Fruit Cost of Production

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COSTS OF ORCHARD ESTABLISHMENT, 1946-49

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I.—INTRODUCTORY

The heavy capital cost of orchard planting and the length of time which must elapse before the first crop of fruit can be expected, have caused growers to consider ways in which quicker returns can be obtained from land under young fruit. The growth of market garden crops between the tree rows is one way of obtaining this end, but the manurial and cultural requirements of the intercrop are likely to conflict with those of the trees. A more satisfactory plan is to use filler trees on dwarfing stocks which come into production comparatively quickly and give an economic return whilst the permanent trees are becoming established. As soon as signs of overcrowding appear, the short-lived filler trees can be grubbed out and the permanent trees left to form the sole crop. Soft fruit may be used in the same way. The cultural and manurial requirements of bush fruit are not so difficult to reconcile with those of the top fruit as are those of market garden crops, but such difficulties as susceptibility of some varieties of soft fruit to spray damage still occur.

A grower contemplating the establishment or extension of fruit plantations needs information concerning the different methods of establishment. He wants to know the effect on the total cost of the orchard of underplanting with soft fruit or filler trees. He also wants to know what effect interplanting is likely to have on the permanent trees : whether it will reduce or postpone their cropping or interfere with their development. These are matters about which very little systematic information exists.

In 1946, as a result of discussions at the East Malling Research Station, a series of experimental plots was laid down on a farm in East Kent, with the object of gathering information on these points. The experiment consists of four ten-acre plots planted with different combinations of permanent trees, filler trees and soft fruit, the object being to compare costs of planting and maintenance, cropping, yields, etc., on the various plots. The recording during the early months was carried out entirely by the farm staff, but in the spring of 1948 the Department of Economics of Wye College became associated with the work and undertook the supervision of the recording and the tabulation and analysis of the data. Detailed records have been kept throughout by the farm manager, to whose interest and care the investigation owes much of its success.

The figures for the period October 1946 to March 1948 are based on records kept on the farm. For this period full cost data are not available and some assumptions have had to be made concerning, for example, wage rates, tractor costs and overhead expenses. These assumptions and the gaps which occur in the available data may influence the calculation of total costs during this period. They do not, however, affect the *comparisons* between the different plots. From April 1948 onwards full cost accounts are available, not only for the experimental plots but for the farm as a whole, and more accurate cost determinations are possible.

The present report deals with the progress of the experiment from the planting of the trees in the winter of 1946-7 up to September 1949, a total period of three years. One of its functions is to record the facts and figures which have emerged during that period ; but it has also a further purpose. It discusses some of the principles underlying the methods of accountancy employed, and endeavours to establish a satisfactory costing technique for use in dealing with orchard fruit. The normal methods of farm costing require some modification when they are applied to a crop like apples which may occupy the land for more than half a century. An attempt is made in the following pages to work out some of the implications of these differences, and to establish methods which will provide a sound foundation for future work.

In making the results so far obtained available to other growers, it is perhaps desirable to point out that they must not be taken as universally applicable. They were obtained on a particular farm in a particular district on orchards planted in a particular season. It is for other growers to decide how far similar results are likely to be obtained on their own farms, which may differ in soil and environment from the farm on which the plots are situated.

The season 1946-7 was in many respects an unfortunate one for the inauguration of the experiment. The severe weather in the early months of 1947 interfered with planting and produced conditions which were far from ideal for the young trees. It would obviously have been better if planting could have been done in a " normal " season ; or, since a " normal " season probably does not exist, if a number of groups of plantations established in different years and in different districts could have been used. Replication of this kind is usual in scientific experiments and serves to equalize the effect of influences other than those which the experimenters are setting out to test.

The purpose of the present experiment, however, is mainly to

compare different treatments, and from this point of view it is less important to overcome the influence of environmental and seasonal factors, since these are likely to influence all the plots equally. Thus, if the blizzards at planting time retarded development of the trees they probably had much the same influence on all the plots : if abnormal post-war prices, or difficult labour conditions influenced the costs, all the plots shared the same drawbacks. There is no doubt that much more work is desirable along similar lines to extend our knowledge of planting costs and methods, and it is hoped that further comparisons will be made between different planting systems in other districts and in other seasons. Nevertheless, the present experiment, despite its limitations, does provide a basis of information of a kind not previously available, and as the years go on its value will be greatly increased as a record of orchard history.

II.—THE ORCHARDS

The Site

The farm is situated in East Kent, on the slopes of the North Downs, above the 300′ contour. The soil is clay with flints overlying the chalk. The plots were tested by the National Agricultural Advisory Service for manurial requirement and details of the results are given in Appendix 1. Most of the land is somewhat low in phosphates, but adequate in potash. The acidity ranges from a pH of 5·2 to 7·3 and in most places exceeds 6·0. There is a slight slope to the north-west and the site has good air drainage and is free from radiation frosts. It is very exposed to winds which may possibly cause some trouble. The farm did not appear to suffer unduly from the drought of 1949, although the apples on grass were somewhat affected.

The whole site, which had been in cultivation for ordinary farm crops, was cleared and levelled; the hedges were grubbed out and a road was made. A water main was laid and simple buildings erected to house implements and stores and to provide an office for the manager. There were no buildings on the farm at the time of purchase. The whole area was ring-fenced against rabbits, so no fencing of individual plots was required. To provide accommodation for workers four new cottages were built and electricity and water services installed.

The experimental plots were cropped with wheat in both 1945 and 1946, the manurial dressing in the latter year being 1 cwt. sulphate of ammonia and 5 cwt. calcined ash per acre. The 1946 crop yielded approximately 5 quarters and was combined. Part of the straw was burnt, but the remainder was too wet to burn and was ploughed in.

The Experimental Plots

Each of the experimental plots is 660 ft. square and contains an area of 10 acres. The plots are grouped together in the centre of the farm.

The crop consists of dessert apples, the varieties selected being Cox's Orange Pippin, Worcester Pearmain, Laxton's Fortune and Sunset. It was decided to plant in the proportions: two-thirds

Cox, one-sixth Worcester, one-twelfth Fortune, one-twelfth Sunset, and the actual plant is :

17	rows	Cox
5	,,	Worcester
2	,,	Fortune
2	,,	Sunset

this being the nearest approximation to the predetermined ratio. The rows are distributed as follows, the varieties being indicated by their initial letters :

C C W C C F C C W C C S

Using this combination of varieties throughout, the plots were planted as follows :

Plot A. This plot contains permanent trees only, at 25 ft. 6 in. square on M.II stocks. This gives 26 rows of 26 trees in each row, or 676 trees in all.

Plot B. The main plant is permanent trees at 25 ft. 6 in. square on M.II stocks=676 trees.

One filler tree is planted in the centre of each square on M.VII stock, making 25 rows of fillers with 25 trees to each row=625 filler trees.

