clean beet per acre, and all these with one exception were in Somerset. Only eight farms in the whole investigation showed a deficit. The highest average sugar content was 17.8% and the lowest was 14.6% which represents a return per ton of from 140s. to 116s.

Table 4, shows where the differences in labour costs in the different areas arose, and also the average man hours involved in the different operations. In order to calculate the man hours worked on each farm, piece-work had to be converted to man hours and to do this the assumption was made that a man would work harder when on piece-work and therefore would do an equivalent amount of work in a shorter time. To divide the cost of piece-work by the standard hourly rate in order to calculate man hours would therefore be unrealistic, so that it was decided that a better approximation of man hours would be obtained by dividing the cost of piece-work by one-and-a-quarter times the standard hourly rate used in this investigation. This latter method would then assume that a man would do one-quarter more work per hour when paid

piece-work. Thus if the cost of singling is £8 per acre and a man were paid piece-work he would be assumed to take 37 hours to single one acre, but a man being paid a weekly wage would work 46 hours for the cost of £8. From discussions with farmers on this point, it would seem that this is a fair assumption to make.

Table 4

Operational Costs, and Manual Labour in Each Area

	Somerset			Herefordshire		Worcester-shire
	West	South	Bridgwater	Central	Ross	
£ per acre.						
Applying F.Y.M. etc. (net cost)	2.02	1.94	2.09	1.84	1.48	1.47
Applying Artificials	0.40	0.38	0.51	0.49	0.50	0.62
Seed-bed Preparations	3.07	3.77	2.43	3.78	2.73	2.88
Drilling and Covering	0.66	0.73	0.68	0.60	0.68	0.67
Tractor/Horse Hoeing	1.56	1.91	1.59	1.98	1.87	1.55
Singling	10.90	8.31	8.43	8.02	7.53	7.69
Other Hand Cleaning	2.86	4.13	2.61	3.84	2.10	2.59
Spraying	0.05	0.06	0.19	0.60	0.20	0.40
Total Summer Cultivations	15.37	14.41	12.82	14.44	11.70	12.23
Harvesting	24.96	17.21	16.59	15.54	14.92	13.49
Transport	16.44	18.11	17.41	14.29	15.56	5.84
Total Operational Costs	62.92	56.55	52.53	50.98	47.57	37.20
Man Hours per Acre						
Applying F.Y.M. etc.	8.2	8.0	9.5	7.2	5.6	4.9
Applying Artificials, Seed-bed Preparations, Drilling & Covering.	12.5	14.6	10.8	13.8	11.3	11.5
Summer Cultivations	84.9	74.4	63.1	71.4	53.7	55.6
Harvesting	128.3	81.9	83.6	66.5	61.7	48.0
Transport	17.4	14.7	11.8	9.0	4.4	1.6
Total Man Hours	251.3	193.6	178.8	167.9	136.7	121.6
Tractor Hours per Acre	26.0	27.7	25.1	32.3	28.5	25.8
Horse Hours per Acre	10.2	10.6	1.1	0.9	1.5	1.6
£ per ton of Clean Beet						
Cost of Harvesting	1.84	1.13	1.11	1.33	1.09	1.07
Cost of Transport	1.19	1.13	1.11	1.10	1.14	0.43
lb. per cwt.						
Total Tare	15.3	14.7	14.4	15.6	15.2	17.2
Top Tare	1.5	1.6	1.9	3.3	2.8	3.0

There are some interesting points arising from Table 4. The cost of seed-bed preparation was lowest in the Bridgwater and Ross areas which had the lighter soils, and highest in the Central Herefordshire and South Somerset areas which had the heavier soils. The table also clearly shows that the high operational costs in West Somerset were largely due to the high cost of harvesting per acre. This matter will be discussed more fully later but it is interesting to note that this was the only area in which no mechanical harvesters were used. It is also apparent that the low operational costs in Worcestershire were largely due to the low cost of transport, resulting from the close proximity of the farms to the factory, as mentioned before.

When the man hours per acre are examined it will be seen that the West Somerset farms required over twice as many man hours as the Worcestershire farms. In West Somerset summer cultivations required half as many more man hours, although in this case it is largely a comparison of piece-work with hour work since the singling on the Worcestershire farms and also on the Ross farms was done very largely by piece-work and as mentioned above, piece-work gets the job done more quickly.

The big difference in man hours at harvesting was partly due to this difference in piece-work and hourly work, but also to the much greater use of mechanical harvesting on the Worcestershire farms. Tractor hours were very much the same in all areas, though highest in Central Herefordshire. A total of 14 farms in all areas had more than 40 tractor hours per acre. The use of horses was only of any importance in the West and South Somerset areas. Only eleven farms had more than 10 horse hours per acre.

Applying Farmyard Manure.

Farmyard manure was applied to the sugar beet crops on 76 of the 105 farms in the investigation, although in many cases by no means all the sugar beet grown on the farm received a dressing of F.Y.M. With such a large number of farms involved it was thus possible to conduct a supplementary investigation into the costs of applying F.Y.M.

There are twelve different methods by which F.Y.M. can be handled and applied. It can be either carted direct from the place where it is made, (this was usually a cattle yard, but in some cases was a heap outside the cowshed or piggery), and deposited on the field in one operation, or else it can be first carted to a mixen in or close to the field where it is to be used, and then at a later date carted again from the mixen on to the field. The carts can be either loaded mechanically or by hand; the most common form of mechanical loader was a foreloader. Finally the F.Y.M. can be applied from a spreader cart which deposits and spreads in one operation or it can be emptied from an ordinary tipping trailer into small heaps which are then spread either by a mechanical heap spreader or by hand. The various combinations of these systems gives a total of twelve different methods, of which eleven of them were found in this sample of farms.

In some cases there were not sufficient examples of a particular method to give worthwhile results. Three farms had their F.Y.M. carted and spread by a contractor so these have been omitted from the analysis, and four farms applied some of their F.Y.M. via a mixen and some direct to the field so these farms have been included twice. A total of 56 farms applied F.Y.M. direct to the field and 21 applied it via a mixen, the latter method obviously being more costly since it involved double handling. The results obtained from these records show that to apply 100 tons of F.Y.M.:

(a) Direct on to the field took 119 man hours and 48 tractor hours and cost £28.6.

(b) To the field via a mixen took 152 man hours and 81 tractor hours and cost £40.2.

