Plums - Cost of prod.

Agricultural Enterprise Studies
in England and Wales
Economic Report No. 17

Price 30p.

University of Bristol

AGRICULTURAL ECONOMICS RESEARCH UNIT

The Economics of Growing and Selling Plums
1923 - 1971

by

J. Rendell

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January 1973

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FOREWARD

University departments of Agricultural Economics in England and Wales have for many years undertaken economic studies of crop and livestock enterprises. In this work the departments received financial and technical support from the Ministry of Agriculture, Fisheries and Food.

A recent development is that departments in different regions of the country are now conducting joint studies into those enterprises in which they have a particular interest. This community of interest is being recognised by issuing enterprise reports in a common series entitled "Agricultural Enterprise Studies in England and Wales", although the publications will continue to be prepared and published by individual departments.

Titles of recent publications in this series and the addresses of the University departments are given at the end of this report.

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ACKNOWLEDGMENTS

Our thanks are due to the many growers who kindly provided information about the physical and financial aspects of their plum orchards.

We would also like to thank our colleagues at Cambridge and Wye for their co-operation and assistance in undertaking the Surveys of individual holdings in their own regions.

THE ECONOMICS OF GROWING AND SELLING PLUMS

1923-71

PART I

A Review of Production, Disposals and Prices

"The plum industry now seems healthy and vigorous and should so remain just as long as the public are interested in plum jam."

"Each year an increasing quantity of plums is preserved in cans."

"An opportunity awaits the English industry to provide the public with real dessert plums when a large trade is sure to develop."

These quotations from "Plums of England" by H.V. Taylor, published in 1949, give an impression of a dynamic industry. The demand never materialised and one may question whether it was a true picture even in 1949; for by that time the national acreage of plums had entered a second period of decline which is still in progress at the present time.

The history of plum growing in this country seems to be inextricably bound up with the fluctuating fortunes of plum jam. Total jam consumption had already experienced a sharp decline in the period following the First World-War. But during the Second World-War consumption recovered sharply, from an annual average of 212 thousand tons in 1934-38 to 363 thousand tons in 1943 and eventually to 381 thousand tons in 1948. A large proportion of this increase consisted of plum jam, for the simple reason that domestic supplies of the fruit were both readily available and comparatively cheap. Nine years later, however, total jam consumption was almost back to its pre-war level and by 1971 had fallen to 182 thousand tons, the lowest figure so far recorded: consumption per head fell at an even faster rate. But while jam consumption as a whole was declining, the more elegant varieties, such as strawberry, raspberry, apricot and blackcurrant, were increasing their share of a contracting market at the expense of the more common-place plum, rhubarb and marrow jams. During the last decade, no more than 10 per cent of a normal plum crop has been bought by jam manufacturers. With the proportion taken up by canners amounting to about 17 per cent, this means that little more than one-quarter of a normal crop is used by processors. Yet in spite of this situation, both consumers and growers alike continue to regard plums as being first and foremost a raw material for processing; so it is not altogether surprising to find that an average or better than average crop meets a slow demand at very indifferent prices.

Another source of weakness affecting both the present position and future prospects for plum growers is the continued existence, despite government grants for grubbing, of an excessive acreage of inferior and semi-derelict orchards. In some years these produce practically nothing at all, while on other occasions they bear a very heavy crop, much of it surplus to processors' requirements, yet quite unsuited, for the most part, to the requirements of the dessert plum trade. It is unlikely that plum growing will provide a steady, reliable and lucrative enterprise until such time as the production base is reorganised in such a way as to bring the varieties, their quality and quantities into line with present-day market requirements.

National trends

As can be seen from the contents of Table 1, the official statistics describing the extent of plum growing in England and Wales are much less complete than one would wish for. The earliest figures relate not to the area of plum orcharding but to the number of trees; perhaps a more satisfactory measure of productive capacity than the former. Then for a few years the numbers of both acres and trees were recorded, until the latter information was discontinued after 1957; since when only the acreage has been recorded. Comparing, where possible, trends in acreage and in tree numbers it is evident that there was fairly heavy culling of stands between 1931 and 1957. It is probable that culling, both deliberate and accidental, has been no less severe since 1957. But even if we assume a tree density as high as one hundred per acre in 1970, this would mean that the total number of plum trees in England and Wales had fallen by approximately two-thirds during the two previous decades. Following a brief period of stability between 1969 and 1971 the national plum acreage fell by nearly 7 per cent in 1972 compared with the previous year. In view of what happened to land values in the same year this further sharp decline in the acreage of plums is not at all surprising.

Table 1

Acreage of plums and the estimated number of plum trees in England and Wales: 1923-1971

Year	Area	No. of trees	Trees per acre
	acres	000's	No.
1923	*	4,642	*
1925	*	5,105	*
1931	*	5,390	*
1935	42,396	*	*
1936	43,402	6,049	138
1944	*	5,774	*
1951	42,172	4,858	114
1957	33,410	3,602	108
1962	23,767	*	*
1966	19,586	*	*
1969(a)	15,770	*	*
1970	16,086	*	*
1970(a)	16,033	*	*
1971(a)	15,485	*	*
1972(a)	14,463	*	*

(a) These figures were recorded at the 4th June Agricultural Census. All other figures in the table are taken from the results of the M.A.F.F's. Orchard Census.

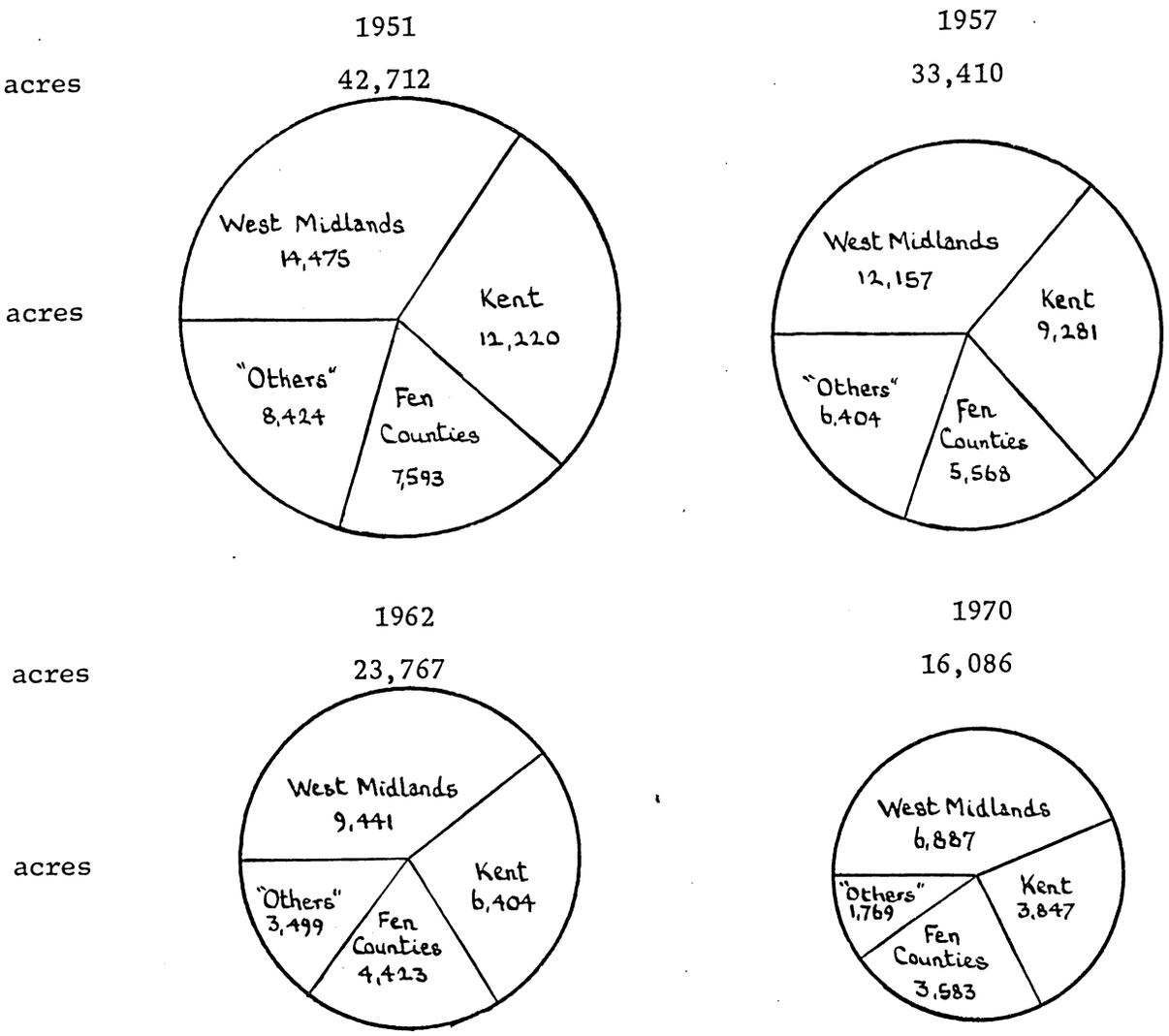
* Not available.

Regional trends

In those areas where the plum acreage was initially relatively small it has now virtually disappeared. For example, in 1951 the combined plum acreage of Devon and Somerset was 722, but by 1970 it had fallen to a mere 33 acres. In other counties, although plum growing has not been virtually abandoned, as in the previous instance cited, there have been some quite drastic changes; as, for example in Kent which in 1951 was outstandingly the most important plum growing county with 29 per cent of the total England and Wales acreage. There the acreage fell from 12,220 in 1951 to only 3,847 in 1970. Although by no means escaping the general experience of a declining acreage, the West Midlands, a traditional plum growing area, has emerged as the most important region, containing as it now does approximately 47 per cent of the 1970 England and Wales total acreage, while Worcestershire, with 4,872 acres of plums representing 30 per cent of the national total, has replaced Kent as the most important individual county.

Diagram 1

Regional changes in the area of plums in England and Wales: 1951-1970



It is evident, therefore, that not only has the acreage of plum orchards become much smaller but it has also become much more concentrated, particularly in certain traditional growing areas where the main processing plants are located. This in itself is another manifestation of the close identity between plum growing and processing referred to earlier.

Varietal changes

The results of the periodic Orchard Censuses provide some limited information about plum varieties and their relative importance. But unfortunately, only two or three of the more important varieties are recorded separately; the rest are included under the omnibus term 'other'varieties, a description which actually embraces nearly a score of named varieties and between fifty and sixty per cent of the total acreage. This information, relating to the last five census years, is given in Table 2 in the form of a percentage distribution.

Table 2

Varietal composition of the plum acreage in England and Wales

Variety	1951	1957	1962	1966	1970
	%	%	%	%	%
Victoria	20	22	22	25	27
Damson	12	13	12	8	8
Pershore Yellow Egg	) 60	55	11	13	13
All others	)		) 55	54	52
Gages	8	10	)		
Total	100	100	100	100	100

It is clear from the figures in this table that there have not been any revolutionary changes; unless, of course, any are obscured by aggregation. The two main changes evident are a substantial decline in the relative importance of Damsons and an increase in the relative importance of Victorias, reflecting, perhaps, the reaction of growers to shifts in demand; from fruit for processing to fruit for dessert.

