

Sugar beets

Agricultural Enterprise Studies
in England and Wales
Economic Report No. 7

GIANNINI FOUNDATION OF
AGRICULTURAL ECONOMICS
LIBRARY

JAN 16 1973

SUGAR BEET:

A Study of Sugar Production in the UK
and the feasibility of expansion

F. G. Sturrock & M. C. Thompson



Agricultural Economics Unit
Department of Land Economy
University of Cambridge

1972

Price 40p

Agricultural Enterprise Studies
in England and Wales
Economic Report No. 7

SUGAR BEET

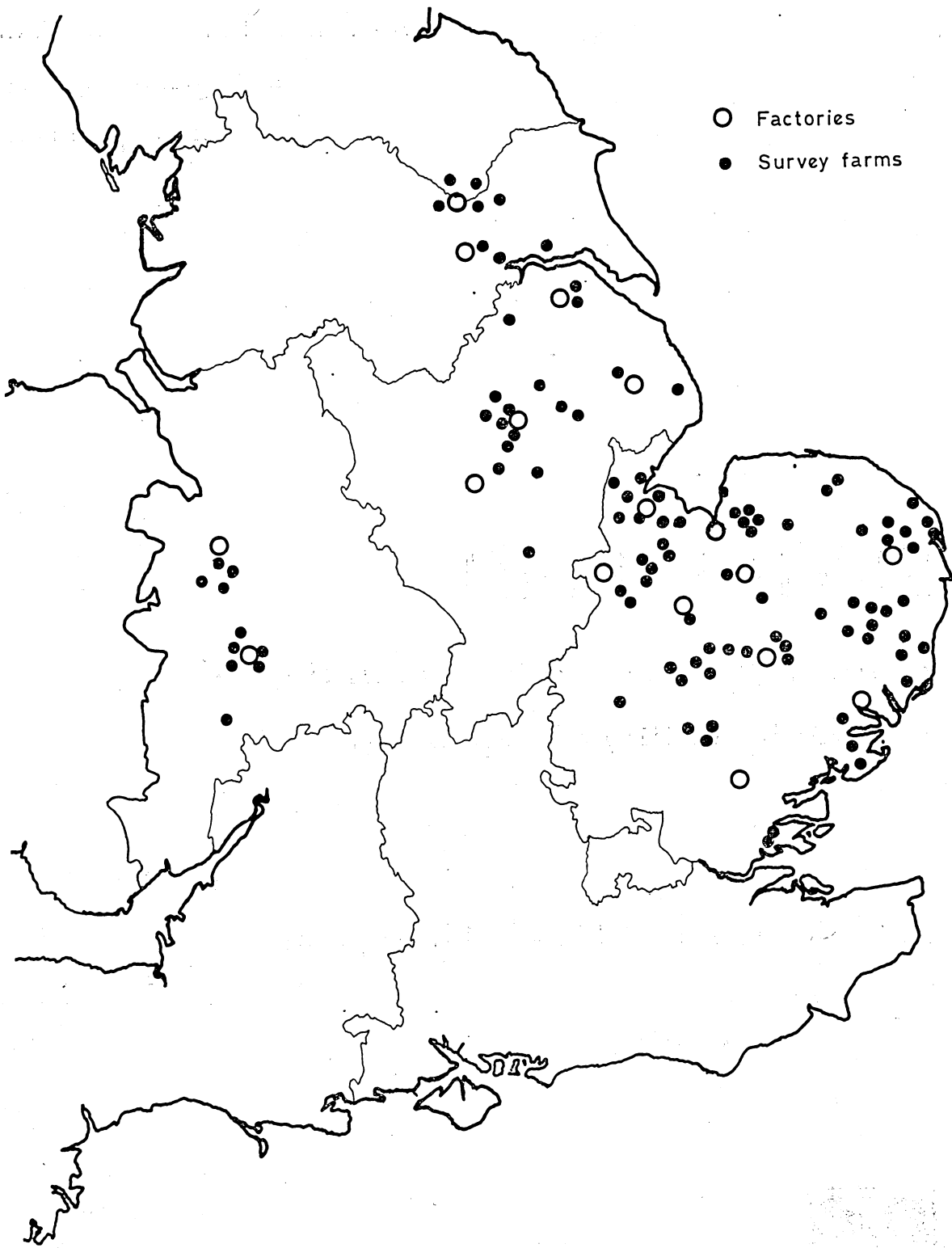
A Study of Sugar Production in the UK
and the feasibility of expansion

F. G. Sturrock & M. C. Thompson



Agricultural Economics Unit
Department of Land Economy
University of Cambridge

1972



Frontispiece. Location of farms taking part in the Survey and the sugar beet factories.