Total trees in plot=1,301.

Plot C. The main plant is again permanent trees at 25 ft. 6 in. square on M.II stocks=676 trees.

The interplant consists of three filler trees on M.IX stocks to each permanent tree. This is equivalent, for the filler trees, to 26 rows of 25 trees and 25 rows of 51 trees=1,925 filler trees. This gives a theoretical total of 2,601 trees. The first tree in each row of fillers was omitted, however, to give more room at the headland, making the actual numbers 676 permanent+1,900 fillers=2,576 trees.

Plot D. This plot was designed to test the effect of growing soft fruit between the apples. The plot is divided into two equal parts, one planted with blackcurrants (referred to as DB), the other with gooseberries (DG).

The main plant on the whole plot is apples on M.II at 25 ft. 6 in. square as in the other plots.

The interplant in section DB (5 acres) is Baldwin blackcurrants, and the layout consists of two continuous rows of currants 8 ft. apart (bushes 4 ft. apart in the rows) between each row of apple

trees; leaving a space of 8 ft. 9 in. between currants and apple rows on each side. In the apple rows are planted three currant bushes between each pair of apple trees, the currants being 4 ft. apart and 8 ft. 9 in. from the apples.

This arrangement gives 338 apples and 4,740 currants to the 5-acre plot.

The gooseberry section (DG) is laid out in the same way, and contains 338 apples and 4,740 gooseberry bushes, half of which are of the variety Lancashire Lad and half Careless.

For convenience of comparison all costs and returns on plots DB and DG have been multiplied by two in this report, so that the figures given are applicable to 10-acre plots in each case.

The layout of the four experimental plots is shown diagrammatically in Appendix 2.

Plots LB and LG. Although not strictly part of the experiment, plot L acts to some extent as a control, since it consists in part of blackcurrants and gooseberries grown in the open without fruit trees. The performance of the fruit bushes on these plots can therefore be compared with those on DB and DG.

Section LB, $2\frac{1}{2}$ acres in area, contains 3,500 Baldwin blackcurrant bushes planted 8 ft. $\times$ 4 ft.

Section LG, 1 acre, contains 1,280 Careless gooseberries at the same spacing.

The Trees

All the apple trees were planted as maidens. The M.II rootstocks were obtained from a commercial grower, the M.VII and M.IX from the East Malling Research Station. The trees were reared partly by contract, partly at East Malling and partly in the farm nursery. All the permanent trees were raised by contract in the same nursery.

At the time when the planting was carried out, maiden trees from reliable nurseries were costing (when they could be obtained) from 8s. to 9s. each. At auctions prices were frequently more than double this figure. The trees actually planted, however, cost considerably less owing to the special arrangements made for raising them.

The cost of the trees forms a very substantial part of the total expense of planting and it is important that a fair value should be placed upon them. No accurate cost figure is available and the alternative of using market price is unsatisfactory because, at the time when planting was carried out, prices were very unstable and

have, in fact, since fallen considerably. In the absence of any satisfactory alternative, an agreed price of 5s. each has been used for all the apple trees.

The gooseberry and blackcurrant bushes were obtained from commercial sources and have been charged at cost, 25s. per 100 for the blackcurrants and 75s. per 100 for the gooseberries.

Farm Equipment and Staff

The equipment of the farm can be discussed only in relation to the farm as a whole, comprising some 150 acres of young fruit plantations of roughly the same age and type as the experimental plots. The latter occupy approximately one-quarter of the total area.

The permanent tractor strength consists of a 25 h.p. Field Marshall tractor bought in December 1946, a 40 h.p. M.M. diesel bought in December 1947, and an old Fordson which has been on the farm from the start. There is also a small Ransome M.G. tractor used chiefly for nursery work and strawberries. The usual implements for cultivation, a gang mower for grass orchards (not part of the experimental area) and a K.E.F. model P.20 sprayer, added in January 1948, complete the equipment.

In the cost accounts kept for the farm, the operating cost of tractors, sprayer, mowers and other implements are determined separately and charged to the various orchards according to the amount of work done on each. These operating costs are somewhat high, partly because the equipment is new and carries high depreciation charges and partly because, at the present stage of development of the farm, the available power is not quite fully utilized. The FM tractor has averaged about 1,000 hours per year and the MM tractor some 1,500 hours. The Fordson is used only occasionally, mainly for work on potatoes.

The cost per hour of tractor work for the period costed was as follows :

	FM	*MM*	*Fordson*
	s. d.	s. d.	s. d.
April 1948-September 1948 ..	4 5	5 0	3 0*
October 1948-September 1949 ..	4 9	7 4	5 8

* Estimated.

In the light of these figures the cost of tractor work during the period October 1946 to April 1948 was taken as 4s. 6d. per hour.

From October 1946 until April 1948, the regular labour force on the farm consisted only of the manager and two men. Planting was done with the aid of labour brought in from outside. In the spring of 1948 the regular staff was increased gradually to seven full-time men in addition to the manager. Occasional help is obtained from women workers, casuals, students and Committee labour. No substantial increase in the labour force should be needed for some years.

III.—CAPITAL INVESTMENT

Capital Costs

In the costs of ordinary farm or market garden crops, capital expenditure is not an item of major importance. An investment of working capital in labour, seeds, manures, etc., is, of course, necessary ; but the period for which the capital is locked up in the growing crop is comparatively short and it is not usual to make provision in cost accounts for interest on working capital.

In fruit-growing the case is different. An orchard is a long-term investment, and when once a grower has sunk his money in planting he cannot get it back quickly (except perhaps by selling both orchard and land, which he may not wish to do). In the first place he must wait for a number of years before the orchard becomes productive at all, and during this period he continues to spend money on maintenance. When finally the trees come into bearing, many years must still pass before the crop yields a sufficient surplus to pay back the original capital.

Capital investment is therefore of primary importance in the economics of fruit-growing, and some consideration must be given to this aspect of the costs.

Rental Value

Another difference in costing practice arises in the method of treating rent.

In costing ordinary farm crops, rent is included as a cost, and if the land is owner-occupied an estimate of rental value is used. The charge made is therefore based on the rents at which farms are let, a figure which may bear very little relationship to the capital cost of the land and equipment in question.

Top fruit is rarely planted in Kent on rented land and to make a charge based on rental value would be unrealistic. Both land and working capital are supplied by the grower, and the distinction between landlord's capital and tenant's capital which usually occurs in ordinary farming does not therefore apply. Instead of a payment of rent there will be a charge for interest on the capital invested in the land. Capital invested in land and that invested in equipment or in planting are thus both treated in the accounts in the same way, except that since the land is permanent and indestructible no allowance need be made for depreciation of the freehold.