Planting and grubbing

Changes in the total acreage of a semi-permanent crop such as plums are the net effect of grubbing and new planting. Also affected by grubbing and planting rates are the average age and age distribution of the 'national' orchard.

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WITH COMPLIMENTS

Table 3

Planting and grubbing: 1944-1970

Period	Average annual acreage			Per cent of total planting	
	Planted	Grubbed	Net change	Victoria	Damson
	acres	acres	acres	%	%
1944-51	1,203	3,347(a)	- 2,144	23	12
1951-57	582	2,132	- 1,550	25	11
1957-62	467	2,396	- 1,929	28	8
1962-66	744	1,789	- 1,045	33	5
1966-70	653	1,528	- 875	31	6

(a) Estimated

The figures in Table 3 for new planting were obtained directly from the census data; the figures for grubbing were calculated from the census data. Since 1962 the rate of net decline has fallen to about half what it was in the previous 18 years. This was mainly the effect of a reduction in grubbing although there was a modest recovery in the rate of new planting following the very low levels of 1957-62. The increasing popularity among growers of the dual purpose Victoria and the declining interest in Damsons, essentially a processing fruit, are illustrated by the figures in the table.

Table 4

Age distribution of plum orchards in selected counties of England and Wales in 1970

County	Under 4 years	5-25 years	Over 25 years	Total
	%	%	%	%
Cambridge & Isle of Ely	10	43	47	100
Gloucester	14	27	59	100
Hunts. & Peterborough	12	55	33	100
Kent	12	52	36	100
Worcester	14	37	49	100
England and Wales	13	44	43	100

The age status of the 'national' plum orchard is summarised in the final row of Table 4. Within this situation there are substantial local variations: Gloucestershire, for example, with nearly sixty per cent of its plum orchards over 25 years old, but showing obvious signs of a renewed interest in plum growing, contrasts with Huntingdonshire and Peterborough with only a third of its orchards over 25 years old, but also showing an active interest in new planting.

Yields

Estimates of annual yields of plums are available in one form or another over quite a long period of years. The first series, commencing in 1936 were based on estimates of yield per tree. These were discontinued after 1952 in favour of yield per acre which was first recorded in 1951. An examination of the data showed that neither series displayed any sign of a trend in either direction, but from the size of the coefficients of variation it can be concluded that yields have been very variable and they became increasingly so during the second half of the period under review. A series of per acre yields, extending over two decades, is available from the A.E.R.U's. own records relating to a sample of plum growers in the Vale of Evesham. This also displays no sign of a trend but it contains confirmatory evidence concerning the presence of substantial year to year variability.

Table 5

Plum yields in England and Wales and in the Vale of Evesham

Year	England & Wales	Year	England & Wales	Vale of Evesham
	Yield per tree		Yield per acre	Yield per acre
	lb.		cwt.	cwt.
1936	44	1950	n.a.	84.6
1937	43	1951	50.4	85.5
1938	13	1952	92.6	76.6
1939	49	1953	36.6	53.8
1940	52	1954	59.5	82.4
1941	19	1955	49.2	88.9
1942	63	1956	65.4	67.8
1943	49	1957	25.0	60.6
1944	38	1958	41.9	47.3
1945	29	1959	63.3	89.8
1946	47	1960	42.5	27.3
1947	56	1961	51.2	76.0
1948	61	1962	57.4	72.0
1949	47	1963	96.2	98.6
1950	44	1964	41.6	29.1
1951	28	1965	35.9	34.0
1952	50	1966	29.4	65.4
-		1967	15.5	43.4
-		1968	90.6	102.0
-		1969	64.6	80.2
Average	43		53.1	68.3
Coefficient of variation	32%		42%	33%

n.a. Not available.

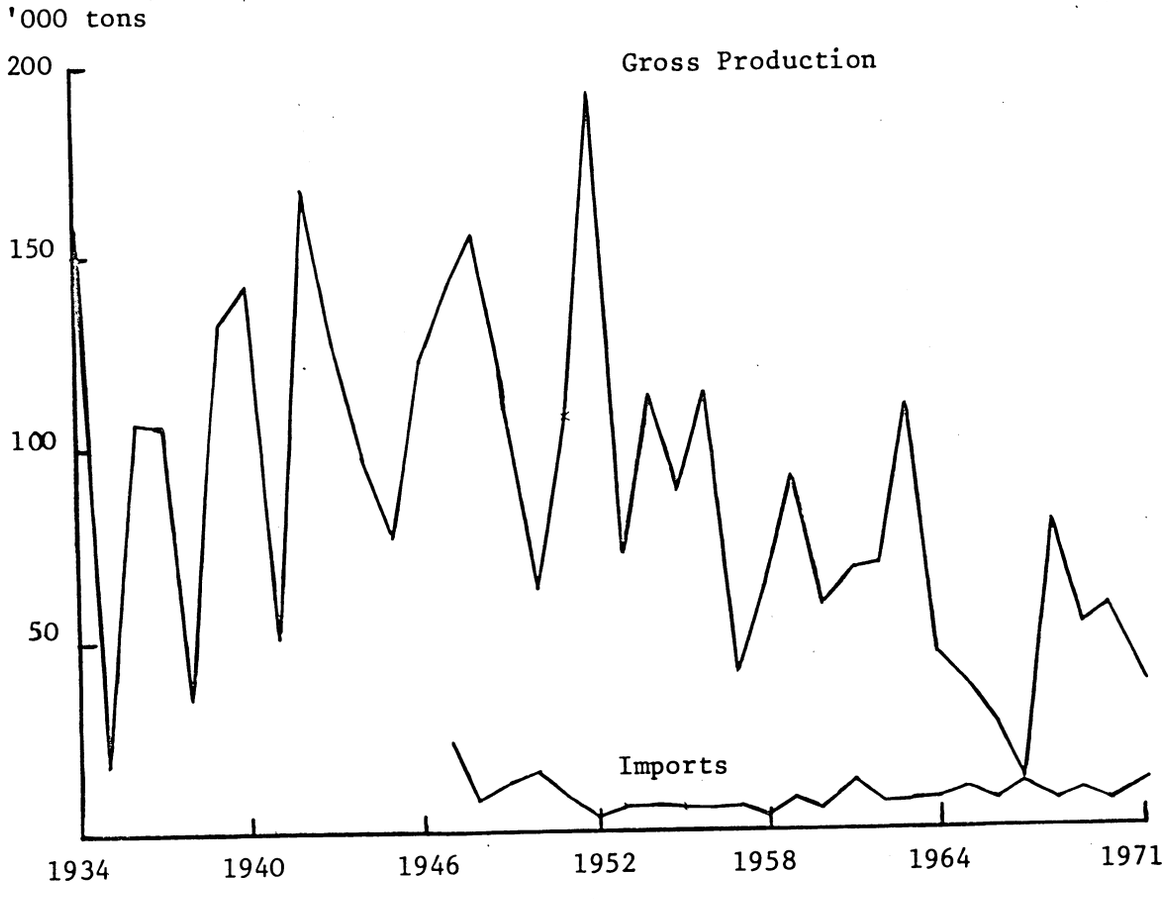
One would certainly not have expected a steep trend in yield, because new varieties and new systems of planting are not, by the nature of things, likely to be introduced other than very slowly. There has, however, been a substantial amount of grubbing during the last twenty-five years, and the natural expectation is that growers would have invariably selected their least productive orchards for this purpose. One would have expected also that the adoption of better techniques of orchard management would in itself have helped to produce better yields from the remaining orchards. Time series analyses of yield data relating to two specific varieties, Victoria and Damson failed to reveal any sign of trend in either series. This evidence would support the hypothesis that there is no underlying improvement in yield per acre associated with better methods of orchard management. Alternatively, it could mean that the generality of growers do not adopt the available improved practices on any significant scale.

Total annual production

Estimates of the annual gross production of plums spanning a period of 36 years are available in the official statistics. They are reproduced here in the form of a graph in Figure 1.

Figure 1

Gross Production and Imports 1934 - 1971



Over the early part of the period the graph appears to suggest the existence of a production cycle of 4 to 5 years duration. During the first half of the period the trend is very much obscured by these cycles with their large amplitude; but from 1951 to 1969, year to year variations are, in general, less well defined and there is a significant

($P < .01$) downward trend corresponding to an average reduction of 4.6 thousand tons per annum. Although in each of the three successive years, 1965-67, the annual yield was well below 40 thousand tons, which is only thirty per cent of the average annual production during the late nineteen forties, this was followed by the comparatively high figure of 84 thousand tons in 1968. So it is evident that the potential output of the 'national' plum orchard is still quite large, despite the fall in acreage: much larger, in fact, than the present level of demand warrants, given the type and quality of fruit likely to be available in such circumstances.

Imports of fresh plums

Judged merely in terms of their quantity, imports of plums are comparatively unimportant. During the last two decades they only exceeded 10 thousand tons per annum on three occasions. Seldom do they appear to have varied with the level of home supplies over the year as a whole, although September imports were found to be significantly ($P < .01$) correlated ($r = -.59$) with home supplies. However, quite a large proportion of imported plums arrive on the U.K. market out of season when fresh home-grown supplies are not available.

Supplies and disposals

A series of annual data were available for the fourteen-year period 1958 to 1971, from which it was possible to construct figures representing production, supplies and disposals as shown in Table 6.

Table 6

Production, supplies and disposals

Year	Home production				Imports	Total supply	Disposals	
	Gross output	Waste	Harvested	Marketed			Processors	Domestic & caterers*
	'000t	'000t	'000t	'000t	'000t	'000t	'000t	'000t
1958	64.1	nil	64.1	63.8	4.8	68.6	18.4	50.2
1959	90.6	3.9	86.7	86.0	8.2	92.2	22.1	70.1
1960	59.6	0.3	59.3	58.6	6.4	65.0	14.9	60.1
1961	67.6	0.5	67.1	66.3	12.0	78.3	16.3	62.2
1962	68.2	0.3	67.9	67.1	7.4	74.5	19.1	55.4
1963	110.1	27.1	83.0	71.3	8.1	79.4	23.8	55.6
1964	45.8	0.2	45.6	45.5	9.6	56.1	9.4	45.7
1965	37.2	0.5	36.7	36.6	11.9	48.5	9.5	39.0
1966	28.8	0.2	28.6	28.3	8.9	37.2	11.4	25.8
1967	13.8	nil	13.3	13.7	13.7	27.4	7.2	20.2
1968	80.7	2.3	78.4	77.1	9.3	86.4	20.5	65.9
1969	54.2	2.4	52.0	51.1	9.9	61.0	16.5	44.5
1970	56.8	11.9	44.9	44.7	7.9	52.6	17.1	35.5
1971	39.5	4.9	34.6	34.1	13.0	47.1	8.6	38.5