Sugar beet is grown mainly in Eastern, E. and W. Midland and Yorks and Lancs (MAFF) regions. The S.W. and S.E. were considered for a new factory.

Contents

	<i>Page</i>
Foreword	4
Introduction	6
Chapter 1 A Survey of British Sugar Beet Production:	
(a) The sample	8
(b) Costs of production	9
(c) Low labour crops	15
(d) Transport	16
Chapter 2 The Implications of Growing More Sugar Beet:	
(a) Sugar beet and sugar cane	19
(b) The place of sugar beet in British farming	23
(c) British sugar beet in the E.E.C.	27
Chapter 3 The Feasibility of Increasing Sugar Production:	
(a) The scope for increased production	30
(b) An economic appraisal	35
(c) Balance of payments	38
(d) Australian sugar	38
Summary	40
Appendix	42
Bibliography	45

Foreword

The economics of particular crop or livestock enterprises have been investigated and reported on by individual departments of agricultural economics at universities in England and Wales for several decades. In this work the departments have received—and continue to receive—generous support, financial and technical, from the Ministry of Agriculture, Fisheries and Food.

From time to time, the departments meet—together with representatives of the Ministry—to discuss common problems in their enterprise study work. One recent development has been the mounting of joint studies by two or more departments with a special interest in a particular enterprise. As a natural sequence, it has been decided that, although the reports will continue to be prepared and issued by individual departments, this community of interest should be recognised by giving the reports a common series title. Hence emerged the series the 'Agricultural Enterprise Studies in England and Wales'. Any views expressed or conclusions drawn are those of the authors.

Recent titles and the addresses of university departments concerned are given at the back of the report.

Preface

This report is based on a national survey of sugar beet organised in Cambridge. The opportunity has been taken, however, to discuss possible future developments. It is now three years since the present writer made a comparison with West Indies production and first suggested an expansion of sugar beet in this country by 100,000 acres. This report deals with the feasibility of such a project in more detail. As entry to the E.E.C. seems imminent, the subject is obviously of topical interest.

The authors are indebted to the farmers who so willingly provided information on their methods of growing sugar beet. They are also indebted to their colleagues in the Universities of Bristol, Nottingham and Manchester who interviewed farmers in their areas. Their thanks are also due to Mr. W. C. Housden who prepared much of the statistical material and Mrs. Ann Bain who typed and corrected the manuscript.

Cambridge
July, 1972

F. G. STURROCK
Director, Agricultural Economics Unit

Introduction

For many years our policy with regard to sugar supplies has remained unaltered. A very reasonable working arrangement had been reached—we produced a third of our supplies from home grown sugar beet and we imported the remainder, nearly all of it cane sugar from the Commonwealth. The prospect of joining the Common Market however has thrown this convenient division of the market into the melting pot and before the Commonwealth Sugar Agreement expires in 1974, a new policy must be evolved. This therefore is the time at which to look afresh at the arrangements for our supplies.

Before doing so, it is worth reviewing briefly the circumstances that dictated policy in the past. In the seventeenth and eighteenth centuries, most of our supplies came from West Indian islands in British possession and were produced on estates worked with slave labour. For many years sugar cane was a prosperous industry but when in 1834 slavery was abolished in British possessions, the plantations were hard hit and production declined in importance until it revived once again in this century.

In the meantime, the sugar beet industry had come into being. The extraction of sugar was first accomplished by Marggraf, a German chemist, in 1747 but production on a commercial scale in Europe did not take place until it was encouraged by Napoleon during the blockade of the French coast by the British navy. Once started, however, the sugar beet industry was fostered and grew in importance. Indeed, by 1913, 80 per cent of our supplies were beet sugar imported from Europe.

During the First World War, supplies from that source were interrupted and the trade in cane sugar was revived. In the 1920's Empire trade was fostered and again we came to depend on imported raw cane sugar refined in this country.

During the Second World War, supplies were secured by the Ministry of Food, largely from the Commonwealth and this arrangement was formalised in 1951 by the Commonwealth Sugar Agreement. Under this arrangement, we guaranteed a market for a quota of sugar at an agreed price based on a '... reasonably remunerative price to efficient producers'.

In the meantime, a sugar beet industry had been created in this country in 1924. At that time, British agriculture was depressed and arable farming in particular was vulnerable to cheap imports. In the traditional Norfolk four course rotation, (clover, wheat, fodder roots, barley) soil fertility was maintained by clover that fixed nitrogen and fodder roots that allowed the farmers to clean the land of weeds. So long as either cereals or fat livestock were profitable, this system (and other variants based on it) held together but in the 1920's and 1930's the prices of grain and meat were both low and arable farmers had to face the competition of cheap imports from countries that did not require as expensive a system of maintaining fertility.