Orchards as a Farm Asset

From the cost standpoint, capital expenditure may be defined as expenditure incurred, not with the expectation of an immediate return, but to increase the returns obtained in the future. Thus the cost of planting fruit trees increases output from the land, but only after a lapse of several years. The capital invested in an orchard is the sum of the costs incurred in its establishment and maintenance, up to the time when the trees are old enough to produce reasonable crops. After this all further expenses are chargeable against revenue and no longer rank as capital.

The capital cost, calculated in this way, does not necessarily correspond to the market value of the orchard as a farm asset, any more than the cost of production of any product necessarily equals its market price. In a period of high prices the selling value of fruit plantations may greatly exceed the cost of their establishment (which may have been carried out when prices were lower), whilst in times of uncertainty or falling prices the market value may fall below the cost. Similarly, disease or neglect may damage the trees, or the selection of unsuitable varieties may result in the cost of planting being largely wasted.

In the present study we are concerned primarily with the capital costs of orchard establishment, and not with the value of the orchard as a marketable asset. In so far, however, as market value depends upon the size of the financial returns from the investment, some evidence on the latter point will eventually be available in the records of crop yields, prices and profits.

Cost of Mixed Plantations

In calculating the capital cost of orchards interplanted with filler trees or soft fruit, the difficulty arises that the crop does not all mature at the same time, so that part of the fruit is still in the development stage whilst the remainder is fully grown and producing crops. Thus the period of unproductive capital investment comes to an end on the soft fruit whilst the capital costs of the permanent trees are still accumulating, and it becomes difficult to separate capital expenses from current costs of production. This difficulty arises, however, only if we think in terms of individual crops, instead of considering the orchard as a unit. For the purposes of the experiment which we are describing, the soft fruit and the apple trees are not separate, but form part of a single planting scheme, designed to produce as economically as possible a full crop of permanent trees. This is the primary purpose for which capital is

being invested, and the function of the intercrop is to reduce the cost of establishing the permanent trees. It is, therefore, logical to treat the receipts from soft fruit and filler trees as a set off against the capital investment. Thus, if the undercrop makes an aggregate profit over the whole period it occupies the ground, it will reduce the capital invested in the orchard as a whole; if the undercrop makes a loss, the cost of the orchard will be correspondingly increased.

Capital Cost of the Plots

Capital costs may be divided into three parts, namely the cost of land, the cost of buildings and equipment, and the cost of planting and maintaining the orchards. The first and second of these cannot always be separated, but in the present case it is possible to make the distinction, since the original purchase consisted of little more than the bare site; buildings, water mains, fences and other equipment being added afterwards.

In dealing with those items which form part of the cost of establishing and equipping the whole farm as a productive unit, the cost has been spread equally over the total area. Since the farm contains approximately 150 acres and each of the experimental plots 10 acres, each plot has been charged with one-fifteenth of the total. Details of the items are given in Table I.

Table I

COMPOSITION OF CAPITAL INVESTMENT AT 30th SEPTEMBER, 1949

(10-acre Plots)

	A	B	C	DB	DG
Freehold Land	£	£	£	£	£
Cost of bare land	322	322	322	322	322
Buildings and Equipment					
Roads	53	53	53	53	53
Water Supply	32	32	32	32	32
Cottages (including water and electric services) ..	411	411	411	411	411
Other Buildings	46	46	46	46	46
Fencing	60	60	60	60	60
Implements	128	128	128	128	128
Orchards					
Cost of Planting and Maintaining Orchards ..	577	945	1,764	777	1,435
Total Investment	£1,629	£1,997	£2,816	£1,829	£2,487

In addition to these general items, there is the capital invested in planting and maintaining each individual plot. This is the sum of the actual costs incurred on each plot, and the figures included under this head in Table I are taken from Table XI where the establishment costs are summarized.

All the capital costs shown in Table I refer to 10-acre plots.

Depreciation has been charged only on machinery and implements and not on other capital equipment. Strictly speaking, the depreciation of a building or other piece of capital equipment may be supposed to start from the time it is first erected. To write off depreciation in the first few years, however, would only mean that the depreciation charges themselves would have to be capitalized, in the absence of any revenue against which to charge them. It is, therefore, better to commence depreciation from the time when the capital investment in the orchards is complete and returns are coming in from sales of fruit. The capital cost can then be written off over the appropriate period during the productive life of the orchard.

In the case of implements and machinery, however, the rate of depreciation is much more rapid than on buildings, roads, etc., and if allowances were deferred until the orchards were mature the equipment might be already worn out. Further, the wear and tear on implements enters into the cost of orchard operations, and omission of this item from the costs would be misleading. The amount written off the value of the implements is simply transferred to the orchards, so that the total capitalization is not affected.

The various items of capital investment shown were not all made at the same time. The original investment consisted of the cost of land, clearing, road-making, water supply and part of the buildings and implements. Fencing and additional implements and buildings were added during the next year, and in 1948 the new cottages were completed. The interest chargeable on capital investment has therefore risen year by year. Further capital costs will be incurred in later years for additional equipment, new buildings, etc., as well as the regular increase in investment in orchards.

The figures given in Table I under the heading " Orchards " are the net capital costs after deducting sales of fruit. This is a point of some importance, since on plots DB and DG sales of soft fruit in 1949 were substantial. The position is shown in detail in Table II which sets out the total costs incurred up to 30th September, 1949, the receipts from fruit sales in that year and the net cost

after deducting sales. No sales of any importance took place in previous years.

TABLE II

EFFECT OF SALES ON ORCHARD COSTS

Plot.	Gross Cost.	Sales 1949 (less picking costs)	Net Cost.
	£ s. d.	£ s. d.	£ s. d.
A	578 9 6	1 7 6	577 2 0
B	946 13 4	1 10 0	945 3 4
C	1,769 6 9	5 13 0	1,763 13 9
DB	1,249 5 9	472 10 6	776 15 3
DG	1,555 4 3	120 7 10	1,434 16 5

The effect of sales is particularly marked on plot DB, the blackcurrants being the first crop to give a full yield, although similar returns may be expected in future years from the gooseberries and filler trees. These receipts are shown as deductions from the capital invested in the orchards. Yet they do not, of course, affect the actual costs which have been incurred in the shape of labour, materials and other expenses. But the grower has had to raise a sum of money sufficient to cover these costs, and this represents his capital investment in the orchard. When cash is received for a crop sold, the grower, instead of treating this as revenue, can use it to pay back part of the money he invested, thereby reducing the amount of capital sunk in the undertaking.

Taking plot DB as an example, the total cost incurred is, in round figures, £1,249, and this is the sum that the grower has had to provide for investment in the plot. The £472 obtained from the sale of blackcurrants is not treated as revenue, for the reasons discussed on page 12, but as a repayment of capital. The plot is therefore in a position to pay back to the grower £472 of the £1,249 he has invested, leaving only the balance of £777 still invested in the plot.