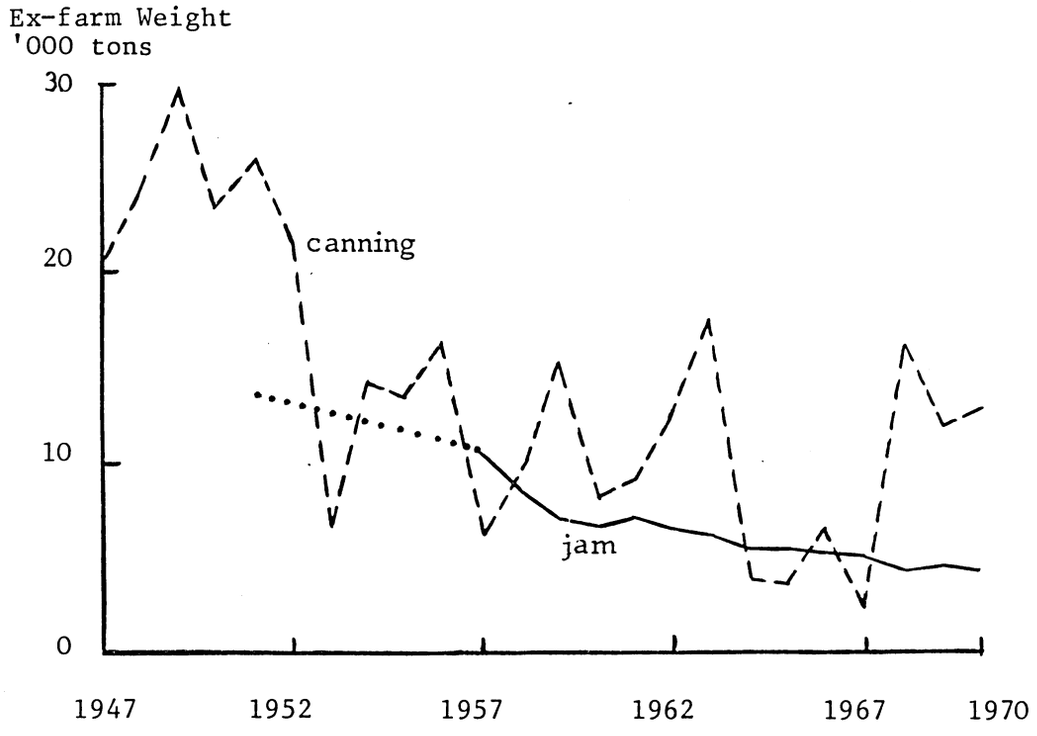
*Assumed to be equal to total supply less quantity consigned to processors.

Gross output is the quantity of crop of a consumable quality estimated on the tree. The difference between this figure and the quantity harvested is described as waste. Nineteen-sixty-three and 1970 were apparently the only years of the series when waste was substantial. However, the 1970 figure for waste is unusually high in relation to the estimated gross output. Crop reports for 1970 appear to suggest that this relatively high wastage

was the result of a sudden deterioration in the quality of fruit on the trees caused by a spell of unusually heavy rain just when the fruit was ripe. A comparison between the quantities harvested and the quantities marketed shows that, with one exception when there was an unusually heavy crop, the quantity left unsold was very small indeed. In a normal year imports provide about ten per cent of total supplies. But as already pointed out, their volume does not respond very significantly to changes in the size of the home crop. However, when home-produced supplies are very scarce, as in 1965, 1966, 1967 and 1971, imports will tend to represent a much larger than usual proportion of total supplies - as high as 48 per cent in the exceptionally bad harvest year of 1967. Because of the trend towards a reduction in home supplies since 1963, imports, relatively speaking, have been about twice as important as they were in the previous period.

Figure 2

Disposals for jam and canning 1947 - 1970



Processors take between twenty and thirty per cent of home production. This picture of the share-out between processors and the domestic market (including caterers) has remained very consistent throughout, despite the run of four lean years from 1964 to 1967. No doubt the situation is in part pre-determined by the varieties grown. As can be seen from the graphs in Figure 2, jam manufacturing, although a steadily declining activity, provides the most reliable outlet for processing plums. The annual rate of decline has been 6 per cent compound: if this rate were to continue, by 1980 the quantity used for jam would be down from the present 4,200 tons to around 2,300 tons per annum. Since 1952 the annual quantity of plums used by canners has also been at a very much lower level than hitherto and annual variations have been very large; but there is no sign of a continuing downward trend. In years when the

supply is short and prices are high, canners presumably turn to any other fruit varieties that happen to be suitable, available and more competitively priced. So on the present evidence it looks as though the future demand for canning is likely to be very similar to what it has been in the past eighteen years or so.

Prices

There is a variety of information available on plum prices. The Ministry of Agriculture is the source of two quite distinct quotations. One is described as a series of annual 'market' prices, based on the reported prices paid by wholesalers at five of the most important wholesale markets. The other series refer to what are described as 'farm-gate' prices. These are estimated national annual average prices per ton ex-farm for all plums sold, which when multiplied by the corresponding total quantities of plums marketed, provide estimates of the total annual ex-farm values of the national plum crop.

Table 7

Plum prices 1947-70

Per ton

Year	M.A.F.F.		Vale of Evesham	Processing fruit		
	Market	Farm-gate		Yellow Egg	Victoria	Damson
	£	£	£	£	£	£
1947	44	n.a.	n.a.	n.a.	n.a.	n.a.
1948	44	"	"	"	"	"
1949	42	"	"	"	"	"
1950	48	"	27	"	"	"
1951	39	"	25	"	"	"
1952	27	"	16	"	"	"
1953	62	"	35	"	"	"
1954	43	"	22	9	"	"
1955	51	"	28	16	19	48
1956	42	21	26	16	19	17
1957	83	50	43	24	38	47
1958	85	54	69	40	40	84
1959	54	30	34	26	40	27
1960	77	49	69	40	46	25
1961	75	48	39	20	30	44
1962	76	65	59	44	44	85
1963	51	28	26	17	23	19
1964	102	83	82	37	37	85
1965	108	78	100	44	50	97
1966	113	74	63	48	70	105
1967	158	119	72	60	n.a.	140
1968	82	47	46	30	25	60
1969	n.a.	54	38	33	48	60
1970	"	n.a.	n.a.	22	30	28

n.a. Not available.

While the latter price series purport to represent average prices for the whole crop, regardless of variety or utilisation, the 'market' price series, on the other hand, refer mainly to plums for dessert and exclude plums sold on contract for processing. From the Unit's own survey records of costs and returns on horticultural holdings in the Vale of Evesham, which go back over a long period of years, it has been possible to construct a series of average prices for all plums sold on the sample of holdings surveyed. This series is somewhat analogous to the M.A.F.F.'s 'market' price series; but because in the Vale of Evesham plums for processing represent a higher proportion of total disposals compared with the national situation, average prices in this series are invariably below the M.A.F.F.'s 'market' price series. Information on processing fruit prices was obtained by private correspondence, separate figures being quoted for each of three named varieties. These prices are net of transport and cost of containers. All six price series are presented in Table 7 for such periods as were conveniently available.

There are, in any one year, large differences between the various quotations, the reasons for which have already been given. But highly significant serial correlation was present between the two M.A.F.F. price series and also between each of the two M.A.F.F. price series taken in turn and each of the other four quotations. The correlation coefficients are given in Table 8.

Table 8

Serial Correlation Coefficients

Price series	M.A.F.F. market price	M.A.F.F. farm-gate price
M.A.F.F. farm-gate price	.97	
Vale of Evesham average price	.83	.76
Processing price Yellow Egg	.89	.88
" " Victoria	.77	.68
" " Damsons	.91	.93

It was concluded from these results that either of the M.A.F.F. price series would provide a satisfactory basis for measuring price changes and price-supply relationships; but as will be seen later, the final choice fell on farm-gate prices.

Both actual and deflated market*, farm-gate and processing contract prices** are presented in graphical form on a logarithmic scale in Figures 3, 4 and 5 for the fourteen-year period 1956-69. The corresponding quantities of total plums harvested have also been included on each of these three graphs. Perhaps this is a convenient point at which to mention that movements in processing contract prices were more closely related to changes in quantities harvested than to quantities actually used for processing.

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*Actual prices were deflated by a retail price index (base 1956 = 100) in order to measure changes in the real value or purchasing power of a ton of plums.