As well as being influenced by the methods of loading and of spreading, these figures are of course also influenced by the quantity of manure applied per acre, and Table 5 below shows the time taken and the cost of applying at different rates of application.

Table 5.

Cost of Applying F.Y.M.

	No. of Records	Tons per Acre	Hours per Acre		Cost per Acre	Cost per Ton
			Man	Tractor		
a) Direct to the Field					£	£
Over 20 Tons per Acre	19	22.2	21.6	8.3	5.11	0.23
13-19 Tons per Acre	19	15.0	19.5	8.1	4.73	0.31
Under 12 Tons per Acre	18	10.2	14.0	6.1	3.45	0.34
Total	56	15.9	19.0	7.5	4.53	0.29
b) To the Field via a Mixen						
Over 20 Tons per Acre	8	21.4	29.8	16.3	7.97	0.37
13-19 Tons per Acre	6	15.5	22.6	12.4	6.06	0.39
Under 12 Tons per Acre	7	8.9	17.4	8.5	4.46	0.50
Total	21	15.5	23.6	12.6	6.25	0.40

The average time taken and cost of applying as shown in Table 5 above depends considerably upon the method by which the F.Y.M. was applied and that each method is proportionately represented in each sample. The time taken and the cost of applying according to both methods of loading and each method of spreading is shown in Table 6 below, which is based on those farms where the F.Y.M. was applied direct to the field.

Table 6.

Cost of Applying F.Y.M. Direct to the Field by Different Methods

	No. of Records	Tons per Acre	Hours per Acre		Cost per Acre	Cost per Ton
			Man	Tractor		
					£	£
Hand Loaded	33	13.6	20.0	6.6	4.52	0.33
Machine Loaded	23	18.0	17.6	8.8	4.54	0.25
Hand Spread	23	16.3	24.9	8.1	5.60	0.34
Heap Spread	10	17.9	18.0	9.7	4.83	0.27
Cart Spread	23	13.3	13.6	6.0	3.36	0.25
Hand Loaded & Hand Spread	15	14.6	25.3	7.9	5.64	0.39
Hand Loaded & Heap Spread	3	15.7	20.2	8.2	4.86	0.31
Hand Loaded & Cart Spread	15	12.1	14.7	5.0	3.36	0.28
Machine Loaded & Hand Spread	8	19.6	24.0	8.3	5.51	0.28
Machine Loaded & Heap Spread	7	18.9	17.1	10.4	4.78	0.25
Machine Loaded & Cart Spread	8	15.7	11.5	7.9	3.37	0.22

The figures shown in Table 6 above are all in accordance with what would be expected, in that machine loading is quicker and cheaper per ton than hand loading and that mechanical spreading is quicker and cheaper than hand spreading. In both Table 5 and Table 6 any horse work that occurred has been converted to tractor work on a proportional cost basis e.g. 8 horse hours being equivalent to 3 tractor hours.

Due to the fact that there were fewer farms that made use of an intermediate mixen when applying F.Y.M. it was thus not possible to analyse the results from these farms in such detail as was done with the other farms in Table 6, but it was possible however to calculate the costs for each stage of the operation and these are shown in Table 7 below. Only the cost of cart spreading was worth analysing, as only two of these farms used heap spreaders, on both of which mechanical loading was employed at the mixen; and only four farms spread by hand, two of these employing mechanical loaders at the mixen, the other two loading by hand.

The results given for spreading from small heaps in the field include those farms which carted direct to the field, since in these cases spreading could be completely separated from the various methods of loading and carting.

Table 7.

Cost of Applying F.Y.M. at Each Stage of Operation

	No. of Records	Tons per Acre	Hours per Acre		Cost per Acre	Cost per Ton
			Man	Tractor		
					£	£
Carting to the Mixen						
Hand Loaded	8	14.7	14.2	4.9	3.26	0.22
Machine Loaded	13	15.9	11.3	7.8	3.32	0.21
Applying from the Mixen to the Field *						
Hand Loaded & Cart Spread	6	14.2	10.1	2.8	2.19	0.15
Machine Loaded & Cart Spread	9	16.5	6.3	5.6	2.08	0.13
Spreading from Heaps on the Field						
By Hand	27	16.7	10.3	-	1.69	0.10
By Heap Spreader	12	17.7	1.1	1.1	0.39	0.02

* 6 records by 3 further different methods omitted

The results in both Table 6 and Table 7 are distorted to a certain extent by variations in the quantity of F.Y.M. applied per acre, and Table 8 shows the same results adjusted for a standard dressing of 15 tons of F.Y.M. per acre which was approximately the average quantity applied on the 73 farms investigated. Also in this table an allowance has been made for the depreciation and repairs to dung-loading and dung-spreading machinery, but it should however be noted that no allowance has been made for depreciation and repairs of carts other than spreader carts that were

used to convey the F.Y.M. so that the total costs are not strictly comparable and favour the hand-spread and heap-spread costs both of which should have an additional cost added for this depreciation and repairs of general farm carts.

Table 8.

Time Taken and the Cost of Applying F.Y.M. Adjusted for a Standard Dressing of 15 Tons per Acre

	Hours per Acre		Operational Cost	Machinery Cost	Total Cost
	Man	Tractor			
			£	£	£
By All Methods Direct to the Field	17.9	7.1	4.28	0.66	4.94
By All Methods via a Mixen	22.8	12.2	6.04	1.00	7.04
Direct onto the Field					
Hand Loaded	22.1	7.3	4.99	0.51	5.50
Machine Loaded	14.7	7.3	3.78	0.86	4.64
Hand Spread	22.9	7.5	5.15	0.12	5.27
Heap Spread	15.1	8.1	4.05	0.75	4.80
Cart Spread	15.3	6.8	3.79	1.15	4.94
Hand Loaded & Hand Spread	26.0	8.1	5.80	-	5.80
Hand Loaded & Heap Spread	19.2	7.8	4.63	0.50	5.13
Hand Loaded & Cart Spread	18.2	6.2	4.16	1.03	5.19
Machine Loaded & Hand Spread	18.4	6.4	4.22	0.35	4.57
Machine Loaded & Heap Spread	13.6	8.2	3.79	0.85	4.64
Machine Loaded & Cart Spread	11.0	7.5	3.21	1.38	4.59
Carting to the Mixen					
Hand Loaded	14.5	5.0	3.33	-	3.33
Machine Loaded	10.7	7.4	3.13	0.35	3.48
Applying from the Mixen onto the Field					
Hand Loaded & Cart Spread	10.7	3.0	2.31	1.03	3.34
Machine Loaded & Cart Spread	5.7	5.1	1.89	1.38	3.27
Spreading from Heaps on the Field					
By Hand	9.2	-	1.52	-	1.52
By Heap Spreader	0.9	0.9	0.33	0.50	0.83