IV.—ORCHARD COSTS

Planting: October 1946 to March 1947

Planting commenced in October 1946, with a somewhat varied gang consisting of farm workers, trainees, women and boys, under the supervision of the farm manager.

All the permanent trees were planted first, starting with Plot B and finishing with C. These were all planted by January 1947, with only relatively slight hindrance from bad weather. The planting of the filler trees was interrupted by the severe snowstorms of February and March 1947. Most of the planting gang left the farm, and the work had to be completed after the snow melted with a somewhat inadequate labour force. Plot C was the chief sufferer from this interruption. The last job was the planting of the gooseberries and blackcurrants, which was completed in March 1947.

Planting was carried out in the normal way except that, on account of the flint layer, charges had to be used for blowing the holes for the trees.

The costs are summarized in the following table.

Table III

SUMMARY OF PLANTING COSTS, OCTOBER 1946 TO MARCH 1947

(10-acre Plots)

	A	B	C	DB	DG
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Ploughing	6 15 6	6 15 6	6 15 6	7 1 6	7 1 6
Planting ..	29 9 6	49 14 2	98 10 6	49 8 9	59 18 9
Trees ..	169 0 0	325 5 0	644 0 0	169 0 0	169 0 0
Bushes ..	—	—	—	118 10 0	355 10 0
Staking (labour)	3 17 0	7 17 6	14 16 0	4 10 6	4 10 6
Stakes ..	16 12 7	32 2 7	65 17 9	16 8 0	16 8 0
Straw Mulching	16 8 10	30 14 9	56 5 0	16 8 8	16 8 8
Sundries ..	1 13 6	2 16 10	6 13 9	1 18 4	1 18 4
£	243 16 11	455 6 4	892 18 6	383 5 9	630 15 9

Several items are identical on plots DB and DG, the work having been done on both plots together and divided equally between them. As already mentioned, these are actually 5-acre plots, but for ease of comparison all costs relating to them in this report are recalculated on the basis of an area of 10 acres.

The costs are shown in detail in the tables which follow. These give not only the cost of each operation, but also the time taken to perform it. This is important if the data are to be of permanent value, as the figures can thus be adapted to future changes in price levels.

TABLE IV

PLANTING TREES AND BUSHES

Plot.	Manual Labour.		Tractor Labour.		Charges.
	Hours.	£ s. d.	Hours.	£ s. d.	£ s. d.
A	173	16 13 0	4	15 6	12 1 0
B	261	25 4 5	7	1 7 0	23 2 9
C	526	51 1 6	8	1 13 0	45 16 0
DB	384	36 10 3	4	15 6	12 3 0
DG	496	47 0 3	4	15 6	12 3 0

The figures include bedding in on arrival, dressing the trees against vermin, marking out, blowing holes and planting. Preliminary ploughing is not included.

Of the £36 10s. 3d. for planting plot DB, £18 16s. 9d. was for planting the apples and £17 13s. 6d. for the blackcurrants. On plot DG the proportions were £18 16s. 9d. for the apples and £28 3s. 6d. for the gooseberries.

Most of the "tractor labour" represents use of a lorry for carting out trees.

It will be seen that plot C with its close plant of apple trees took longer to plant than the plots with soft fruit. Work in plot C was, however, delayed somewhat by the weather, and some allowance should be made for this fact. The cost of planting is roughly proportional to the number of trees in the various plots.

The gooseberries took very much longer to plant than the blackcurrants. This is partly because they were more difficult to handle, but mainly because the blackcurrants were delivered straight from the nursery, whereas the gooseberries had been

purchased the previous year and planted out, so that they had to be lifted before being planted.

TABLE V

STAKING TREES

Plot.	Manual Labour.			Tractor Labour.		Stakes.
	Hours.		£ s. d.	Hours.	£ s. d.	£ s. d.
	Men.	Women.				
A	28	9	3 8 0	2	9 0	16 12 7
B	58	12	6 10 6	6	1 7 0	32 2 7
C	94	23	13 0 0	8	1 16 0	65 17 9
D	40	—	3 17 0	3	13 6	16 8 0

Staking was actually not carried out until after April 1947, but it is included in this section of the costs so as to provide a complete record of planting. The costs depend almost entirely on tree numbers and show little variation from the anticipated ratio. DB and DG are not shown separately, as the costs were the same. All trees were staked with a single 3 ft. 6 in. stake driven in obliquely, and tied with tape.

Straw mulching round the apple trees on all the plots was carried out in April and May 1947, 4¼ tons of straw being used on plots A, DB, and DG; 8½ tons on plot B and 16 tons on plot C. Straw was charged at 57s. 6d. per ton. The costs are shown below.

TABLE VI

STRAW MULCHING

Plot.	Manual Labour.		Tractor Labour.		Straw.	
	Hours.	£ s. d.	Hours.	£ s. d.	Tons.	£ s. d.
A	24	2 8 6	8	1 16 0	4¼	12 4 4
B	29	2 18 6	15	3 7 6	8½	24 8 9
C	46	4 12 6	25	5 12 6	16	46 0 0
DB	24	2 8 4	8	1 16 0	4¼	12 4 4
DG	24	2 8 4	8	1 16 0	4¼	12 4 4

INTERCROP—POTATOES, 1947-1948

From the point of view of the experiment it would have been preferable to keep the land free of annual crops. The national need

for maximum production in 1947 made this course difficult, and it was decided to take a crop of potatoes on plots A, B and C in that year.

A total area of 18·8 acres was planted, 8 acres on plot A and 5·4 acres on each of plots B and C. The average cost per acre was £37 5s. Yields were rather low, partly because the crop was harvested early to avoid interfering with work on the trees, and equalled only 5 tons per acre. The whole crop resulted in an average loss of £6 19s. per acre.

All work on the potato crop has been excluded from the fruit costs. It is impossible to say what effect, either harmful or beneficial, the growth of the potatoes may have had on the trees. There was a good deal of weed in the plots and, the planting gang having been dispersed, labour during a large part of the year was scarce. Had the land been bare there is no doubt that more cleaning work would have been done and charged to the trees ; as it was, most of the cultivations were carried out for the potatoes, and the trees derived some indirect benefit. The potatoes also received a dressing at the rate of 15 cwt. to the acre of potato manure. No allowance has been made for this in costing the trees. The manure was applied in the potato drills, and its effect on the growth of the trees is very problematical.

No annual crops were grown after 1947 on the experimental plots.

Costs for the Year April 1947 to March 1948

During the first year after planting, little work was required in the orchards. Cultivations carried out on the potato crop on plots A, B and C helped to keep down weeds and reduced the labour of hoeing. The temporary labour which had been employed for planting left the farm in the spring of 1947, and the staff was reduced to a minimum during this period. The costs shown in the following table are further reduced by the fact that the staking of the trees, which actually took place within this year, has, for the sake of completeness, been included with the costs of planting.