**Estimated by the writers of this report.

Fig. 3

Harvested quantities, actual and deflated
M.A.F.F. market prices 1956-69

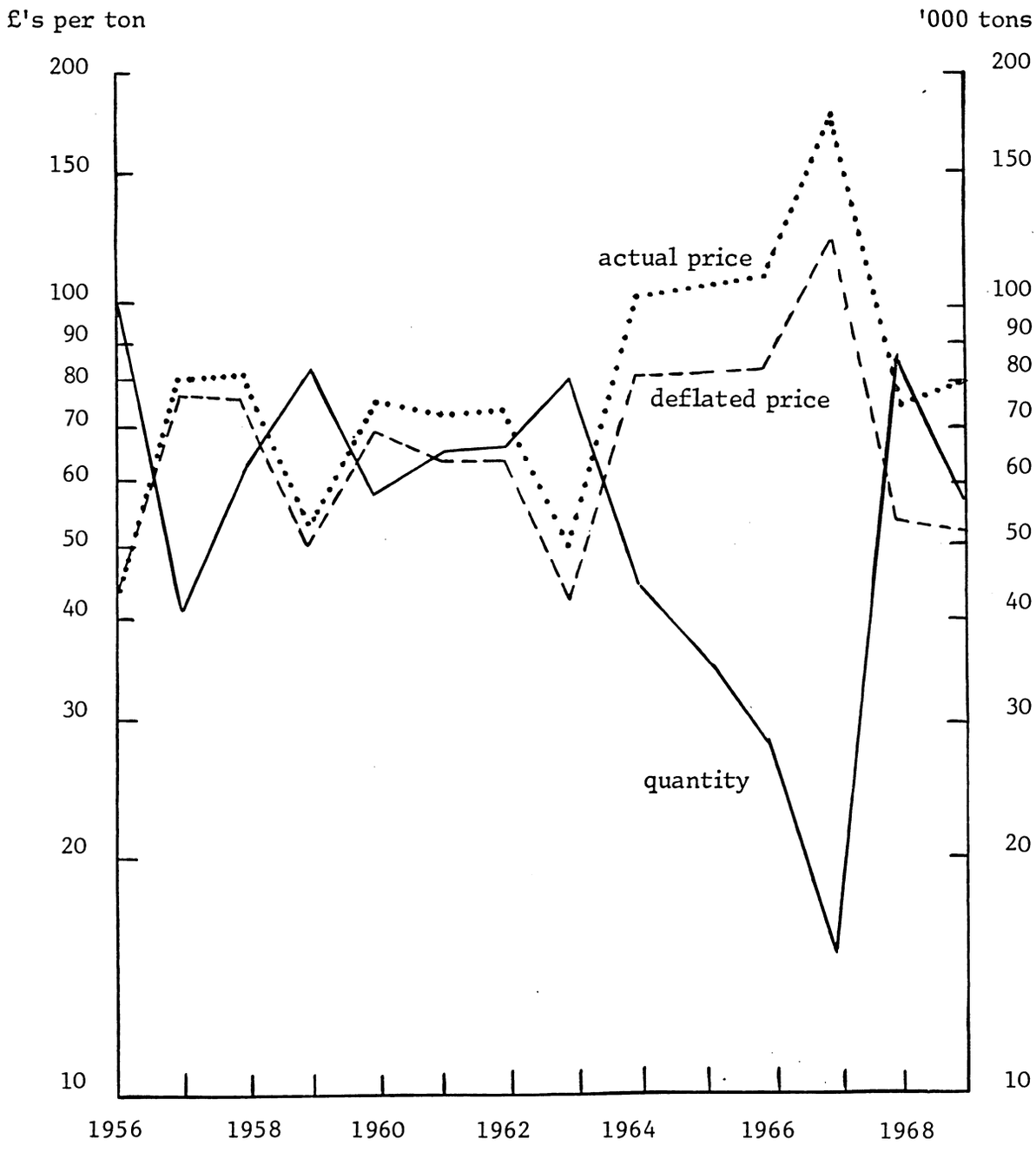


Fig. 4

Harvested quantities, actual and deflated
M.A.F.F. farm-gate prices 1956-69

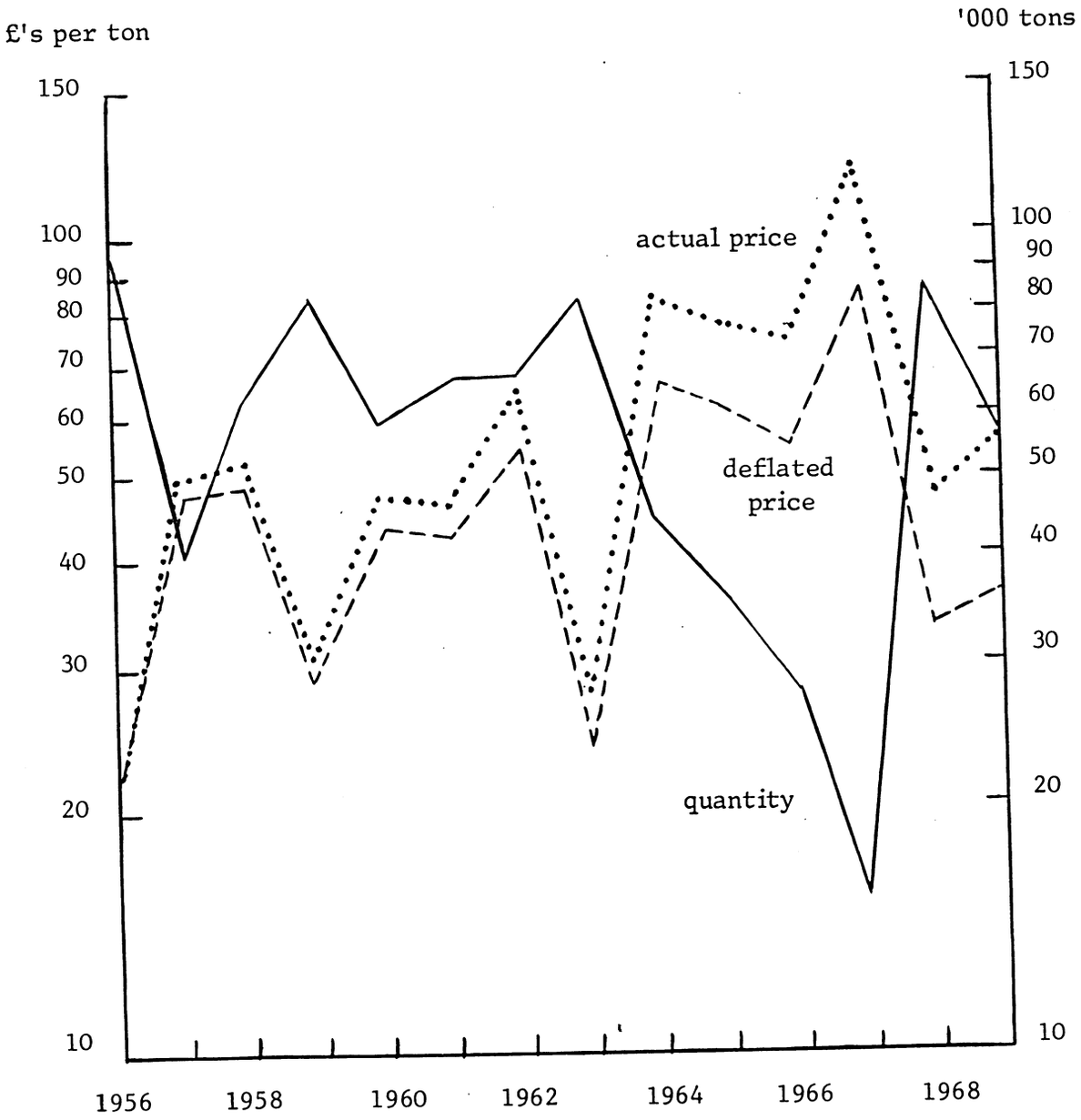
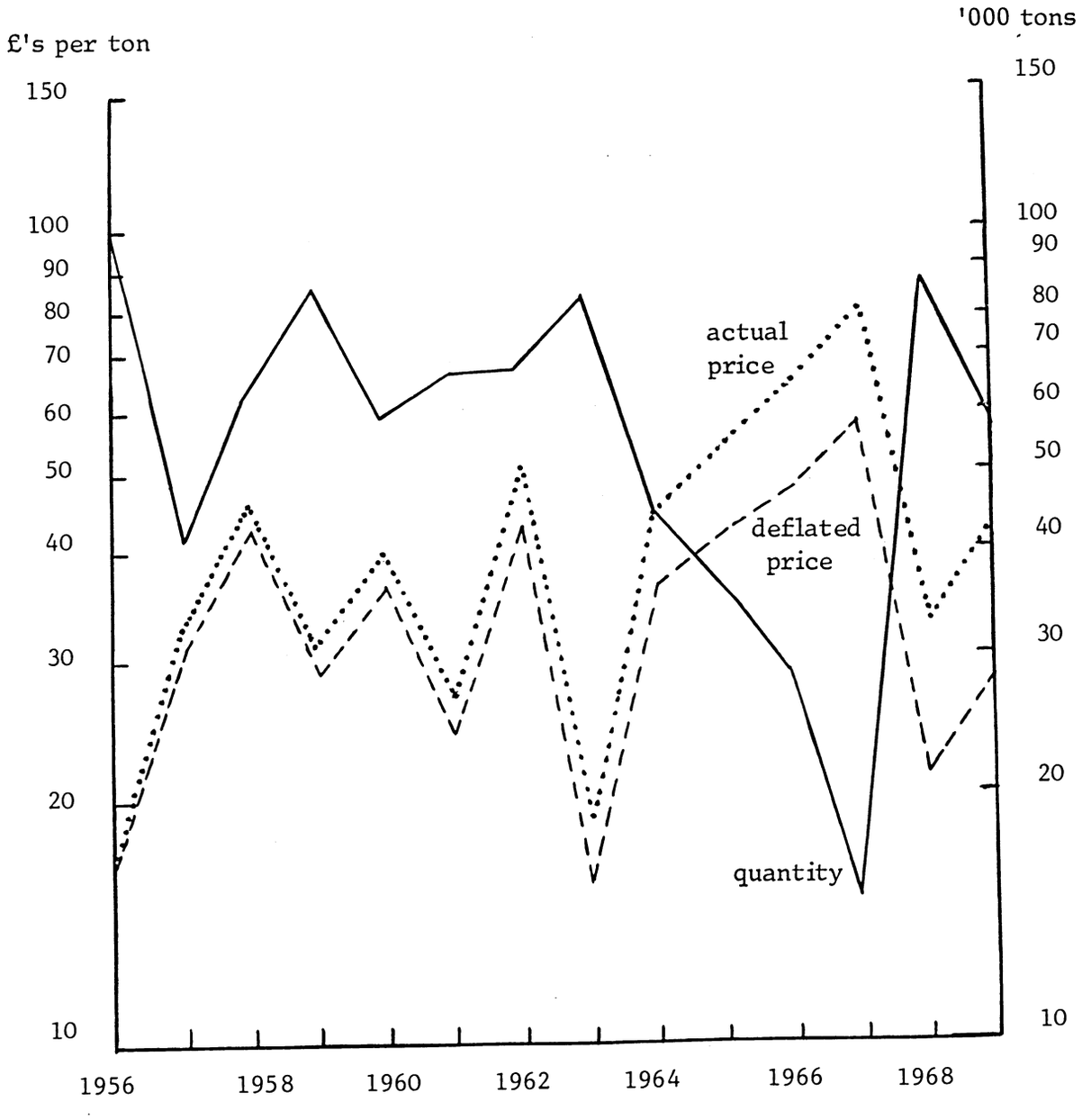


Fig. 5

Harvested quantities, actual and deflated processing fruit prices 1956-69



The relationship between prices and quantities was explored in somewhat greater depth using a simple regression model. It was first assumed that real, or deflated prices would be dependent on changes in the quantities of plums harvested and changes in real incomes. This assumption was tested with respect to both market and farm-gate prices, but in neither case was the coefficient of the income variable significant at even the 20 per cent level, nor did its inclusion add significantly to the explanation of price variations. So the income variable was discarded leaving just one explanatory variable - the quantity of plums harvested. The results for this very simple model, using each of the three price series in turn as the dependent variable, are summarised in Table 9.

Table 9

The regression of deflated plum prices on total quantities harvested 1956-69

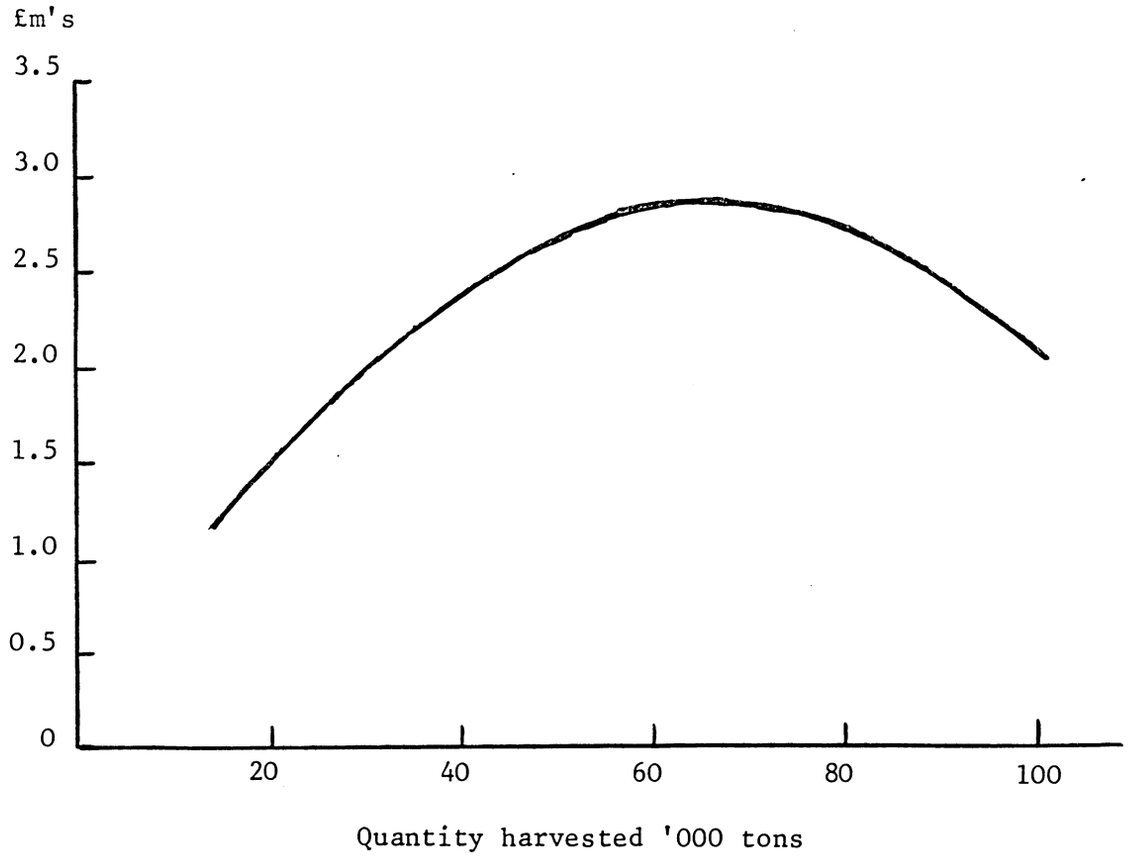
	M.A.F.F. market prices	M.A.F.F. farm-gate prices	Estimated processing prices
Mean values:			
Price (£'s) per ton	70.00	46.55	34.19
Harvested quantity (thousand tons)	59.71	59.71	59.71
Regression values:			
Constant (£'s)	118.46	85.16	58.56
Regression coefficient (a)	-.812	-.647	-.408
R^2	.80	.77	.66

(a) All three regression coefficients were significant at the 1% level.