Due to the relatively small number of farms employing each method of dung handling some of the results tend to be rather conflicting. It will be noticed that dung that was hand-loaded and hand-spread cost more to apply than dung hand-loaded and heap-spread or hand-loaded and cart-spread. As the method of loading was the same, one would then assume that hand-spreading costs between 12s. 0d. and 13s. 6d. per acre more than cart-spreading and heap-spreading respectively and in the case of heap-spreading this is borne out again in the comparison of spreading from

heaps in the field. However, when the cost of machine-loading and hand-spreading is compared with machine-loading and heap- or cart-spreading it would appear then that hand-spreading is cheaper than either cart or heap-spreading. Similarly from these same sets of figures all the machine loaded methods were cheaper than any of the hand-loaded methods but when the cost of carting to the mixen is examined it will be seen that the reverse is true.

The fact that all these conflicting results occur illustrates how complicated dung-handling can be, and that another very important factor, namely the distance which the F.Y.M. has to be carted, can influence the results quite appreciably. But it would seem that the efficiency of the organisation is more important than the degree of mechanisation, and variations in costs by the same method on different farms were considerable. The average cost of depreciation and repairs of each item of machinery was calculated, and this average cost applied to each method so that differences in machinery costs on individual farms using the same methods of dung-handling will not influence the result of the whole sample. The method by which these machinery costs were calculated and the detailed costs of each machine are shown later in the general machinery costs.

The cost of applying farmyard manure shown in Table 4 is a net cost, the actual cost having been spread over three crops in the same way as the cost of the F.Y.M. itself. Thus one-half the actual cost of applying is charged to the first crop, one-third to the second crop and one-sixth to the third crop. It should also be pointed out that whilst the costs of F.Y.M. and applying it, shown in Tables 3 and 4, also includes Shoddy which was applied on four farms, Sewage Sludge applied on three farms and Leather Waste applied on one farm, the investigation in applying F.Y.M. does not include these other organics. The cost of these other organics and of applying them has also been spread over three crops in the same way as F.Y.M.

Applying Artificial Manures

The cost of applying artificial manures shown in Table 5 is the actual cost and in this case admittedly the method of treatment is not consistent with that used for F.Y.M. But the total cost was very small, amounting to a maximum of only 12/6d per acre on the Worcestershire farms, so that it was felt it was not worth the trouble of apportioning the cost over more than one year. As would be expected, the cost of applying artificial manures per acre varies according to the quantity applied, and it was possible to show this by analysing the costs of applying at three different levels of application when a tractor and manure drill were involved and, for comparison, the time taken and cost when done by hand. The three levels taken were 8 cwt. per acre and over, 3 to 8 cwt. per acre, and 3 cwt. per acre or less, and the results are shown in Table 9 below.

Table 9.

Time and the Cost of Applying Artificial Manures

	Total Acreage	Average Dressing	Hours per Acre		Cost per Acre	Cost per Ton
			Man	Tractor		
Tractor and Spreader		Cwt./Acre			£	£
High (8 cwt. per acre and over)	654	9.95	1.08	0.93	0.36	0.73
Medium (3.1 to 7.9 cwt. per acre)	483	5.92	0.78	0.75	0.28	0.93
Low (3 cwt. per acre and under)	210	2.19	0.53	0.52	0.19	1.75
By Hand (all levels of application)	163	1.96	2.04	0.03	0.36	3.66

Small amounts of artificial manures were applied by contract, by horse and with a combined drill, but these have been omitted from this analysis. Naturally much of the sugar beet had two or more separate applications of artificials, so that one piece of sugar beet may well appear more than once in the above analysis. Of the 163 acres that had artificials applied by hand, only 18 acres had more than 3 cwt. per acre. This was in most cases a top dressing of nitro-chalk put on when the beet was well grown and when the use of a tractor and spreader would have damaged the plants. The cost of applying by hand at this low rate was five times as much per ton as applying by tractor and spreader at a high rate per acre. The tractor hours listed under hand application consist of tractors carting the artificials out to the field.

Seed-bed Preparations

As will be seen in Table 4, and as has been mentioned before, the cost of seed-bed preparations and the time involved was less on the lighter soil areas of Bridgwater, Ross and Worcestershire, and greater on the heavier soil areas of South Somerset and Central Herefordshire. However from an analysis of the various operations carried out to obtain a seed-bed and the time taken on each operation it would seem that on the lighter soils fewer operations were required rather than less time being taken to perform each operation, since there was no significant difference in the time taken per acre to perform each of the principal operations between the lighter soils and the heavier soils and there was also no significant difference between Somerset and Herefordshire and Worcestershire. Table 10 below shows the average time taken per acre to perform the various operations by tractor on all farms in the investigation and also the number of farms on which each operation was carried out. Besides the seed-bed preparations the covering operations also are shown. Horses were only used frequently enough for any valid comparison to be made with tractors for harrowing after drilling.

Table 10

Seed-bed Preparation and Covering
(By tractor except where otherwise stated)

	No. of Records	Hours per Acre	Acres per Day
Seed-bed Preparations			
3 Furrow Ploughing	45	2.22	3.6
2 Furrow Ploughing	39	2.86	2.8
1 way Ploughing (reversible plough)	18	2.95	2.7
Rotovating	7	1.72	4.6
Cultivating	62	0.72	11.1
Disc Harrowing	16	0.71	11.2
Spring Tine Harrowing	47	0.49	16.4
Zig-zag Harrowing	74	0.40	19.8
Cambridge Rolling	62	0.48	16.8
Harrowing and Rolling together	45	0.52	15.4
Covering			
Cambridge Rolling	44	0.47	17.0
Zig-zag Harrowing	37	0.39	20.6
Harrowing & Rolling together	11	0.52	15.4
Zig-zag Harrowing by Horse	13	0.68	11.8

The acres per day refer to the average amount of work done in a normal day of $8\frac{1}{2}$ hours allowing half an hour for preparing the machine and taking it out to the field.

Drilling and Covering

Drilling of sugar beet is a very simple operation compared with most crops, and the total cost of drilling and covering averaged about 13s. 6d. per acre on the whole sample of farms. Twenty-one of the farms in the investigation used a horse for drilling, and this is one of the operations where if there is a horse on the farm it can justifiably be used instead of a tractor. Table 11 shows the time taken and the cost of each of the different methods of drilling and the number of farms on which they occurred.