Table VII gives a summary of the costs incurred during this period. A full analysis of the figures, with particulars of the hours of manual and tractor labour, will be found in Appendix 3.

The manure applied was a special fruit fertilizer put on at the rate of 7½ cwt. on plots A and B, 12½ cwt. on plot C and 27½ cwt. on plots DB and DG.

TABLE VII

SUMMARY OF COSTS, APRIL 1947 TO MARCH 1948

(10-acre Plots)

	A			B			C			DB			DG		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Cultivations ..	15	3	0	12	5	2	30	1	0	35	2	5	35	2	5
Manuring ..	11	1	6	11	1	6	18	4	6	39	2	2	39	2	2
Pruning		10	0		18	6	1	13	0	3	11	9	4	8	3
Retying and Gapping ..		17	6	3	0	6	3	19	0	2	15	0	4	0	8
Sundries		15	6	1	3	9	3	12	4		15	6		15	6
Trees and Bushes (replacements)	21	15	0	54	10	0	75	5	0	21	8	6	37	10	0
Total .. £	50	2	6	82	19	5	132	14	10	102	15	4	120	19	0

The items call for little comment, but the rather high cost of cultivating in plot C may be mentioned. One reason for this was the fact that owing to the nature of the soil (absence of stones, etc.) plot C was more suitable for working by women than the other plots. As the only extra labour available was that of women, plot C tended to receive a more thorough cleaning than the other plots.

The replacement figures give the following percentages of failures :

	No. of Trees or Bushes replaced	%
Plot A	87	13
,, B	218	16
,, C	301	12
,, D Apples	75	11
Blackcurrants	214	2
Gooseberries	500	5

These rather high rates of replacement are due to several causes. Not only was the season 1946-7 unfavourable to planting, but the snow enabled hares to get over the fences and do much damage to the trees. Further, since plenty of spares were available, it was thought wise to replace all damaged trees, but a number of those taken out were replanted in the nursery and afterwards recovered.

Costs for the Half-year April 1948 to September 1948

From April 1948 the costing was taken over by Wye College, and from this date complete data on all costs on the farm are available. From this point wages are based on actual costs instead of on average wage rates; tractor costs are available from the actual expenditure incurred in running the tractors, and the costs of implements, etc., are accurately known. An allowance can also be made for a share of general farm overhead expenses.

The first costed period covers only six months, to bring the cost accounts into line with the farm financial year which closes on 30th September.

Table VIII gives a summary of the expenditure on each plot.

Table VIII

SUMMARY OF COSTS, APRIL TO SEPTEMBER 1948

(10-acre Plots)

	A	B	C	DB	DG
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cultivations ..	38 13 2	43 0 6	100 10 3	118 12 6	141 0 10
Manuring ..	7 14 8	19 14 9	56 6 6	16 3 0	8 15 10
Washing ..	4 4 0	11 10 0	12 13 3	6 13 10	10 11 2
Pruning, etc. ..	1 19 1	5 15 9	17 18 2	3 16 4	3 16 6
Overheads ..	9 5 0	16 14 0	52 9 0	42 6 0	49 14 0
Total .. £	61 15 11	96 15 0	239 17 2	187 11 8	213 18 4

An analysis of the items is given in Appendix 3.

The amount of tractor cultivation was fairly uniform on all plots, but the amount of hand work—hoeing round the trees—was very much greater in the closely planted plots. Once more plot C was somewhat high. A large proportion (two-thirds) of the work on this plot was done by European Voluntary Workers.

With regard to manurial treatment during the period, all the plots had sulphate of ammonia and a dressing of old straw (charged at £1 per ton) in the following amounts:

	Sulphate of Ammonia	*Straw*
Plot A	$\frac{3}{4}$ cwt.	4 tons
,, B	$1\frac{1}{2}$,,	8 ,,
,, C	3 ,,	16 ,,
,, DB	$10\frac{3}{4}$,,	6 ,,
,, DG	$\frac{3}{4}$,,	5 ,,

On plots DB and DG the straw was not applied round the trees, as in the other plots, but spread evenly over the ground, which reduced the labour cost of these plots.

Costs for the Year October 1948 to September 1949

The costs for the year ending 30th September 1949 are summarized below; a full analysis of the figures is given in Appendix 3.

Table IX

SUMMARY OF COSTS, OCTOBER 1948 TO SEPTEMBER 1949
(10-acre Plots)

	A	B	C	DB	DG
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Cultivations ..	84 15 3	102 14 3	124 16 0	335 14 6	295 16 0
Manuring ..	18 9 11	30 4 4	79 13 6	46 17 8	50 5 4
Washing ..	14 7 5	20 16 7	29 6 11	11 12 10	11 9 2
Pruning	1 10 3	3 14 10	2 19 4	7 0 2	11 3 4
Retying and Gapping ..	10 8 6	17 4 11	34 1 10	16 17 6	17 6 0
Sundries	7 0	14 0	1 8 0	7 0	7 0
Overheads ..	7 15 10	12 3 8	21 10 8	51 3 4	28 4 4
Total	137 14 2	187 12 7	293 16 3	469 13 0	414 11 2
Picking ..			1 12 0	149 17 0	15 17 8
			£295 8 3	619 10 0	430 8 10

The general level of costs was similar to those of the previous half-year, except that plot C was more in line with the others. The effect of the reduced planting distance is shown in the steadily rising scale of costs: lowest on plot A, where the number of trees is smallest, and rising on plots B and C until it reaches a maximum on the closely interplanted soft fruit plots.

The manuring programme included compound ruit manure, castor meal and chalk, as follows:

Plot	*Compound Manure*	*Castor Meal*	*Chalk*
A	6 cwt.	9 cwt.	6 tons
B	11 ,,	17½ ,,	—
C	23 ,,	34½ ,,	12 ,,
DB	6 ,,	30 ,,	15 ,,
DG	16½ ,,	9 ,,	15 ,,

The quantity of compound manure and castor meal on all plots was proportional to tree numbers (1 lb. per tree of compound, 1½ lb. per tree castor meal.) The soft fruit received 2 oz. per bush compound manure on plot DG and 4 oz. per bush castor meal on plot DB.

Chalk was applied according to requirements as shown by soil analyses and was put on by a contractor, with the exception of 8 tons of chalk on plot C. This was applied by farm labour on about 3½ acres of this plot which showed an exceptionally high lime requirement. The cost of this work is reflected in the high cost of manuring on this plot.

The cost of pruning in plot DG is high owing to the pruning required by the gooseberries.

Picking costs make their appearance for the first time during this period. These are separated from the other costs in Table IX, as they are not included in the calculation of capital, but are treated as a deduction from the value of the crop sold.