For each of the three price series the relationship with the quantity of plums harvested proved to be highly significant. This variable alone explained most of the variation in the deflated prices - as much as 80 per cent in the case of the M.A.F.F.'s wholesale market price series. By definition, however, the most representative and relevant price series as far as the industry as a whole is concerned is the M.A.F.F.'s farm-gate price. Farm-gate prices are also used by the M.A.F.F. as a component in the estimation of the total annual ex-farm value of the plum crop. Using the parameters of the regression of deflated farm-gate prices on total quantities harvested it was possible to estimate the total deflated ex-farm value of harvested crops of different sizes. This was done with reference to the range of values observed between 1956 and 1969: the results are presented in Figure 6. The graph suggests that a harvested crop of 100 thousand tons produces approximately the same total gross ex-farm revenue as does a harvested crop of 30 thousand tons. In terms of deflated prices, the effective marginal value, to the plum growing industry as a whole, of an additional thousand tons above the average quantity harvested appears to be no more than £6.06 per ton. The average value per ton falls from £46.57 for the average harvested crop of 59.7 thousand tons to an average of £45.92 when the harvested crop rises to 60.7 thousand tons. It is evident, from the graph, that any harvested crop in excess of an optimum of approximately 65 thousand tons has a negative value as far as the industry as a whole is concerned.

Fig. 6

Relationship between total deflated value of plum crop [a] and variations in harvested quantities. 1956-69



[a] Using an index of retail prices with 1956 as the base year = 100

As can be seen from the graph in Figure 4, the underlying trend in deflated farm-gate prices was rising during the fourteen year period 1956-1969, although deviations from the trend were obviously very large. According to the linear trend values, the deflated price per ton increased from £37 in 1956 to £56 in 1969. This price trend is paralleled by a corresponding decline in the trend in quantities harvested, which fell from 75 thousand tons in 1956 to 45 thousand tons in 1969, accompanied by proportionately somewhat larger deviations from the trend. The product of the respective trend values of price and quantity provided an estimate of the total deflated ex-farm value of the plum crop, amounting to £2.7 million in 1956 and £2.5 million in 1969. Thus, it would appear that the elasticities of total real expenditure with respect to both supply and income were very close to zero.

PART II

The Location of Plum Orchards in England and Wales in 1969

Commercial plum-growing in this country is virtually restricted to a dozen or so well defined areas in the Eastern, South Eastern and West Midland regions.

Table 10

Principal plum-growing regions in England and Wales: 1969

Region	Area (a)	Percentage of England & Wales Total
	acres	%
Eastern	4,470	28
South Eastern	4,219	27
West Midland	6,328	40
Others (b)	733	5
Total	15,750	100

(a) The acreages relate to 'commercial orchards only.
(b) Includes 396 acres in Berkshire and Buckinghamshire.

The parishes, in the main plum-growing counties, with at least 10 acres of plums grown on holdings having at least 2 acres of plums are shown as hatched areas on the accompanying maps. These parishes, 238 in all, contain approximately 78 per cent of the total acreage of plum orchards in England and Wales. The figures in Table 11 show how the parishes and the plum acreages are distributed locally within regions.

In the Eastern region the most important plum growing area is in Central Cambridgeshire, on the fertile soils along the stretch of the Great Ouse between St. Ives and Ely. Most of the orchards are very old and there has been very little new planting; consequently productivity is low. There are canning facilities at Wisbech, but these are primarily concerned with vegetables. Since 1945 there is some evidence of renewed interest in top fruit growing but it has been mainly concentrated on dessert apples while plums have been almost entirely ignored. In the Fen country plum trees were frequently planted along the dykes to serve as wind-breaks for the more profitable apple orchards. Having regard first to the fact that plum orchards tend to be found on the better quality land, and secondly to the fact that the area offers so many economically more attractive ways of utilising the land, it is surprising that plum growing continues to survive at all in this region.

Table 11

Regional and sub-regional distribution of plum orchards: 1969(a)

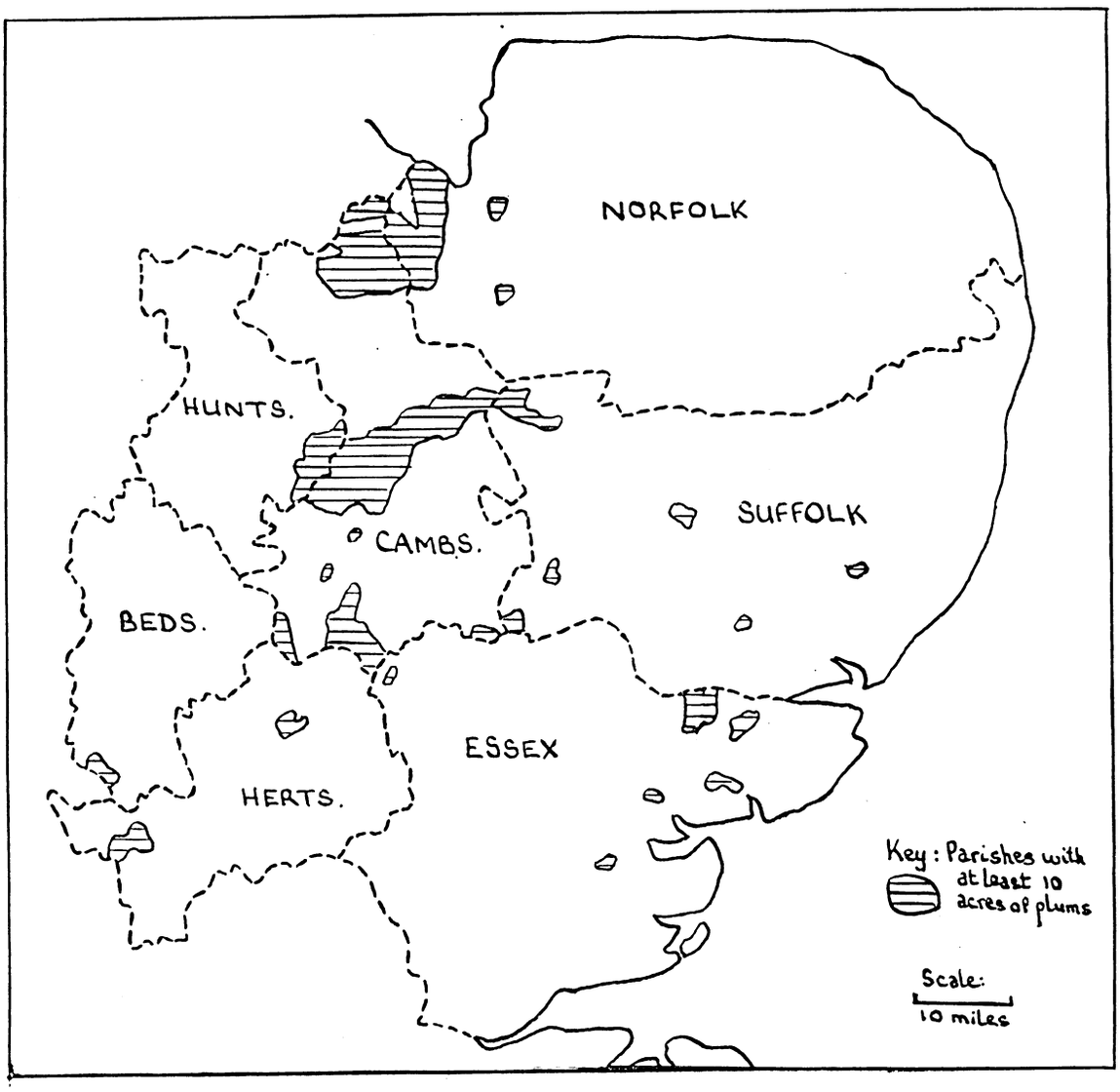
Regions and sub-regions	Parishes with at least one holding with at least two acres of plums		Parishes with at least ten acres of plums on holdings with at least two acres		
	Parishes	Plum area	Parishes	Plum area	Density(b)
Eastern	No.	acres	No.	acres	%
Central Cambs.	29	2,029	22	1,998	2.2
Fens	25	735	16	697	0.9
South Cambs.	17	549	11	518	1.8
Other	46	466	11	329	1.1
South Eastern					
North Kent	74	2,362	54	2,273	1.6
Vale of Kent	51	836	32	758	0.9
Other	20	202	7	139	0.4
West Midland					
Vale of Evesham	47	3,448	35	3,390	5.3
N.W.Glos.	15	680	10	652	2.0
Teme Valley	26	661	18	627	1.1
Severn Valley	31	513	12	434	1.2
North Cotswold	12	344	8	333	1.1
Other	14	128	2	68	1.7
Total	407	12,953	238	12,216	1.7