Table 11

Drilling Sugar Beet

	No. of Records	Hours per Acre	Cost per Acre
			£
Two Men and a Tractor	69	0.95	0.51
One Man and a Tractor	14	0.95	0.34
Two Men and a Horse	12	0.98	0.41
One Man and a Tractor	9	1.51	0.36

One farm used three men and a tractor with a very old steerage drill, one farm had the sugar beet drilled by contract, and one farm used two men and a tractor in one field and one man and a tractor in another field.

Covering after drilling was a comparatively simple operation and in several cases was not done at all. The different methods may be summarised thus:

a) Rolling only - 26 farms
b) Harrowing only - 25 farms
c) Rolling and Harrowing separately - 22 farms
d) Rolling and Harrowing in tandem - 11 farms
e) No separate covering operation - 21 farms

Horses were used for the covering operation on 16 farms, and on thirteen of these farms for harrowing only.

Summer Cultivations

Tractor or horse hoeing cost on average between 30/- and £2 per acre in all areas. Horses were used to quite an appreciable extent as in the case of drilling and Table 12 shows the time taken and cost of each of the different methods and the number of farms on which they occurred.

Table 12

Hoeing Sugar Beet

	No. of Records	Hours per Acre	Cost per Acre
			£
Two men and a Tractor	63	1.09	0.58
One man and a Tractor	17	1.11	0.40
Two men and a Horse	12	1.31	0.55
One man and a Horse	13	2.80	0.64

It may seem rather strange that one man and a horse should take more than twice as long as two men and a horse. Of course a horse will stop more often and take much longer turning round when it is not being led but much of this difference must be due to the sample of farms.

The cost per acre shown in Table 12 represents the cost for horse or tractor-hoeing once only, but on nearly every farm the sugar beet was horse or tractor-hoed more than once and in a few cases even five or six times. The average number of times the beet was horse or tractor-hoed in each area was:

	No. of Times
South Somerset	2.2
West Somerset	2.8
Central Herefordshire	3.1
Worcestershire	3.1
Ross	3.2
Bridgwater	3.2

It would be thought from this that horse and tractor-hoeing would have cost least in South Somerset, but this was not so, due to the fact that eight of the one-man-and-a-horse teams were in this area. Hand-steered motor hoes were used instead of, or as well as, horse and tractor-hoes on six farms.

The cost of singling was highest in the areas where least piece-work was done and lowest in the areas where most piece-work was done. Table 13 shows the method of paying for singling and for the second hand-hoeing in each area.

Table 13

The Number of Farms which Hand-hoed Sugar Beet By Hour Work and By Piece-work

	Somerset			Herefordshire		Worcester-shire
	West	South	B'water	Ross	Central	
Singling						
By Hour Work	11	15	4	1	9	3
By Piece-work	1	12	5	18	5	12
By Both Hour Work and Piece-work	-	2	2	1	2	1
Second Hand Hoeing						
By Hour Work	7	19	7	13	10	4
By Piece-work	-	6	2	5	2	10
By Both Hour Work and Piece-work.	-	1	1	-	1	1
Not Carried Out	5	3	1	2	3	1

When the figures in the table above are compared with the costs of singling as shown in Table 4 it is at once obvious that piece-work is a far cheaper method of doing the job. In West Somerset where only one farm paid by piece-work the cost of singling was nearly £11 per acre whilst in the Ross area where all the farms except one paid by piece-work the cost was only £7. 10s. per acre. Spraying, mostly against aphides, only cost a small amount, especially in the West and South Somerset areas, where only 6 of the 41 farms did any spraying. One-half of the farms in the other areas did some spraying.

Harvesting

The cost of harvesting showed considerable differences from farm to farm. Twenty-six farms had harvesting costs of more than £20 per acre and twenty of these were in the West and South Somerset areas and none in the Ross and Worcestershire areas; whilst thirteen farms had harvesting costs of under £10 per acre, six of which were in South Somerset. The cost of harvesting of course is dependent on the yield of sugar beet per acre and also whether it is done mechanically or by hand. A better comparison between farms can be made by calculating the harvesting costs on a per ton basis instead of a per acre basis. Table 14 shows the distribution of farms according to the cost of harvesting per ton of clean beet in each area.

Table 14

Cost of Harvesting Per Ton of Clean Beet

	Somerset			Herefordshire		Worcester-shire
	West	South	B'water	Ross	Central	
Over £2 per ton	3	2	0	0	3	1
£1.10s.to £2 per ton	3	3	4	3	1	1
£1 to £1.10s. per ton	6	12	0	8	8	5
10s. to £1 per ton	0	9	6	8	4	8
Under 10s. per ton	0	3	1	1	0	1
	£	£	£	£	£	£
Average Cost per Ton	1.84	1.13	1.11	1.09	1.33	1.07

The differences in the harvesting costs between the various farms were far greater than for any other item of cost, and it seems that the profitability of sugar beet growing can be very largely influenced by the cost of harvesting, and it is in harvesting that the use of modern machinery can be put to its greater use. A total of thirty-six farms used mechanical harvesters on at least part of their sugar beet acreage, and a comparison between the farms using mechanical harvesting and those doing it by hand is shown in Table 15. The three Somerset areas have been grouped together and the two Herefordshire and the Worcestershire areas have also been grouped together. Not all of these farms owned their harvesting machinery. Eight of them had their harvesting done on contract.

Table 15.

Some Comparisons Between Hand Harvesting and Mechanical Harvesting of Sugar Beet

	Hand Harvesting		Mechanical Harvesting	
	Somerset	Hereford and Worcester	Somerset	Hereford and Worcester
Number of Farms	37	31	15	21
Average Acreage Harvested per Farm	7.07	8.68	15.63	13.82
Man Hours per Acre	108.2	70.2	55.2	40.6
Tractor Hours per Acre	8.7	10.4	9.3	13.4
Cost of Contract Work per Acre (£)	0.05	0.32	0.42	1.99
Operational Cost per Acre (£)	21.48	16.24	12.18	12.36
Total Cost per Acre (£)	21.68	16.38	13.75	13.74
Total Cost per Ton of Clean Beet (£)	1.45	1.22	0.86	1.10
Yield of Clean Beet per Acre (tons)	15.4	14.0	16.0	12.7
Total Tare (lb. per cwt.)	13.4	14.5	18.3	18.3
Top Tare (lb. per cwt.)	1.3	2.7	2.4	3.5

NOTE: Total cost per acre includes allowances for repairs and depreciation of harvesters and beet lifters.