Sales

1949 was the first year in which any income was obtained from sales of fruit. There was a crop of blackcurrants and gooseberries on plots DB and DG, and a few apples were sold from the M. IX trees on plot C. The returns are summarized below:

Table X

SALES OF FRUIT, 1949

(10-acre Plots)

	Gross Receipts.	Picking Costs.	Net Receipts.
	£ s. d.	£ s. d.	£ s. d.
Plot C			
6½ bushels of apples	5 12 6	1 12 0	4 0 6
Plot DB			
8,280 lb. of blackcurrants	621 0 0	149 17 0	471 3 0
Plot DG			
2,844 lb. of gooseberries	134 18 0	15 17 8	119 0 4

The sales of blackcurrants and gooseberries have been adjusted to represent the return from 10-acre plots in each case.

Reference to Table IX and Appendix 3 shows that the gooseberries cost only £15 17s. 8d. to pick and took 208 hours compared

with a cost of £149 17s. and 1,434 hours for the blackcurrants. This large difference is due not only to the bigger crop and the greater difficulty of picking blackcurrants, but also to the fact that the gooseberries were picked by local women whilst the blackcurrants were picked by holiday campers. Actually, a pound of blackcurrants took three times as long to pick as a pound of gooseberries.

In addition to sales of fruit there were some small sales of bud wood, etc., amounting to the following sums :

	£	s.	d.
Plot A	1	7	6
,, B	1	10	0
,, C	1	12	6
,, DB	1	7	6
,, DG	1	7	6

It may be of interest to compare the yields of blackcurrants and gooseberries with those obtained on plot L where similar bushes are grown without fruit trees. The relevant figures are :

	Plot	*Yield per Bush* lb.
Blackcurrants	DB	0·87
	LB	1·09
Gooseberries	DG	0·30
	LG	0·44

The apple trees on plot D are probably too small as yet to have any effect on the soft fruit, and it is unlikely that the differences in yield are due to this cause.

Summary of Results, October 1946 to September 1949

The tables previously given have summarized the direct costs incurred each season from planting in 1946-7 to September 1949. We may now bring together these results to show the total costs up to the latter date. This is done in Table XI. In order to complete the picture, the table also shows the accumulated compound interest chargeable to the orchards in respect of the capital invested in their development, and the amounts to be deducted for sales of by-products. The gross totals in Table XI represent the costs which have been incurred in bringing each plot to that stage. The net totals are the sums still invested in the plots after deduction of the amounts received for sales.

TABLE XI

SUMMARY OF ORCHARD COSTS, 1946-9

(10-acre Plots)

	A			B			C			DB			DG		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
Year ending March, 1947 (Planting costs) ..	243	16	11	455	6	4	892	18	6	383	5	9	630	15	9
Year ending March, 1948..	50	2	6	82	19	5	132	14	10	102	15	4	120	19	0
Half-year ending September, 1948 ..	61	15	11	96	15	0	239	17	2	187	11	8	213	18	4
Year ending September, 1949 ..	137	14	2	187	12	7	293	16	3	469	13	0	414	11	2
Total Cost of Planting and Maintenance	493	9	6	822	13	4	1,559	6	9	1,143	5	9	1,380	4	3
Interest on Land at 4 per cent.	27	0	0	27	0	0	27	0	0	27	0	0	27	0	0
Interest on other Capital at 4 per cent. ..	58	0	0	97	0	0	183	0	0	79	0	0	148	0	0
Total Gross Cost	578	9	6	946	13	4	1,769	6	9	1,249	5	9	1,555	4	3
Less Sales ..	1	7	6	1	10	0	5	13	0	472	10	6	120	7	10
Total Net Cost £	577	2	0	945	3	4	1,763	13	9	776	15	3	1,434	16	5

No accurate determination of overhead expenses was possible before April 1948, but some allowance has been made for these in calculating wage rates during that period. The costs from then onward include a share of the overhead expenses for the farm as a whole.

V.—GENERAL OBSERVATIONS

The experimental plots have been in existence for three years. They are now well established and the earliest returns are beginning to come in. The first stage in the life of the orchards is at an end, and the second period, that of growth and development, is under way. Necessarily the main theme of the present report has been the cost of establishment, and much space has been taken up with a discussion of the principles underlying the treatment of capital costs. This excursion into theory was necessary for a clear understanding of the economic basis upon which the comparison between the plots in future years must rest. Having disposed of these matters, the way is clear for the consideration in future reports of the later stages of the experiment. The next phase will be the development of the intercrop, and during this second period we shall have to trace the growth of the filler trees and bushes, observe how quickly they come into full production, and what contribution they make to farm income. The permanent trees will commence cropping a few years later, and this will mark the beginning of a period in which soft fruit, filler trees and permanent trees are all in production side by side. The final stages of the experiment will commence when the time comes to grub out the temporary trees and bushes, leaving the permanent trees in full possession of the ground.

Not until this stage is reached can answers be given to all our questions. Even then, some years' experience of the cropping capacities of the plots will be necessary before we can estimate with certainty the full effects of the different methods of establishment. It is clear, therefore, that only preliminary comments can be made at this stage.

The establishment costs do not show any very unexpected features. The costs per acre rise as the density of planting becomes greater, but not so rapidly as the increase in tree numbers. For example, plot B contains nearly twice as many trees as plot A, but the cost of planting is one and two-thirds times the cost on plot A. Plot C contains nearly four times as many trees as plot A, but the cost of planting is only a little over three times as high. It is noteworthy that the close plant of filler trees on plot C cost considerably more to establish than the soft fruit on DB and DG.

It remains to be seen whether the returns will be proportionately greater.

So far, the trend of the figures suggests that the actual cost of establishing the trees doubles itself in two to three years, as maintenance costs accumulate. It is this rapid piling up of capital investment, due to the snowball effect of accumulating maintenance costs, that makes it so desirable to find means of shortening the time before returns begin to come in, and prompts the grower to try such quick-yielding intercrops as those which form the subject of this experiment.

In this connexion the results on plot DB are of great interest. Here the profits from a single crop of blackcurrants in 1949 sufficed to reduce the capital cost of the orchard by nearly a half. This result is very striking and does suggest that, in relation to the returns which may be obtained by judicious planning, the cost of planting, heavy as it is, may perhaps not be so formidable as at first appears. There seems some hope that the capital cost may be covered by receipts within a reasonably short period of time.

Two warnings must be sounded in face of this encouraging result. First, the favourable relationship of returns to costs is entirely dependent upon the price of soft fruit. An increase in planting or a succession of favourable seasons could easily depress the price of a quick yielding crop like blackcurrants and produce a very different relationship between costs and returns. The price of blackcurrants in 1949 was, in fact, exceptionally favourable to the grower.

Secondly, one must not jump to the conclusion that blackcurrants are necessarily the best crop for underplanting apple orchards. All that is proved by the figures is that blackcurrants have given the *quickest* return. There is nothing to indicate whether or not they will give the best results in the long run. It is quite possible that returns from the other undercrops may be equally good, or even better, when records covering a longer period become available.