(a) Based on M.A.A.F. data relating to holdings with 2 acres or more of plum

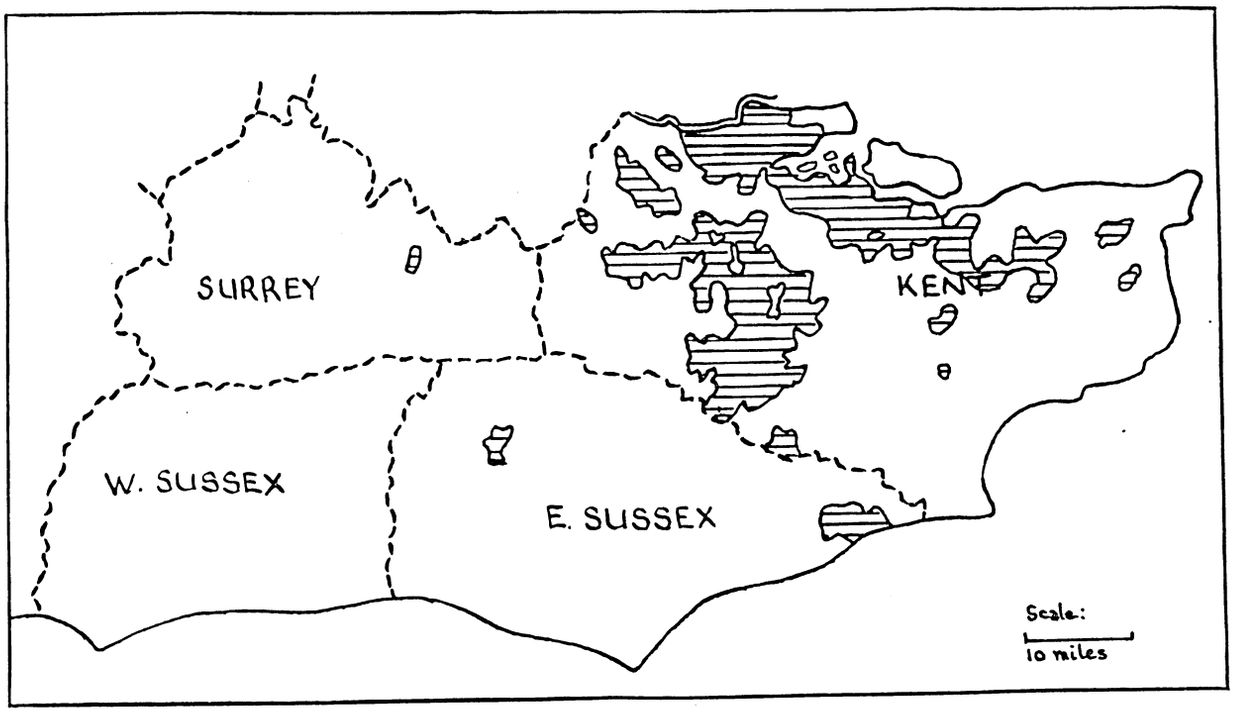
(b) Expressed as the acreage of plums per 100 acres of agricultural and non-agricultural land.

In the South Eastern region, apart from one very small area in Surrey and two somewhat larger but still relatively minor areas in East Sussex, plum growing is concentrated between the North Downs and the Thames Estuary and on the Gault Clay and Greensand in the Vale of Kent. The region is, of course, well known as a major fruit growing area, but plum orchards amount to less than a fifth of the total orchard area. Most of the plantations are very mature and scarcely any replanting was done during the post-war period, when not only was a large part of the existing apple acreage grubbed and replanted with modern varieties but apple growing was extended into many other parts of the county where it had not hitherto existed.

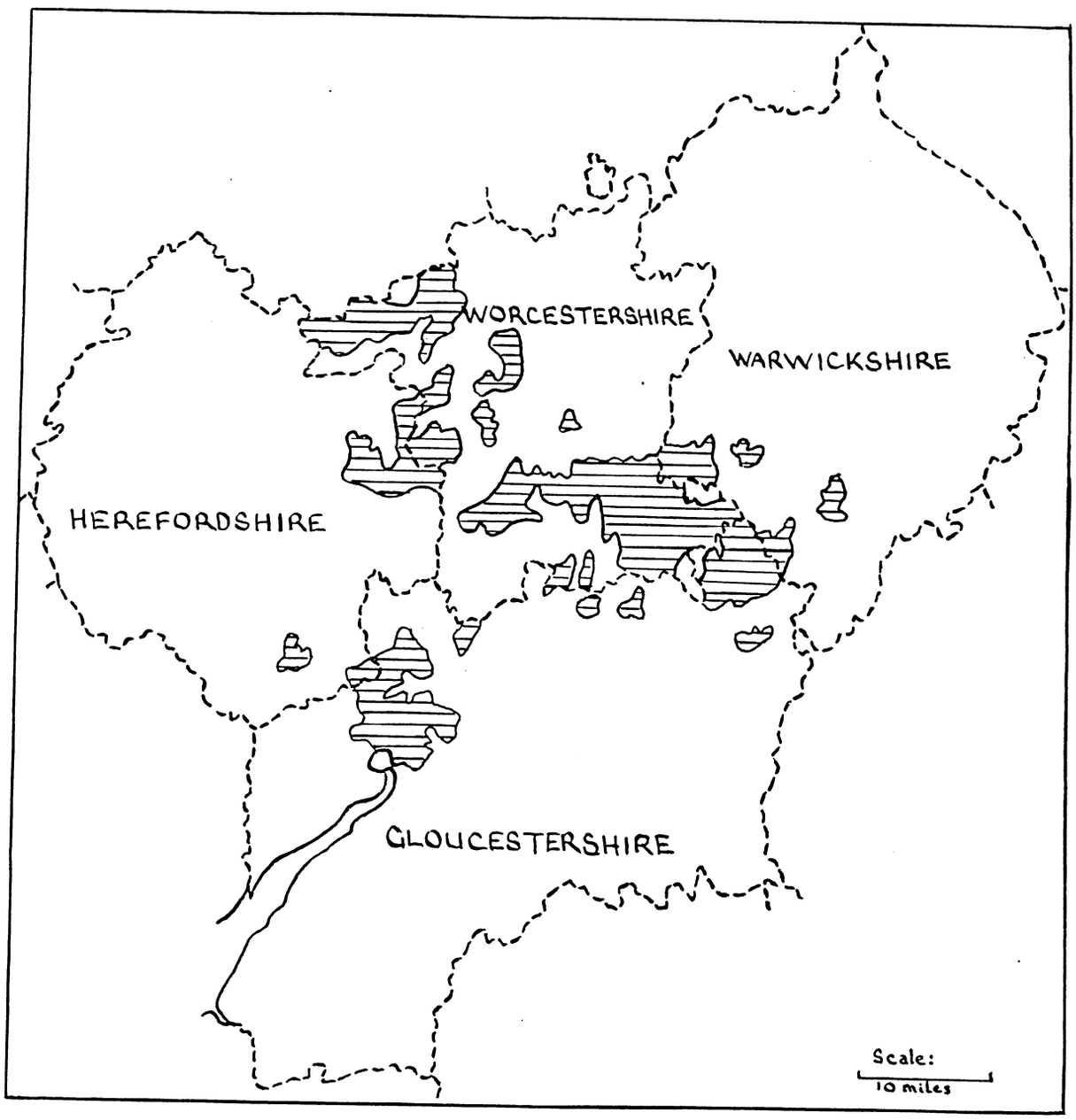
Eastern region



South Eastern region



West Midland region



In the West Midlands plum orchards are more widespread than in the Eastern and South Eastern regions. Nevertheless, certain areas within the region are particularly important, with the Vale of Evesham being pre-eminent in that not only does it contain a larger acreage of plums than any other sub-region in England and Wales but also because it has a plum orchard density amounting to 5.3 acres of plums per 100 total acres, which is more than twice that of any other sub-region.

Plums in the Vale account for a substantial proportion of all orcharding, nearly 70 per cent. The best orchard sites are those on the lower ridges which fringe the River Avon. Many were established on unsuitable sites which are particularly susceptible to spring frosts, with the result that yields are very variable and uncertain. Although grubbing is gradually reducing the area of these ill-sited orchards many still remain - over-mature, inclined to dereliction and rarely profitable. The natural market outlets for the region are the Midlands, Lancashire and South Wales.

Table 12

Distribution of Holdings with 2 acres or more of plums in relation to area of other top fruit

Regions and sub-regions	Holdings with 2 acres or more of plums	Holdings with 2 acres or more of plums		
		With no other top fruit	With other Fruit	
			Less than plums	More than plums
	No.	%	%	%
Eastern				
Central Cambs.	187	27	53	20
Fens	105	20	20	60
South Cambs.	24	8	42	50
Other	52	12	17	71
South Eastern				
North Kent	230	3	10	87
Vale of Kent	105	4	6	90
Other	27	11	4	85
West Midland				
Vale of Evesham	280	65	34	1
N.W. Glos.	60	40	33	27
Teme Valley	71	15	17	68
Severn Valley	53	36	28	36
North Cotswold	30	23	40	37
Other	19	11	15	74
Total	1,243	27	25	48

In the South Eastern region plums on plum growing holdings are clearly very much less important than other top fruit. At the other extreme, in parts of the West Midlands and in Central Cambridgeshire plum growing is the speciality, either to the exclusion of any other top fruit or involving a larger acreage than all other top fruit combined. In the Vale of Evesham, for example, 65 per cent of holdings with plums are not concerned at all with other top fruit while on a further 34 per cent of plum holdings the area of plums grown is greater than the area of all other top fruit. Other sub-regions in which plums appear to occupy a position of major importance in the context of top fruit production are North-West Gloucestershire, the Severn Valley and the North Cotswolds.

Table 13

Regional distribution of plum holdings by plum orchard size 1969

Regions and sub-regions	Holdings with 2 acres or more of plums					
	Total	Distribution by plum orchard size (acres)				
		2-4.9	5-9.9	10-19.9	20-29.9	30 & over
	No.	%	%	%	%	%
Eastern						
Central Cambs.	187	49	23	17	6	5
Fens	105	59	25	10	1	5
South Cambs.	24	21	21	17	4	37
Other	52	53	25	10	2	16
South Eastern						
North Kent	230	40	23	20	10	7
Vale of Kent	105	45	27	22	2	4
Other	27	41	33	11	11	4
West Midland						
Vale of Evesham	280	46	28	13	4	9
N.W.Glos.	60	43	28	15	7	7
Teme Valley	71	54	20	18	1	7
Severn Valley	53	55	15	17	7	6
North Cotswold	30	30	27	20	17	6
Other	19	42	42	11	5	-
Total	1243	46	25	16	6	7

Nearly half of the 1,243 holdings growing 2 acres or more of plums grow less than five, and a further quarter grow between 5 and 10 acres. Only 13 per cent grow more than 20 acres and only 7 per cent grow more than 30 acres. Surprisingly, there is little significant variation between regions and sub-regions in the distribution of holdings according to the acreage of plums grown per holding; for the most part they correspond very closely to the average pattern quoted above.

PART III

A Survey of Costs, Returns and Margins in 1971

The sample

The sampling frame was restricted to holdings in the nine most important plum-growing counties of the Eastern, South Eastern and West Midland regions with at least two acres of plums at the time of the June 1969 census. These nine counties together contained nearly eighty per cent of the total commercial plum acreage of England and Wales.

Table 14

National, regional and sample plum acreages: 1969

	Total area of commercial plum orchards	Area from which the sample was drawn	Area of plums grown on the sample holdings in 1971
Region	acres	acres	acres
Eastern	4,470	3,486	180
South Eastern	4,219	3,286	277
West Midland	6,328	5,774	427
Sub-total	15,017	12,546	884
Other regions	733		
Total England & Wales	15,750		

The total number of holdings in the sampling frame was 1,209, from which three random samples were drawn, stratified by size and each containing 82 holdings. The purpose of the second and third samples was to provide replacements for non-respondents. Details of the 1,209 holdings and of the sample and respondents are given in Table 15.