The use of mechanical harvesters reduced the man hours worked per acre very considerably; on the Somerset farms mechanical harvesting required only one-half the manual labour per acre as hand harvesting and on the Herefordshire and Worcestershire farms the saving of man hours was almost as great proportionately. The reasons for the greater number of man hours worked on the Somerset farms compared with the Herefordshire and Worcestershire farms has been discussed before and can be largely attributed to the payment by piece-work, resulting in the job being done more quickly. Twenty-three of the 31 farms in Herefordshire and Worcestershire that harvested by hand paid their workers piece rates for pulling and topping, but only five of the 37 Somerset farms did so. However these figures for man hours do not include work done by contract, and, because of this, the figures are not strictly comparable since a lot more contract work was done on the Herefordshire and Worcestershire farms using harvesting machines than on any other of the above groups of farms. There are however several different types of machines and some do a more complete form of harvesting than others.

The simplest machines cut off the tops and lift the roots and deposit them in rows or heaps on the field, and the roots then have to be picked up by hand and loaded into carts, often having to be examined to see if they are properly topped. Another type of machine carries the roots in a large hopper and deposits them in a clamp on the headland so that loading the carts is much quicker. This method has the additional advantage in that the beet can be left in these clamps until "delivery permits" allow it to be sent off to the factory, thus the actual harvesting can be done when the weather conditions are most favourable without the necessity of having to cart the beet to another clamp and then reload it again when it is despatched. Yet another type of machine

loads directly into a trailer attached to another tractor following beside the machine, so that here the beet does not have to be moved by hand at all at harvesting time. This method naturally makes harvesting cheaper still, but it only works to its best advantage in a dry season when the beet can be harvested at times to coincide with the "delivery permits". As delivery is usually spread over two or three months the beet either has to be harvested in often unfavourable conditions or else it has to be clamped. Clamping of a certain proportion of the beet crop occurred quite frequently and this unfortunately has rather distorted any comparisons that could have been made between these various types of machines. To get a true picture of the comparative values of these machines, a separate investigation employing work study methods would be necessary to elaborate further on this important factor in sugar beet growing.

It should be pointed out that for the purposes of this investigation the term "harvesting" includes all work up to the time the beet actually leaves the farm, thus clamping or loading lorries or trailers at the clamp is all included in harvesting. Transport commences immediately the beet leaves the farm.

The figures given as "operational cost per acre" are calculated on the same basis as the harvesting cost shown in Table 4. To this, however, the cost of depreciation and repairs to machinery must be added, as this item of cost is naturally much higher for harvesters than for the ordinary lifters and this is included in the "total cost per acre" and also in the "total cost per ton of clean beet". This latter figure is also not comparable with the figure given in Table 4.

It was not possible to know how much beet was wasted by the machines breaking off the ends of the roots and leaving them in the ground, a point which was often mentioned by those who did not approve of machines, but even if this amounted to half a ton per acre, it would still bring the argument out in favour of the machines. However, Table 15 does show that the machines send more dirt and tops to the factory, but this is only a matter of minor importance for in a crop of 15 tons per acre the average amount of extra tare would only amount to about 12 cwt. and involve a cost of not more than ten shillings per acre in extra transport costs, and as to the argument of sending the best soil to the factory, it would take 250 beet crops to move one inch of soil more than would be sent by hand harvesting.

There was however a considerable difference from farm to farm on the proportion of total tare. Nine farms had less than 10 lb. per cwt. total tare, one small farm on light sandy soil near Yeovil having under 4 lb. per cwt. At the other end of the scale, sixteen farms had more than 20 lb. per cwt. total tare and two of these had more than 24 lb. per cwt. Now the difference at these extremes does mean that on a 15 ton per acre crop some farms are sending nearly 3 tons of soil per acre to the beet factory in addition to the extra tops. This means a cost of over £2 per acre on transporting the soil to the factory, but even so it would take at least eighty crops of beet to remove an inch of soil.

Top tare was not a very important item and it is naturally better to cut off too little and pay the extra transport charge than cut off too much and lose some of the value of the crop. A few small farms were recorded with no top tare, and eight farms sent more than 4 lb. per cwt. of top tare to the factory. These farms incidentally were all in Worcestershire or Herefordshire and seven of them were using machines.

However the chief factor which determines whether it is profitable to use a machine or not is undoubtedly the acreage of sugar beet which is grown. The average annual cost of repairs and depreciation of a beet harvester is nearly £30 and this figure includes some of the smaller less expensive machines; for the bigger more modern machines, the cost averages over £40 per annum. Thus to justify the use of a machine it should be used on a minimum of eight acres per annum, and if anyone is considering buying a new machine costing over £350 at least twelve acres should be harvested per annum to justify the expense. Eleven of the farms using machines grew less than ten acres of sugar beet but these mostly either had the harvesting done by a contractor, owned the machine jointly with a neighbour, or else had been able to buy a more simple type of second-hand machine at a favourable price. The contractors charge was from £8 per acre upwards depending on what the contractor undertook. But a charge of £8 per acre for the use of a machine, tractor and one man, while showing a reasonable return to the contractor, does not seem so expensive as many other forms of contract work, and at this price would show quite a considerable saving on doing the job by hand. One argument for doing the job by hand however was that the farm employed a fairly large labour force which was necessary for corn growing and other farm work and that the beet harvest came at a relatively slack time of the year and employed labour that would otherwise not be gainfully employed at that time of the year. However there are still many farms that would be justified in purchasing a machine and could probably add to their profits by doing some contract work for their neighbouring smaller growers, thus benefiting everyone.

Transport

For the purpose of this investigation, transport includes all costs incurred by the sugar beet after it has left the farm. Thus where the beet was sent by rail the cost of transporting to and from the station and loading the trucks at the station was included in addition to the rail charge. But where the beet was sent by lorry, there would only be the one item of cost. Loading beet from a clamp was considered part of the harvesting cost. Naturally the Worcestershire farms benefited very considerably from their proximity to the factory at Kidderminster in this item of cost. None of these farms sent beet by rail and six of them delivered it in their own lorry or tractor trailer, and the average cost of transport on these six farms was only £2.06 per acre or 3s. 6d. per ton. Slightly more than half the farms in the two Herefordshire groups sent their beet by road. Although the actual cost of hiring road transport was often more than the rail charge, it did however eliminate an extra handling of beet. All the Somerset farms sent their beet by rail and three of them hired lorries as well to cart it to the station. Table 16 below shows how the cost of transport was apportioned between the farms' own cost and the freight charges, and also the total cost of transport according to the type of transport used.