There were two weaknesses in the traditional arable rotations. The first was that the proportion of cash crops was low. The second was that the growing of fodder roots whether for folding sheep in the field or for carting to cattle in yards was labour intensive and the output was insufficient to pay the wages of the labour force required.

One solution proposed by the Ministry of Agriculture was the introduction of sugar beet. Not only did this provide an additional high value cash crop to replace the fodder roots but the tops and the sugar beet pulp provided fodder for livestock. Sugar beet was also a cleaning crop.

To establish the crop, a subsidy was promised for ten years, while farmers became accustomed to growing the crop. At the end of this time, however, the industry was still not viable and the subsidy was continued. The eighteen factories which had until then been managed by private enterprise were however taken over by the British Sugar Corporation, a public corporation in which the Government has an interest.

Although from the point of view of husbandry sugar beet seemed an ideal remedy for the hard pressed arable farmer, the introduction of this crop was severely criticised at the time. There were two main reasons. The first was that by growing sugar we were depriving the West Indies of a market

for their produce and that if we improved the lot of the British arable farmer, it was at the expense of West Indies sugar workers who were also suffering from the effects of the world wide depression.

The second criticism was that a subsidy on sugar beet was an expensive way of giving aid and helped farmers in only one part of the country—the East of England. It was further suggested that a labour intensive crop such as sugar beet was never likely to compete with sugar cane grown in tropical countries with much lower wage rates. Indeed, for many years it was taken for granted by writers on agricultural policy that sugar beet survived as a crop only because it was protected from competition from imports. Production in this country was also limited to preserve a market for Commonwealth countries, most of them undeveloped and heavily dependent on the British market for traditional exports such as sugar.

As will be shown in this report, the position has changed. The efficiency of production of sugar beet has improved substantially. The yield per acre has doubled and labour requirements have fallen by more than 80 per cent. Sugar beet is thus competitive at least with West Indian cane sugar. It is therefore no longer necessary to defend the sugar beet crop solely as a special form of protection for British farmers.

In joining the Common Market, moreover, a new aspect is introduced. We shall no longer be able to choose supplies from the cheapest sources but will be compelled to pay for refined sugar at E.E.C. prices which are higher than those now paid to our farmers or to the Commonwealth. In these circumstances, it would be to our advantage to grow more sugar in this country. The aim of this report is to examine this proposition from such evidence as is available.

CHAPTER 1

A Survey of British Sugar Beet Production

The Sample

The survey of sugar beet grown in 1970 was based on a random sample of 104 farmers. The sample which was drawn by the British Sugar Corporation was stratified into three size groups according to the acreage of beet grown on each farm under 20 acres, 20 to 50 acres, and over 50 acres. As the number of farms in each stratum was approximately proportional to the acreage of sugar beet in that stratum, each acre of sugar beet in England and Wales had an equal chance of inclusion in the sample.

<i>Stratum</i>	<i>Acres</i>		<i>Holdings</i>		<i>Sugar Beet</i>	
	<i>Sugar Beet</i>		<i>Number</i>	<i>Per cent</i>	<i>Acres</i>	<i>Per cent</i>
1	1-19 $\frac{3}{4}$		14,826	69.6	105,554	25.0
2	20-49 $\frac{3}{4}$		4,428	20.8	132,114	31.2
3	Over 50		2,046	9.6	185,241	43.8
			21,300	100.0	422,909	100.0

Representative farms were drawn from all the factories. The distribution was as follows:—

Eastern Counties	71
East Midlands	16
West Midlands	10
Yorkshire	8
	105

No attempt was made to sample Scottish growers (which are outside the jurisdiction of this department). Since then, the Cupar factory has been closed.

Statistical Criteria

The analysis of the survey results was carried out using the normal distribution and the associated probability functions. Figure 1.1 shows the distribution of gross margin per acre over the whole sample and clearly demonstrates the normality of the sample.