Appendix 1

SOIL ANALYSES OF EXPERIMENTAL PLOTS

(Four samples were taken from each Plot)

Plot	*Corner*	*Acidity*	*Available P_2O_5*	*Available K_2O*
A	North	5·9	L	H
	South	6·0	L	H
	East	6·0	L	H
	West	6·2	L	H
B	North	6·3	L	M
	South	7·1	M	H
	East	6·3	L	MH
	West	7·3	M	M
C	North	6·4	L	VH
	South	5·7	L	M
	East	5·2	L	H
	West	6·6	L	M
DB and DG	North	6·4	L	H
	South	6·3	L	VH
	East	6·6	L	MH
	West	5·6	VL	H

VH=Very High
H=High
MH=Medium High
M=Medium
L=Low
VL=Very Low

Appendix 2

ARRANGEMENT OF TREES IN PLOTS

PLOT A

C	C	S	C	C	W	C	C	F	C	C	W
C	C	S	C	C	W	C	C	F	C	C	W
C	C	S	C	C	W	C	C	F	C	C	W
C	C	S	C	C	W	C	C	F	C	C	W
C	C	S	C	C	W	C	C	F	C	C	W

C=Cox on M.II. S=Sunset on M.II. W=Worcester on M.II. F=Fortune on M.II.

PLOT B

C C S C C W C C F C C W

f c c w c c s c c w c

C C S C C W C C F C C W

f c c w c c s c c w c

C C S C C W C C F C C W

f c c w c c s c c w c

C C S C C W C C F C C W

f c c w c c s c c w c

C C S C C W C C F C C W

C=Cox on M.II.
S=Sunset on M.II.
W=Worcester on M.II.
F=Fortune on M.II.

c=Cox on M.VII.
s=Sunset on M.VII.
w=Worcester on M.VII.
f=Fortune on M.VII.

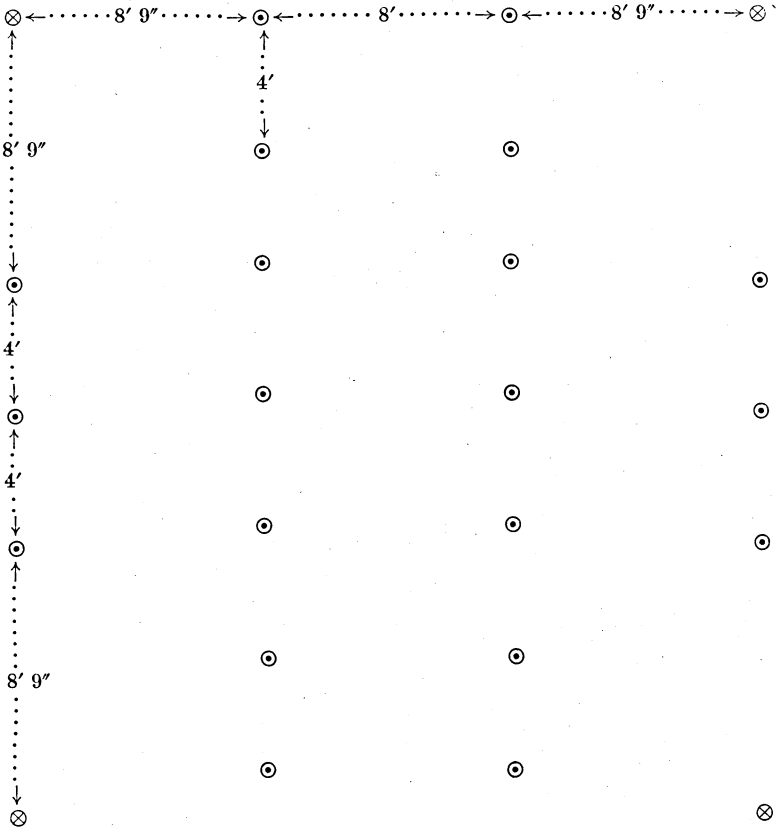
PLOT C

C	w	C	c	S	c	C	s	C	c	W	c	C	w	C	c	F	c	C	f	C	c	W
c	w	w	c	c	c	c	s	s	c	c	c	c	w	w	c	c	c	c	f	f	c	c
C	w	C	c	S	c	C	s	C	c	W	c	C	w	C	c	F	c	C	f	C	c	W
c	w	w	c	c	c	c	s	s	c	c	c	c	w	w	c	c	c	c	f	f	c	c
C	w	C	c	S	c	C	s	C	c	W	c	C	w	C	c	F	c	C	f	C	c	W
c	w	w	c	c	c	c	s	s	c	c	c	c	w	w	c	c	c	c	f	f	c	c
C	w	C	c	S	c	C	s	C	c	W	c	C	w	C	c	F	c	C	f	C	c	W
c	w	w	c	c	c	c	s	s	c	c	c	c	w	w	c	c	c	c	f	f	c	c
C	w	C	c	S	c	C	s	C	c	W	c	C	w	C	c	F	c	C	f	C	c	W

C=Cox on M.II.
S=Sunset on M.II.
W=Worcester on M.II.
F=Fortune on M.II.

c=Cox on M.IX.
s=Sunset on M.IX.
w=Worcester on M.IX.
f=Fortune on M.IX.

PLOT D



⊗ = Permanent Trees (layout as in Plot A).
⊙ = Soft Fruit Bushes.

APPENDIX 3
ANALYSIS OF ORCHARD COSTS, 1946-9
(10-acre Plots)
Planting: October 1946 to March 1947

	Manual Labour.			Tractor Labour.		Materials.
	Man Hours.	Woman Hours.	£ s. d.	Hours.	£ s. d.	£ s. d.
Ploughing						
A	22		2 5 6	20	4 10 0	
B	22		2 5 6	20	4 10 0	
C	22		2 5 6	20	4 10 0	
DB	23		2 7 0	21	4 14 6	
DG	23		2 7 0	21	4 14 6	
Planting						
A	173		16 13 0	4	15 6	12 1 0
B	261		25 4 5	7	1 7 0	23 2 9
C	526		51 1 6	8	1 13 0	45 16 0
DB	384		36 10 3	4	15 6	12 3 0
DG	496		47 0 3	4	15 6	12 3 0
Trees						
A						169 0 0
B						325 5 0
C						644 0 0
DB						169 0 0
DG						169 0 0
Bushes						
DB						118 10 0
DG						355 10 0
Staking						
A	28	9	3 8 0	2	9 0	16 12 7
B	58	12	6 10 6	6	1 7 0	32 2 7
C	94	23	13 0 0	8	1 16 0	65 17 9
DB	40	—	3 17 0	3	13 6	16 8 0
DG	40	—	3 17 0	3	13 6	16 8 0
Straw-Mulching						
A	24		2 8 6	8	1 16 0	12 4 4
B	29		2 18 6	15	3 7 6	24 8 9
C	46		4 12 6	25	5 12 6	46 0 0
DB	24		2 8 4	8	1 16 0	12 4 4
DG	24		2 8 4	8	1 16 0	12 4 4
Sundries						
A						1 13 6
B						2 16 10
C						6 13 9
DB						1 18 4
DG						1 18 4
Total						
A	247	9	24 15 0	34	7 10 6	211 11 5
B	370	12	36 18 11	48	10 11 6	407 15 11
C	688	23	70 19 6	61	13 11 6	808 7 6
DB	471	—	45 2 7	36	7 19 6	330 3 8
DG	583	—	55 12 7	36	7 19 6	567 3 8