Table 16

The Cost of Transporting Sugar Beet From Farm to Factory

	Somerset			Herefordshire		Worcester-shire
	West	South	B'water	Central	Ross	
	£	£	£	£	£	£
Cost per Acre						
Manual Labour, Tractor and Farm Lorry	3.96	3.57	2.87	1.62	1.79	0.78
Hired Lorry	-	0.41	0.73	6.81	8.49	5.06
Rail	12.48	14.13	13.81	5.86	5.28	-
Total Cost per Acre	16.44	18.11	17.41	14.29	15.56	5.84
Cost per ton Clean Beet	1.19	1.13	1.11	1.10	1.14	0.43
Total Cost per ton on those farms which:						
a) Sent by Rail	1.19	1.13	1.11	1.06	1.11	-
b) Sent by Hired Lorry	-	-	-	1.11	1.24	0.58
c) Sent by Own Transport	-	-	-	-	0.68	0.18

In those cases where beet was carted by lorry to the station it has been classified as sent by rail, and where beet was sent by more than one type of transport, a cost for each type of transport was calculated and the results included under each. The reason that the Worcestershire farms which used their own transport had a far lower cost per ton than those Worcestershire farms sending by hired lorry was that the former farms were only two to five miles from the factory whilst some of the latter farms were up to fifteen miles from the factory. On both groups of Herefordshire farms the lorry transport cost more than the rail transport in spite of less handling being required, though of course those farms in these two areas which sent by lorry were probably farther from the station than those that sent by rail, so if they had sent by rail their costs would still have been higher and it is therefore doubtful if there is any real difference between rail and lorry costs in these areas.

Contract Work

The total cost of contract work shown in Table 3 is largely composed of transport charges and indeed in the West Somerset area is entirely rail transport. Table 17 shows the cost per acre of contract work for road and rail transport, harvesting and other operations.

Table 17

Analysis of Contract Charges

	Somerset			Herefordshire		Worcester-shire
	West	South	B'water	Central	Ross	
Cost per Acre	£	£	£	£	£	£
Rail Transport	12.48	14.13	13.81	5.86	5.28	-
Road Transport	-	0.41	0.73	6.81	8.49	5.06
Harvesting	-	0.21	0.15	0.83	0.24	2.10
Other Operations	-	0.08	0.12	1.26	0.32	0.92
Total Contract Work	12.48	14.83	14.81	14.76	14.33	8.08

Manures

The method of calculating the net cost of manures has been discussed previously. The total cost of the various manures applied, brought forward and carried forward are shown in Appendix 2 at the end of this report. The very small value of residual manures from folded roots in Herefordshire and Worcestershire compared with Somerset was due to the fact that on only one farm in the former counties did the sugar beet crop follow a folded root crop and that, incidentally, was a sugar beet crop grown the previous year the tops having been folded off. In Somerset however a total of nineteen farms had a folded root crop previous to the sugar beet crop.

Potatoes, a crop which usually receives a heavy dressing of both organic and inorganic manures were grown prior to sugar beet on twelve farms in South Somerset, but only on a total of six farms in the other five areas. There was quite a difference in the most usual crop grown prior to sugar beet in the different areas. In the West Somerset and Bridgwater areas, the most common crop was barley; in South Somerset, potatoes and swedes or kale. In the Ross area, wheat and barley; in the Central Herefordshire area, wheat and oats; and in Worcestershire, wheat and vegetables (cabbage, sprouts, peas and potatoes).

Although the cost of other organic manures may seem high, they were only applied on a very few farms. Four farms used sewage sludge, three farms used shoddy and one used leather waste.

Seed

Compared with the majority of farm crops the cost of seed is a very small item in the total cost of growing sugar beet. In this investigation the total cost of the seed purchased was charged to the crop, although in many cases not all the seed that was purchased was sown, and the remainder being wasted, thus the average rate of sowing was well short of the recommended rate of 15 lb. per acre of natural seed. Table 18 below shows the varieties of seed sown, the type of seed and the average rate of sowing in each area.

Table 18

Distribution of Farms According to Variety and Type of Sugar Beet Seed Sown and the Average Rate of Sowing per Acre

	Somerset			Herefordshire		Worcester-shire
	West	South	B'water	Central	Ross	
Variety of Seed (number of farms)						
Klein E.	6	20	7	12	19	13
Battle's E.	6	7	7	-	-	1
Webbs No. 2	-	-	-	4	1	3
Hilleshog E.	2	2	-	2	-	1
Hilleshog N.	-	1	1	-	-	1
Bush E.	1	3	-	-	-	-
Others[x]	1	1	1	1	-	1
Type of Seed (number of farms)						
Natural	9	22	7	12	17	13
Rubbed and Graded	3	10	5	5	4	3
Polyploid	2	-	-	-	-	1
Rate of Sewing (lb. per acre)						
Natural Seed	12.8	12.0	12.5	10.1	11.6	11.2
Rubbed and Graded Seed	7.0	6.5	8.4	6.0	8.7	6.0

[x]Other varieties included Johnson's E, Cannell's, Garton's C and Goldsmith's Dobrovice.

Several farms grew more than one variety of seed and it was thus not possible to analyse yields or sugar content according to variety. In fact when the farms growing more than one variety were eliminated from the sample, there were only eight farms which grew Battle's E as the only variety and this was the second most popular variety grown. Battle's E was only grown on one farm in the Herefordshire and Worcestershire group. There were different strains of Klein E, Sharpe's being the most popular but quite a lot came from East Germany and West Germany.

The growing of rubbed and graded seed instead of natural seed is supposed to make singling an easier job, as the plants should come up singly instead of in groups of three or four, but there was no case of any farmer paying his piece rate workers a lower rate because he had sown rubbed and graded seed, although this should be the logical outcome. The actual cost per acre of rubbed and graded seed is about the same as natural seed, since although it is sown at a lower rate, its cost per lb. is more.