The effective sample was 80 per cent of the target sample although the actual response rate, i.e. the ratio of respondents to the number of growers canvassed, was considerably less than this. As the figures in Table 15 indicate, the main deficiency in the effective sample lies in the 2 to 4.9 acre group where the final number of respondents was rather less than two-thirds of the target. Difficulty in recruiting very small-scale operators is a feature common to most random sample studies of costs and returns in farming and horticulture. The total plum acreage costed amounted to about seven per cent of the total area sampled, a higher proportion than is usually found in similar surveys.

Table 15

Distribution of holdings in the sampling frame and in the sample

	Holdings with ≥ 2 acres of plums	Sampling fraction	Target sample	Effective sample	Sample acres as % of total
Region	No.		No.	No.	%
Eastern	349	-	22	18	5.2
South Eastern	347	-	25	16	8.4
West Midland	513	-	35	32	7.4
Plum acreage					
2 - 4.9	561	1 - 19	29	18	3.3
5 - 9.9	303	1 - 15	20	19	7.2
10 - 19.9	193	1 - 10	19	19	10.4
20 and over	152	1 - 11	14	10	6.6
All holdings	1,209	-	82	66	7.0

A special problem arose in connection with the West Midland sample, in which, from observation in the field, it was noted that the plum orchards on a comparatively large number of holdings were neglected, and in poor condition. It was eventually decided to include such holdings in a separate category, referred to here as 'inferior' orchards; other members of the West Midland sample are referred to as 'conventional' orchards. Inclusion in the 'inferior' category was based partly on appearance and partly on a £1.00 per acre ceiling of expenditure on fertilisers and sprays. Altogether, a total of eleven respondents were considered to be occupying orchards which, either wholly or mainly, qualified for inclusion in the 'inferior' category. In the analysis of the West Midland sample they are treated as a separate sub-group.

Table 16 describes the broad characteristics of the national and regional samples. The two contrasting regions are the South Eastern and the West Midland, although in some respects they are very similar - in their average area of plum orchards for example. But having regard to the differences in holding size, plums are clearly a more significant crop for growers in the West Midland than for those in the South-East region. The situation in the Eastern region is, in nearly all respects, very similar to the overall sample average. It is evident from the table that the 'inferior' orchards in the West Midland region tend to be located on holdings that are nearly three times as large as those with conventional orchards; and plum growing clearly plays a comparatively unimportant role in the economy of these large farms, a point which is consistent with the low level of inputs and low productivity of these 'inferior' orchards.

Table 16

Average size of sample holdings, and average area of total orchards and of plum orchards per holding

	Total sample	Eastern	South Eastern	West Midland	
				Conventional	Inferior
	acres	acres	acres	acres	acres
Average size of holding	142	141	218	67	174
Average area of total orchards	46	47	90	24	26
Average area of plum orchards	13	10	17	16	8
	%	%	%	%	%
Total orchards as per cent of total holding	33	34	41	35	15
Plums as per cent of total holding	10	7	7	24	4
Plums as per cent of total orchards	29	21	19	69	29

Specialisation is most marked in the Eastern and West Midland regions where, in each case, three varieties, Victoria, Yellow and Purple Egg, occupy 50 per cent of the total plum acreage. In the South Eastern region, on the other hand, no two varieties together account for more than 27 per cent of the total plum acreage. By applying the appropriate raising factors to the sample results, estimates were obtained of the total acreage of each of the main varieties grown in the sampled areas of the nine selected counties, which, as previously noted, contained 80 per cent of the total area of commercial plum orchards in England and Wales. Only three varieties, viz: Victoria, Yellow and Purple Egg each occupy more than 2,000 acres. Next on the list comes Czar occupying a little over 1,100 acres. Of the remaining varieties none exceeds 1,000 acres. These estimates of the varietal distribution agree only moderately well with the more limited information available from the Ministry's 1970 Orchard Census.

Table 17

Distribution within regions of varieties grown on sample holdings and raised sample estimates of the total acreage of each variety

Variety \ Region	Eastern	South Eastern	West Midland		Total (a) (raised sample)	
			Conventional	Inferior		
	%	%	%	%	acres	%
Victoria	35	12	26	15	2,953	22
Yellow and Purple Egg	15	2	34	18	2,439	19
Damson	1	4	3	20	620	5
Czar	11	14	6	1	1,114	8
Giant Prune	14	13	-	-	887	7
Marjorie's Seedling	4	13	3	-	808	6
River's Early Prolific	5	2	4	14	589	5
Blaisdon Red	-	-	5	19	523	4
Other (b)	15	40	19	13	3,166	24
Total	100	100	100	100	13,099	100

(a) This calculation produced a somewhat larger total acreage, 4 per cent more, than the total acreage sampled.

(b) Among the varieties included in this category are Burbank, Wyedale, Warwickshire Drooper, Gages, Belle de Louvain, Kentish Bush, President, Monarch, Ontario, Bennets Red and Bennets Blue. No single variety accounted for more than 3 per cent of the total acreage.

Table 18

A comparison of the distribution of plum varieties between Orchard Census data and raised sample survey estimates: 1970

Varieties	Census	Raised sample
	%	%
Victoria	27	22
Yellow and Purple Egg (a)	13	19
Damson	8	5
All other	52	54
Total	100	100

(a) The Census data does not include Purple Egg plums.

Forty-three per cent of the total plum acreage is estimated to be over 25 years old. Six per cent had been planted within the four years prior to the survey, a rate well below what would be required in order to achieve satisfactory progress towards the modernisation of the plum-growing industry. Compared with the 1970 Orchard Census results, new orchards appear to be under-represented while 4 - 25 year old orchards appear to be somewhat over-represented.

Table 19

Per cent distribution of plum orchards by age: 1970

	Years			Total
	Under 4	4 - 25	Over 25	
Region	%	%	%	%
Eastern	3	46	51	100
South Eastern	9	62	29	100
West Midland				
Conventional	6	49	45	100
Inferior	6	31	63	100
Plum acreage				
2 - 4.9	7	41	52	100
5 - 9.9	11	60	29	100
10 - 19.9	4	46	50	100
20 and over.	7	52	41	100
All holdings	6	51	32	100

Yields

The national average raised sample estimate of marketed yield in 1971 is 32.2 cwt per acre. The corresponding M.A.F.F. estimate for 1971 is 43.5 cwt per acre, exceeding the sample estimate by almost thirty-five per cent. Whether this is a reflection on the sampling methods used in the Survey or on the accuracy of the M.A.F.F.estimate it is not possible to say. Certainly 1971 was not considered by growers to have provided even average conditions. Waste on the trees was also high.

Both the above estimates were substantially below the long term average marketed yield of 53.1 cwt. However, it is worth noting that even lower yields have been recorded in recent years - 28.9 cwt in 1966 and 14.6 cwt in 1967.

Table 20

Marketed yields per acre by regions and by size groups: 1971

Region	Yield per acre	Plum acreage	Yield per acre
	cwt.	acres	cwt.
Eastern	37.1	2 - 4.9	31.8
South Eastern	30.7	5 - 9.9	28.2
West Midland			
Conventional	33.6	10 - 19.9	29.9
Inferior	12.8	20 and over	34.6
All regions	32.2	All holdings	32.2

Yield variations between sample holdings were very large indeed, as can be judged from the frequency distribution in Table 21. Seven of the nineteen holdings with yields below 10 cwt per acre were in the West Midland 'inferior' category, which means that twelve other sampled holdings not so described nevertheless also had yields below 10 cwt per acre.

Table 21

Frequency distribution of marketed yields

Yields per acre	Holdings
cwt.	No.
Under 3	10
3 - 6.9	5
7 - 9.9	4
10 - 19.9	9
20 - 29.9	9
30 - 39.9	10
40 - 59.9	11
60 - 79.9	4
80 and over	4
Total	66

Nothing very useful or significant emerged from attempts to investigate factors associated with yield variation. In the South Eastern region the variety Victoria appeared to have performed less well than other varieties; due, perhaps, to its greater susceptibility to adverse seasonal conditions. But this experience was not repeated in other regions. In the West Midlands processing varieties tended to out-yield dessert varieties, a not uncommon experience in this region but one seldom repeated outside. Not surprisingly, orchards in the age group over 12 years and under 40 years tended to out-yield younger and older orchards; also arable orchards tended to be somewhat superior in yields to grass orchards. However, over the sample as a whole, none of these associations were particularly strong and a regression model in which all the factors referred to were included as explanatory variables together with expenditure on fertilisers and sprays only accounted for 20% of the variation present in yield per acre and provided only one significant regression coefficient ($P < .05$). It is evident from these results that a sample of 66 sets of observations for one season provided insufficient data for the purpose in hand, having regard to the extremely multi-variate character of the problem.

Methods of disposal and prices

Plums may be sold on contract to processors, on commission or by direct sale to wholesalers, or direct to retail shops and to consumers. The relative importance of these outlets is illustrated in Table 22 below with reference to the disposal of the 1971 crop. The sample estimate of sales to processors, twenty-six per cent of total disposals, corresponds very closely to the twelve year average, 1958 - 1969, which was twenty-eight per cent of total disposals. With one or two notable exceptions, differences between regions and between acreage groups did not appear important.

Table 22

Distribution of sales according to method of sale, and net price per ton realised, by region and by enterprise acreage 1971

	Method of sale						All sales	
	Contract		Commission		Other			
	Per cent	Net price	Per cent	Net price	Per cent	Net price	Per cent	Net price
	%	£	%	£	%	£	%	£
Region								
Eastern	27	47	57	70	15	71	100	65
South Eastern	-	-	91	54	9	103	100	62
West Midland								
Conventional	39	24	58	78	3	96	100	56
Inferior	74	26	16	57	10	64	100	38
Plum acreage								
2 - 4.9	21	27	68	64	11	108	100	60
5 - 9.9	14	27	74	84	12	84	100	78
10 - 19.9	19	55	62	85	19	71	100	72
20 and over	34	26	64	54	2	113	100	48
All holdings	26	30	65	66	8	81	100	59

The comparative advantages of selling through the more lucrative outlets are summarised in the final row of Table 22. But as already pointed out, the outlet used may be partially pre-determined by the variety.

The comparatively high net proceeds per ton from sales on commission in the Eastern and West Midland (conventional type) regions are probably associated with the comparatively high proportions of Victorias grown in these regions, while the comparatively higher net proceeds from 'other' sales in the South Eastern and West Midland (conventional type) regions are probably associated with easy accessibility from large urban centres and a consequentially thriving retail trade from roadside stalls.

The following table contains a detailed analysis of gross prices and net proceeds in respect of commission sales.