APPENDIX 3 (*continued*)

ANALYSIS OF ORCHARD COSTS, 1946-9

(10-acre Plots)

Analysis of Costs, April 1947 *to March* 1948

	Manual Labour.			Tractor Labour.		Materials.
	Man Hours.	Woman Hours.	£ s. d.	Hours.	£ s. d.	£ s. d.
Cultivations						
A	66	—	6 12 0	38	8 11 0	15 6*
B	48	17	5 14 8	29	6 10 6	1 3 9*
C	141	131	21 1 0	40	9 0 0	3 12 4*
DB	230	16	23 17 5	50	11 5 0	15 6*
DG	230	16	23 17 5	50	11 5 0	15 6*
Manuring						
A	12		1 2 0	1	4 6	9 15 0
B	12		1 2 0	1	4 6	9 15 0
C	19		1 15 0	1	4 6	16 5 0
DB	17		1 11 2	8	1 16 0	35 15 0
DG	17		1 11 2	8	1 16 0	35 15 0
Pruning						
A	5		10 0			
B	9		18 6			
C	16		1 13 0			
DB	31		3 11 9			
DG	39		4 8 3			
Retying and Gapping Failures						
A	10		17 6			21 15 0†
B	33		3 0 6			54 10 0†
C	43		3 19 0			75 5 0†
DB	30		2 15 0			18 15 0† 2 13 6‡
DG	44		4 0 8			18 15 0† 18 15 0‡
Total						
A	93	—	9 1 6	39	8 15 6	32 5 6
B	102	17	10 15 8	30	6 15 0	65 8 9
C	219	131	28 8 0	41	9 4 6	95 2 4
DB	308	16	31 15 4	58	13 1 0	57 19 0
DG	330	16	33 17 6	58	13 1 0	74 0 6

* Cultivator Points, etc. † Replacement Trees. ‡ Replacement Bushes.

APPENDIX 3 (*continued*)

ANALYSIS OF ORCHARD COSTS, 1946-9

(10-acre Plots)

Analysis of Costs, April to September 1948

	Manual Labour.			Tractor Labour.		Materials.
	Man Hours.	Woman Hours.	£ s. d.	Hours.	£ s. d.	£ s. d.
Cultivations						
A	186		19 10 2	74	19 3 0	
B	243		25 1 3	67	17 19 3	
C	781		83 12 9	62	16 17 6	
DB	955		102 14 0	63	15 18 6	
DG	1,149		122 11 2	72	18 9 8	
Manuring and Mulching						
A	23		2 4 6	4	1 2 0	4 8 2
B	94		9 15 5	5	1 3 0	8 16 4
C	353		36 15 5	8	1 18 6	17 12 7
DB	41		4 5 10	—	—	11 17 2
DG	35		3 7 8	—	—	5 8 2
Washing						
A	9		17 2	3	13 10	2 13 0
B	41		4 1 1	10	2 15 5	4 13 6
C	33		3 3 0	9	2 9 9	7 0 6
DB	25		2 9 8	2	10 10	3 13 4
DG	40		4 1 6	8	2 4 2	4 5 6
Pruning, etc.						
A	12	8	1 19 1			
B	14	54	5 15 9			
C	84	109	17 18 2			
DB	13	32	3 16 4			
DG	13	32	3 16 6			
Total						
A	230	8	24 10 11	81	20 18 10	7 1 2
B	392	54	44 13 6	82	21 17 8	13 9 10
C	1,251	109	141 9 4	79	21 5 9	24 13 1
DB	1,034	32	113 5 10	65	16 9 4	15 10 6
DG	1,237	32	133 16 10	80	20 13 10	9 13 8

APPENDIX 3 (*continued*)

ANALYSIS OF ORCHARD COSTS, 1946-9

(10-acre Plots)

Analysis of Costs, October 1948 *to September* 1949

	Manual Labour.			Tractor Labour.		Materials.
	Man Hours.	Woman Hours.	£ s. d.	Hours.	£ s. d.	£ s. d.
Cultivations						
A	263	32	40 7 8	107	44 7 7	
B	358	80	58 19 2	104	43 15 1	
C	478	216	86 18 1	92	37 17 11	
DB	1,881	332	285 14 6	130	50 0 0	
DG	1,379	658	250 13 0	112	45 3 0	
Manuring						
A	13		1 19 2	—	—	16 10 9
B	42		5 18 4	—	—	24 6 0
C	162		22 16 0	22	5 4 6	51 13 0
DB	58		8 8 4	12	4 2 10	34 6 6
DG	80		12 0 8	2	14 8	37 10 0
Washing						
A	36		5 18 9	13	5 9 0	2 19 8
B	51		8 2 5	20	8 7 8	4 6 6
C	84		13 17 5	17	7 2 6	8 7 0
DB	38		5 16 8	6	2 10 2	3 6 0
DG	28		4 16 2	8	3 7 0	3 6 0
Pruning						
A	10	—	1 10 3			
B	24	—	3 14 10			
C	20	—	2 19 4			
DB	32	20	7 0 2			
DG	69	—	11 3 4			
Retying and Gapping						
A	39		5 8 6			5 0 0
B	66		9 4 11			8 0 0
C	169		24 1 10			10 0 0
DB	102		14 17 6			2 0 0
DG	100		15 6 0			2 0 0
Picking						
C	7	7	1 12 0			
DB	—	1,434	149 17 0			
DG	—	208	15 17 8			
Sundries						
A						7 0
B						14 0
C						1 8 0
DB						7 0
DG						7 0
Total A	361	32	55 4 4	120	49 16 7	24 17 5
B	541	80	85 19 8	124	52 2 9	37 6 6
C	920	223	152 4 8	131	50 4 11	71 8 0
DB	2,111	1,786	471 14 2	148	56 13 0	39 19 6
DG	1,656	866	309 16 10	122	49 4 8	43 3 0

Note.—Most of the picking was done by piecework. Holiday campers are entered under the heading " Woman hours ".

HEADLEY BROTHERS
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