Sprays

The cost of sprays in Table 3 only relates to those farms that did the spraying themselves. Ten of the 38 farms that sprayed their sugar beet had it done by contract and it was thus not possible to distinguish the cost of the sprays from the cost of the spraying on these farms and in those cases the cost of sprays is included in the contract work. On the twenty-eight farms that did their own spraying the average cost of sprays per acre was approximately 17s. 6d.

Machinery Repairs and Depreciation

Information was obtained regarding the cost of depreciation and repairs of certain implements which were used to a considerable extent in the production of sugar beet and the average cost of depreciation and repairs of these implements are shown in Table 19 below. Where the cost of a particular implement was calculated it was charged at that rate on the farm in question but where there was no such information available the average cost per acre shown in Table 19 was charged. Other implements not listed in Table 19 were covered by a standard charge of £1. 10s. per acre on all farms.

Table 19.

Average Cost of Depreciation and Repairs of Certain Implements and Machines

	Number of Records	Total Depreciation	Estimated life	Annual Depreciation	Annual Repairs	Depreciation & Repairs	Annual Acres	Cost per Acre
		£	Years	£	£	£		£
Fore-end Hydraulic Dung Loaders	19	108	12	10.5	1.6	12.1	35	0.36
Dung Spreading Carts	18	143	11	13.1	5.0	18.1	21	1.01
Dung Heap Spreaders	8	143	12	12.8	2.6	15.4	34	0.52
Root Drills	23	57	16	3.9	0.9	4.8	24	0.28
Tractor Hoes	16	84	19	5.0	4.4	9.4	43	0.25
Beet Lifters	16	32	17	2.1	1.2	3.3	10	0.41
Beet Harvesters (a)	10	107	13	8.1	3.0	11.1	9	1.55
Beet Harvesters (b)	16	380	12	31.8	8.5	40.3	22	2.00

(a) Beet Harvesters costing less than £150
(b) Beet Harvesters costing more than £150

The total depreciation shown in Table 19 is the difference between the cost price and the estimated second hand or scrap value. Each of the figures given in Table 19 is the simple average for each item of cost, so that the average figures cannot necessarily be mathematically related to each other. Quite a number of the root drills, tractor hoes and beet lifters used on farms in this investigation were over fifteen years old, and it was not possible to discover their original purchase price. Although they were still quite serviceable their present day

value would be very low indeed and they could not be regarded as likely to depreciate any further so that their only cost would be for repairs; these machines have consequently been excluded from the results in Table 19.

Field Costs

These costs consisted of (a) rent (b) lime and (c) hedging, fencing and ditching. Hedging, fencing and ditching was charged at a standard cost of eleven shillings per acre on the Herefordshire and Worcestershire farms and at thirteen shillings per acre on the Somerset farms where the fields were on the whole slightly smaller. The cost of lime which was calculated as being the average cost per acre of lime on the whole farm amounted to approximately 2s. 6d. per acre on the Somerset farms and to nearly 6s. 0d. per acre on the Herefordshire and Worcestershire farms.

Rent, which was calculated as the net rent or rental value per acre after deductions for the value of buildings and cottages had been made from the total rent or rental value of the farms, averaged £2. 16s. per acre on the Somerset farms and £2. 12s. per acre on the Herefordshire and Worcestershire farms. There was an appreciable variation in the rents from farm to farm and between farms in different areas. In West Somerset the average rent per acre was under £2, whilst in South Somerset it was over £3, and on individual farms varied from as low as £1 per acre up to nearly £5 per acre. The gross rent on some farms was as high as £6 per acre.

Large and Small Growers

The mean acreage of sugar beet grown per farm was seven acres. Fifty-two farms grew less than seven acres and fifty-three farms grew seven acres or more, and this proportion was the same when the farms were grouped into counties. In Somerset twenty-six farms grew less than seven acres and twenty-six farms grew seven acres or more, and in Herefordshire and Worcestershire twenty-six farms grew less than seven acres and twenty-seven farms grew seven acres or more. Thus seven acres was the most convenient point at which to subdivide the farms according to the acreage of sugar beet grown and the results of this analysis are shown in Tables 20 and 21. These tables are similar to Tables 3 and 4 respectively, only the farms are grouped according to acreage grown instead of their location.

Table 20

Costs, Returns and Margin Per Acre on Large and Small Farms in Somerset, Herefordshire and Worcestershire.

	Somerset		Hereford & Worcester	
	Under 7 Acres	Over 7 Acres	Under 7 Acres	Over 7 Acres
COSTS	£	£	£	£
Manual Labour: Hour-work	36.82	28.07	17.48	14.50
Piece-work	3.55	5.34	9.02	11.63
Total	40.37	33.41	26.50	26.13
Tractor	5.27	5.34	5.75	5.20
Horse	1.10	0.18	0.13	0.07
Farm Lorry	-	0.09	-	0.77
Contract	13.37	15.20	14.34	10.34
Total Operational Costs	60.11	54.22	46.72	42.51
Manures: F.Y.M. etc.	5.27	4.52	4.09	3.60
Artificials	5.73	6.56	7.98	8.37
Crop Residues	0.73	0.93	0.08	0.18
Total	11.73	12.01	12.15	12.15
Seed	1.18	1.12	1.09	1.12
Sprays	0.13	0.29	0.19	0.32
Machinery Depreciation and Repairs	2.23	3.29	2.54	2.73
Field Costs	3.85	3.52	3.19	3.39
Total Material Costs	19.12	20.23	19.16	19.71
Crop Failures	0.38	0.24	0.60	0.20
TOTAL COST	79.61	74.69	66.48	62.42
Sales of Sugar Beet	93.49	105.96	85.96	90.74
Value of Beet Tops	9.29	8.15	7.75	9.22
TOTAL RETURN	102.78	114.11	93.71	99.96
MARGIN	23.17	39.42	27.23	37.54
Number of Farms	26	26	26	27
Average Acreage per Farm	3.61	15.47	3.93	16.93
Yield of Clean Beet (tons)	14.5	16.6	13.2	13.3
Sugar Content (%)	16.2	15.8	16.3	16.0
Average Size of Farms (acres)	165	272	163	254

Table 21

Operational Costs and Manual Labour Per Acre on Large and Small Farms in Somerset, Herefordshire and Worcestershire