Table 23

Gross prices, marketing costs and net receipts per ton from sales on commission by region and by size of enterprise: 1971

	Gross price	Market charges	Packing materials	Trans-port	Total costs	Net receipts
Region	£	£	£	£	£	£
Eastern	95.6	10.7	7.4	7.3	25.4	70.2
South Eastern	80.9	11.6	6.2	5.7	23.5	57.4
West Midland Conventional	101.1	11.0	7.4	3.8	22.2	78.9
Plum acreage:						
2 - 4.9	83.6	8.0	7.2	4.1	19.3	64.3
5 - 9.9	111.1	13.6	8.7	5.1	27.4	83.7
10 - 19.9	118.4	16.0	9.3	8.0	33.3	85.1
20 and over	74.0	9.5	5.3	5.0	19.8	54.2
All holdings	89.9	11.2	6.8	5.4	23.4	66.4

Market charges alone averaged approximately 12½ per cent of the gross price, which is very nearly half the total cost of marketing. The total cost of marketing as a percentage of the gross price did not appear to vary significantly according to the gross price.

Costs, outputs and margins

Average variable costs, according to the raised sample estimate, amounted to £52.8 per acre, of which 80 per cent was incurred on marketing and casual labour, the latter used mainly for harvesting. It follows from this that variable costs are partially determined by the amount of crop harvested and the method of its disposal, and partially by the differing proportion of regular and casual labour used in harvesting; this latter being largely a function of scale. In these circumstances any conventional input-output analysis would appear to be both inappropriate and unrewarding.

Table 24

The levels and composition of variable costs: 1971

	Variable costs per acre					
	Marketing (a)	Sprays etc.	Fertilisers	Casual labour(b)	Other costs(c)	Total
Region	£	£	£	£	£	£
Eastern	20.8	6.2	5.3	19.8	1.8	53.9
South Eastern	33.9	4.1	8.0	22.4	2.2	70.6
West Midland						
Conventional	18.6	3.5	4.8	21.2	2.4	50.5
Inferior	0.4	0.1	0.3	4.0	0.8	5.6
Size group						
2 - 4.9 acres	17.5	3.2	4.7	12.4	2.4	40.2
5 - 9.9 "	27.6	4.5	4.4	25.1	1.7	63.3
10 - 19.9 "	21.7	5.0	3.7	18.8	2.6	51.8
20 and over "	21.2	3.4	6.7	20.0	1.9	53.2
All holdings	21.9	3.9	5.4	20.6	2.0	52.8

(a) Includes materials. (b) Mainly for harvesting. (c) Includes contract work.

It should also be noted that the average cost per acre of technical inputs, such as fertiliser and sprays, is a comparatively small proportion of total variable costs, although between holdings there are very wide variations in the level of expenditure on these items. This again raises the question of a relationship between expenditure on fertilisers and sprays, and yield. As already pointed out, a generalised and highly simplified hypothesis about such a relationship is open to all the usual criticisms, and particularly so on account of the possible effects of excluded variables and the fact that only one year's results are available for analysis.

But for what it is worth, and maybe the answer to this is, very little; a simple linear regression was performed with yield per acre as the dependent variable and expenditure on fertilisers and sprays as the independent variable; but no significant relationship emerged from this. Obviously, such a result does not disprove the existence of a relationship between the variables. It may, for example, be obscured by the effects of the excluded variables. It is none the less surprising that no sign whatsoever of a relationship appears to have filtered through the haze created by what is admittedly a multi-variate situation, with respect to which there is available only one year's records.

Table 25 contains two concepts of "margin-over-costs". There is first the conventional gross margin over variable costs, which in this instance include marketing, materials and casual labour; and secondly there is a margin over marketing, materials and all labour, i.e. casual, regular and grower's own labour. This adjustment removes the somewhat arbitrary element that may arise in a situation such as this one, when casual but not regular labour is included as a variable cost.

Table 25

Returns, costs and margins per acre 1971

	Gross output	Variable costs	Margin over	
			Variable costs	All labour marketing and materials (a)
Region	£	£	£	£
Eastern	142.2	53.9	87.3	65.1
South Eastern	129.4	70.6	58.8	33.9
West Midland				
Conventional	117.4	50.5	66.9	48.7
Inferior	22.0	5.6	16.4	12.7
Size group				
2 - 4.9 acres	113.6	40.2	73.4	47.4
5 - 9.9 "	137.2	63.2	73.9	53.0
10 - 19.9 "	129.1	51.8	77.3	62.6
20 and over "	104.6	53.2	51.4	36.2
All holdings	116.4	52.8	63.6	48.3

(a) Also includes contract work.

The increase in margins, particularly in the margin over marketing, materials and all labour, with increasing scale of enterprise, which is apparent in the first three size groups, is consistent with conventional expectations about the relationship between efficiency and scale. But in the largest size group the result is completely at variance with this trend. The reason can be traced back to a relatively poor average net price - only £48 per ton compared with about £70 per ton in the other size groups. This in its turn appears to be due to a relatively high proportion of fruit being sold for processing and to a relatively very low net receipt from sales on commission.

The most informative scheme of tabular classification to which these Survey results lend themselves is that shown in Table 26. This table demonstrates very clearly the dependence of both forms of margin over costs on yield per acre, and the economic disadvantage, other things being equal, of selling, or having to sell a high proportion of the harvested crop on contract for processing, although as previously observed, this may be largely pre-determined by the variety or varieties of plums grown.

The table also helps to place the economics of plum growing in perspective.

Table 26

Summary of returns, costs and margins per acre

	Method of disposal						All holdings (raised sample)
	Little or no processing			Over 25% for processing			
	Yield: cwt per acre			Yield: cwt per acre			
	Under 20	20 - 39.9	40 & over	Under 20	20 - 49.9	50 & over	
No. of holdings	19	17	10	9	6	5	66
Plum acreage	10	17	10	13	24	11	11
Yield: cwts	9	32	69	3	40	68	32
Percent for processing	0	2	0	35	59	72	26
	£	£	£	£	£	£	£
Gross output	53	142	277	7	117	200	116
Less marketing	12	25	59	0	12	29	22
Net output	41	117	218	7	105	171	94
Less materials	7	12	14	2	6	7	9
Less all labour	16	40	71	5	49	51	37
Margin over materials and all labour	18	65	133	0	50	113	48
Gross Margin	25	83	160	4	65	128	63

With the exception of the two orchard groups in the below 20 cwt per acre yield class, average gross margins per acre are by no means commercially unattractive, having regard to what in reality is a mainly historic and zero-salvage value capital situation. But even the group in the first column of the table with an average yield of only 9 cwt per acre - sold, however, at an exceptionally good net price per ton - produced a gross margin only a little inferior to what one would have expected from an average crop of barley in the same year. Where, in addition to the fruit, there was also orchard grazing available*, valued at say £20 per acre, the total gross margin would then have been £45 per acre, a performance at least comparable in this respect with that from an average acre of wheat. In the two average, or intermediate yield groups - columns 2 and 5 in the table - the gross margins were either comparable or more than comparable with what one could have expected in 1971 from most agricultural enterprises considered as alternative forms of land use. It is only when the average gross margin from plums is compared with average gross margins obtained from alternative horticultural enterprises then plum growing fails to impress. In this context one thinks, for example, of average gross margins per acre such as:- strawberries £400-£500, blackcurrants £200-£250, dessert apples £150-£200 and carrots £100-£125.

Unfortunately we are reporting here on one year's results only; although this defect would have been less serious had it been possible to combine the survey results with M.A.F.F. estimates of yields and prices for previous years; because this would have provided estimates of the level of gross margins for a variety of yield and price situations. But when the M.A.F.F. and the raised sample estimates for 1971 were compared, they were found to be completely incompatible. For not only was the M.A.F.F.'s estimated yield, at 43.5 cwts. per acre, much higher than the raised sample average of 32.2 cwt. per acre; the M.A.F.F.'s estimated farm-gate price of £100 per ton over all sales far exceeded the raised sample estimate of £59 per ton. Equating the ex-farm value per acre to the product of yield and price, the M.A.F.F. figures gave the answer as £217 per acre, an estimate which is more than twice as large as the raised sample estimate of £94 per acre obtained in the survey. This comparison can be taken a stage further. After allowing for additional variable costs which might be incurred in respect of more casual labour for harvesting a larger crop, a gross output per acre of £217 would suggest a gross margin in the region of £150 per acre. The raised sample gross margin in the survey was only £64 per acre. The size of the gap between these two estimates is astonishingly large.

The degree of consistency between the M.A.F.F.'s 1971 yield and price estimates and similar estimates relating to previous years was checked by using the derived estimate of the total harvested crop in that year in conjunction with the second equation in Table 9; and then comparing the 1971 deflated farm-gate price per ton, as predicted by the equation, with the observed 1971 deflated M.A.F.F. farm-gate price. The two figures, £63.07 and £57.14 respectively are in fairly close agreement: even much more so if it is conceded that plums are a commodity whose

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*Regrettably, the schedule of information required to be collected from the sample holdings omitted any reference to the grazing of grass orchards.

prices probably did not keep pace with the high rate of inflation during 1970 and 1971. So it would appear that the M.A.F.F.'s 1971 yield and price estimates were perfectly consistent with the rest of the time series. And it also follows that if the 1971 estimates were significantly biased in any way, then a similar bias or biases must be present in the estimates relating to earlier years.

Using the derived estimate of total harvested quantity based on the raised sample yield of 32.2 cwt. per acre in conjunction with the same equation (in Table 9) as the one referred to above, produces a predicted 1971 deflated price of £68 per ton. While this figure is significantly higher than the deflated M.A.F.F. price of £57 per ton, it is also twice as great as the deflated raised sample price of £34 per ton.

With respect to the price of plums sold for processing, it has been suggested that the M.A.F.F. report prices paid by processors to wholesalers rather than prices paid by wholesalers to growers. It has also been suggested that the prices quoted by the M.A.F.F. for other market sales - 'the most usual prices' - do not adequately reflect sales of lower grade produce and of less popular varieties. With regard to M.A.F.F. yield estimates, one would not be surprised to learn that crop reporters set their own minimum standards as to what constitutes a serious plum orchard for the purpose of reporting yields. The survey estimate, on the other hand, is related to the sample as drawn and so does not make any distinction between orchards if they are returned as such.

It is difficult to believe that systematically recorded information about yields and prices obtained by direct contact from a stratified random sample of growers could produce less accurate estimates of these parameters than the obviously much less systematic and detailed, but more subjective approach employed by M.A.F.F. crop and market reporters. However, it would be unwise to draw any final conclusions about these differences, large though they may be, on the evidence of a single year's survey results. So, until another similar survey is undertaken, the possibility must remain that the profitability of plum growing is about two and a half times as great as the figures produced by the survey suggest.

Glossary of terms

Gross Output is total Revenue before deducting off-farm marketing expenses such as commission and hire of containers, if incurred.

Market charges are charges levied by the market on the grower's produce, i.e. commission and handling charges.

Marketing costs include market charges, packing materials and transport costs.

Transport costs include both hired and grower's own transport facilities.

Net Output is Gross Output less Marketing costs.

Variable costs include marketing, materials, casual labour and contractors' charges.

Gross Margin, also referred to as Margin over Variable costs, is Gross Output less Variable costs.

Margin over all labour, marketing and materials is Gross Margin less the cost of regular hired and grower's own labour.

Materials include crop protection sprays, herbicides, fertilisers and replacement trees.

Gross price is the price before deducting off-farm marketing expenses.

Farm-gate price is the price net of marketing costs.

Yields unless otherwise stated, are marketed yields.

Acres are field acres, not tree acres.

A share of General Farm Overheads is not included

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