	Somerset		Hereford & Worcester	
	Under 7 Acres	Over 7 Acres	Under 7 Acres	Over 7 Acres
	£	£	£	£
Applying F.Y.M.	2.12	1.86	1.88	1.25
Applying Artificials	0.40	0.41	0.54	0.51
Seed-bed Preparations	4.09	2.56	3.47	2.63
Drilling and Covering	0.78	0.63	0.63	0.66
Tractor/Horse Hoeing	1.91	1.62	1.80	1.74
Singling	8.92	8.95	7.21	7.94
Other Hand Cleaning	4.29	2.74	2.81	2.65
Spraying	0.06	0.10	0.48	0.29
Total Summer Cultivations	15.18	13.41	12.30	12.62
Harvesting	20.79	16.95	14.57	14.23
Transport	16.75	18.40	13.33	10.61
Total Operational Costs	60.11	54.22	46.72	42.51
Man hours	Hours	Hours	Hours	Hours
Applying F.Y.M.	9.0	7.7	6.8	4.7
Applying Artificials, Seed-bed Preparations, Drilling and Covering.	15.9	10.7	12.9	10.9
Summer Cultivations	81.2	67.8	58.2	59.0
Harvesting	104.2	81.7	59.5	56.3
Transport	14.8	14.6	5.7	4.2
Total Man Hours	225.1	182.5	143.1	135.1
Tractor Hours	27.1	26.5	29.6	27.0
Horse Hours	14.5	2.4	1.7	0.9
Per Ton of Clean Beet	£	£	£	£
Cost of Harvesting	1.54	1.05	1.18	1.13
Cost of Transport	1.16	1.12	0.98	0.84

Although the margin per acre was appreciably higher on the larger farms it was however largely due to a higher return rather than to lower costs that this was achieved. In fact it was rather surprising that there was so little difference particularly in the cost of manual labour between the large and small farms in Herefordshire and Worcestershire. When referring to large and small farms here the terms large and small reflect the acreage of sugar beet grown and not necessarily the size of the whole farm. It is also surprising that, in spite of many more of the large farms harvesting mechanically, fifteen large farms used harvesting machines and only six small farms did so; the cost of harvesting on the large farms was very little less than on the small farms. The differences between the large and small farms are more marked on the Somerset farms, and on these farms the major difference in cost was in harvesting; only two small farms used machines compared with thirteen of the large farms. Horses were also used to a far greater extent on the small Somerset farms than on any of the other three groups of farms.

Summary

Compared with cereal crops the margin per acre from sugar beet compares quite favourably but compared with potatoes it compares very unfavourably especially in recent years. In terms of return as a percentage of cost sugar beet does not compare very well with other crops especially when it is realised that 1956 was a distinctly favourable year for growing sugar beet. Farmers generally were not particularly enthusiastic about growing it as there are many difficulties about the organisation of labour, particularly at singling time, when it may well clash with many other jobs on the farm, and it does seem that only where casual labour is readily available, as in the Eastern Counties, can the labour question be readily solved.

Growers are not particularly impressed by the concessions which allow them to buy beet pulp at a reduced price as they consider it still rather expensive, compared with home-grown oats. The one thing however which really decides the farmer to grow sugar beet is the value of the tops. Roots and green fodder for cattle and sheep are expensive and time-consuming crops to grow, and sugar beet does provide a very good feed as a by-product in the form of the tops. It is this factor that, after making a reasonable though not particularly generous profit from the sale of the roots, there is also some very valuable feed readily available for the sheep and cattle, that finally weighs the farmer's decision to grow sugar beet.

APPENDIX 1

Aggregate Costs, Returns and Margin on All Farms in Somerset, Herefordshire, and Worcestershire

	Somerset	Herefordshire & Worcestershire
Number of Farms	52	53
Number of Fields	86	77
Total Acreage Occupied by Beet Fields	520.10	591.62
Less (a) Unsown Headlands	0.30	23.37
(b) Crop Failures	23.75	8.00
Acreage of Sugar Beet Harvested	496.05	560.25
PRODUCTION COSTS	£	£
1. Labour and Power (a) Time Rates	12763.3	7286.8
(b) Piece Rates	3488.0	6583.2
(c) Tractor	2640.4	2896.5
(d) Horse	133.9	39.7
(e) Farm Lorry	16.8	357.8
(f) Road/Rail Contract	7347.7	4451.0
(g) Other Contract	113.4	1087.6
Total Labour and Power	26503.5	22702.6
2. Manures (net cost) (a) F.Y.M. etc.	2033.3	2086.0
(b) Artificials	3100.9	4780.5
(c) Crop Residues	402.1	70.2
Total Manures	5536.3	6936.7
3. Field Costs (a) Rent	1388.6	1461.9
(b) Lime	63.2	164.5
(c) Maintenance	323.7	320.6
Total Field Costs	1775.5	1947.0
4. Machinery Depreciation and Repairs	1624.3	1548.1
5. Seed	549.4	624.4
6. Sprays etc.	144.1	198.4
7. Crop Failures (net cost)	141.8	93.7
Total Production Costs	36274.9	34050.9
Sales of Sugar Beet	52675.2	51127.4
Value of Beet Tops	3465.1	4684.5
Total Production	56140.3	55811.9
Margin (Surplus)	19865.4	21761.0
Weight of Clean Beet (tons)	8237.7	7866.0
Manual Labour Hours	72125	41260
Tractor Hours	13637	15151
Horse Hours	1774	524
Farm Lorry (miles)	409	9503

Appendix 2

The Aggregate Cost of Manures on All Farms in Somerset, Herefordshire and Worcestershire

	Somerset	Herefordshire & Worcestershire
Inorganic Manures	£	£
Applied (a) Compounds	3225.6	5519.6
(b) Phosphates	92.6	59.3
(c) Potash	57.9	275.4
(d) Nitrogen	205.1	295.1
(e) Salt	175.7	188.8
Total Applied	3756.9	6338.2
Brought Forward	469.4	393.7
Carried Forward	1125.4	1951.4
Net Inorganic Manures	3100.9	4780.5
F.Y.M.		
Applied	2717.8	2648.6
Brought Forward	864.8	440.7
Carried Forward	1609.2	1426.4
Net F.Y.M.	1973.4	1662.9
Other Organic Manures		
Applied	63.4	817.0
Brought Forward	37.5	16.9
Carried Forward	41.0	410.8
Net Other Organic Manures	59.9	423.1
R.M.V. of Folded Roots		
Brought Forward	499.3	5.6
Carried Forward	199.6	-
Net R.M.V. of Folded Roots	299.7	5.6
R.M.V. of Leys		
Brought Forward	165.4	116.4
Carried Forward	63.0	51.8
Net R.M.V. of Leys	102.4	64.6
Net Cost of Manures	5536.3	6936.7