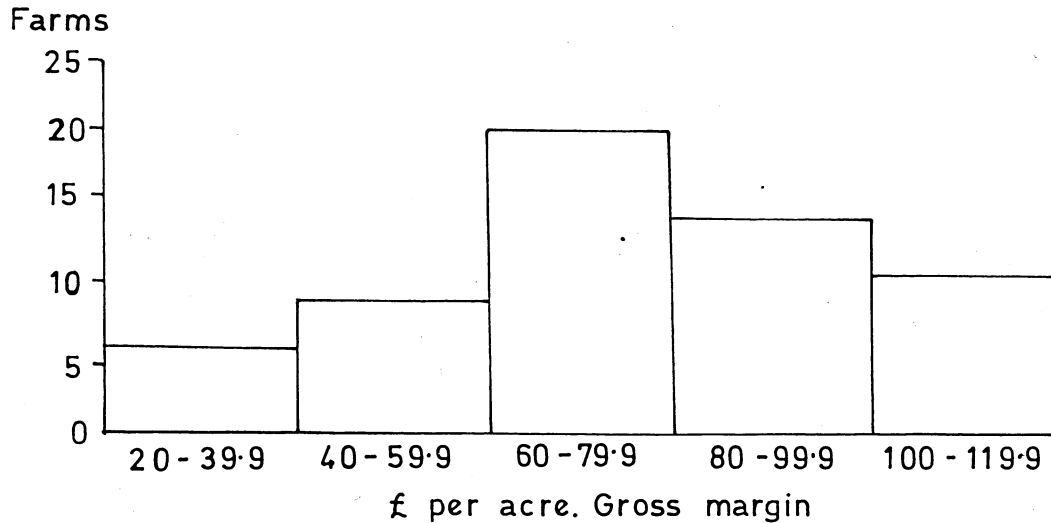
Some of the survey results are concerned with examining and describing sub samples classified within the total sample by a variety of classifications. All comparisons between sub samples are examined using Analysis of Variance to test for significant classifications. Where more than two 'classes' are analysed at the same time t tests are used to examine the significance of the difference between class means. The residual variance obtained in the analysis of variance was used as a best estimate of the population variance.

Bartlett's test for homogeneity of variance was used with every analysis of variance and in no analysis was there need to reject the results because of heterogeneity of variance.

The calculated F and t ratios are only quoted in the results where conclusions are based on marginally significant results but the level of significance is indicated by asterisks placed near the results, thus:—

* = P 0.05 ** = P 0.01 *** = P 0.001

Figure 1 Distribution of Gross Margin per acre



Costs of Production

Details of the assumptions made are given in the Appendix. The costs and returns of the three size groups are shown in Table 1.1. Three results are shown:—

1 Gross Margin A. This is output less variable costs for seed, fertiliser and sprays. As the same items of cost are deducted on each farm the Gross Margin A provides a useful method of comparing individual farms and groups. In this case, the figures are £93.0, £93.2 and £80.7 on the small, middle and large groups. As the costs of seed, fertiliser and sprays are fairly similar in all three size groups, the lower G.M. of the large group is mainly due to the lower yield and output (£100.5 per acre compared to £115.2 and £114.2).

2 Gross Margin B. This is output less *all* variable costs including contract work and casual labour. This is the G.M. that reflects most accurately the marginal contribution of the crop on each farm towards covering fixed and overhead costs and providing a profit. It is thus the figure used to plan an individual farm. It is less useful however as a means of comparing groups because the list of cost items deducted is not the same on all farms. The 'other' variable costs on the small group at £22.0 are substantially higher than the medium or large groups (£14.5 and £10.7 respectively). This is because farmers in the small group rely more heavily on contractors for haulage and cultivations. In the larger groups where the farmers make more use of their own lorries and implements, the costs of this equipment appear lower down in fixed costs.

3 Net Margin. To arrive at this figure deductions are made from the output not only for variable costs but also for an estimated share of fixed costs and overheads.

In total, fixed costs are apparently similar in all three groups. There are, however, some differences in detail. The smaller units have lower costs for machinery because as already noted, they rely on contractors to a greater extent.

As can be seen in Tables 1.2 and 1.3, the large units use significantly less labour for ploughing, seedbed preparation, hoeing and spraying. As these are mostly on large farms with large fields and implements, this is to be expected. On the other hand, more labour is used for haulage and other operations left to contractors on the small units.

4 Total Costs. In total, costs decline significantly from £93.8 on large units to £78.8 on small units. Receipts are £115.2 and £114.2 on small and medium units and £100.5 on the larger units. The latter figure reflects the lower yields on the large units (13.5 tons per acre compared to 15.6 and 15.1 tons per acre). The net margins are £21.4, £31.5 and £21.4 per acre respectively.

These are the averages but it should be stated that there are wide variations in individual results. Although the average net margin is £25 per acre, 15 of the 104 growers concerned showed a loss whereas 17 had net margins exceeding £50 or more than twice the average. An examination of the individual results showed that the size of unit had no relationship whatever either to gross or net margin. In other words, there is no indication that the small grower is at any disadvantage in margin over costs in comparison with the large unit.

5 Gross Margin and Net Margin. As can be seen from Figure 1.2, the size of the net margin is related very closely to the yield of beet per acre. The equation is as follows:—

$$Y = -162.77 + 5.69x_1 + 6.19x_2$$

(55.54) (0.41) (3.29)

$$\bar{R}^2 = 66.87$$

Y = Net margin, x_1 = yield (tons/acre), x_2 = % sugar.

Figure 1.2 Effect of yield per acre on net margin over all costs

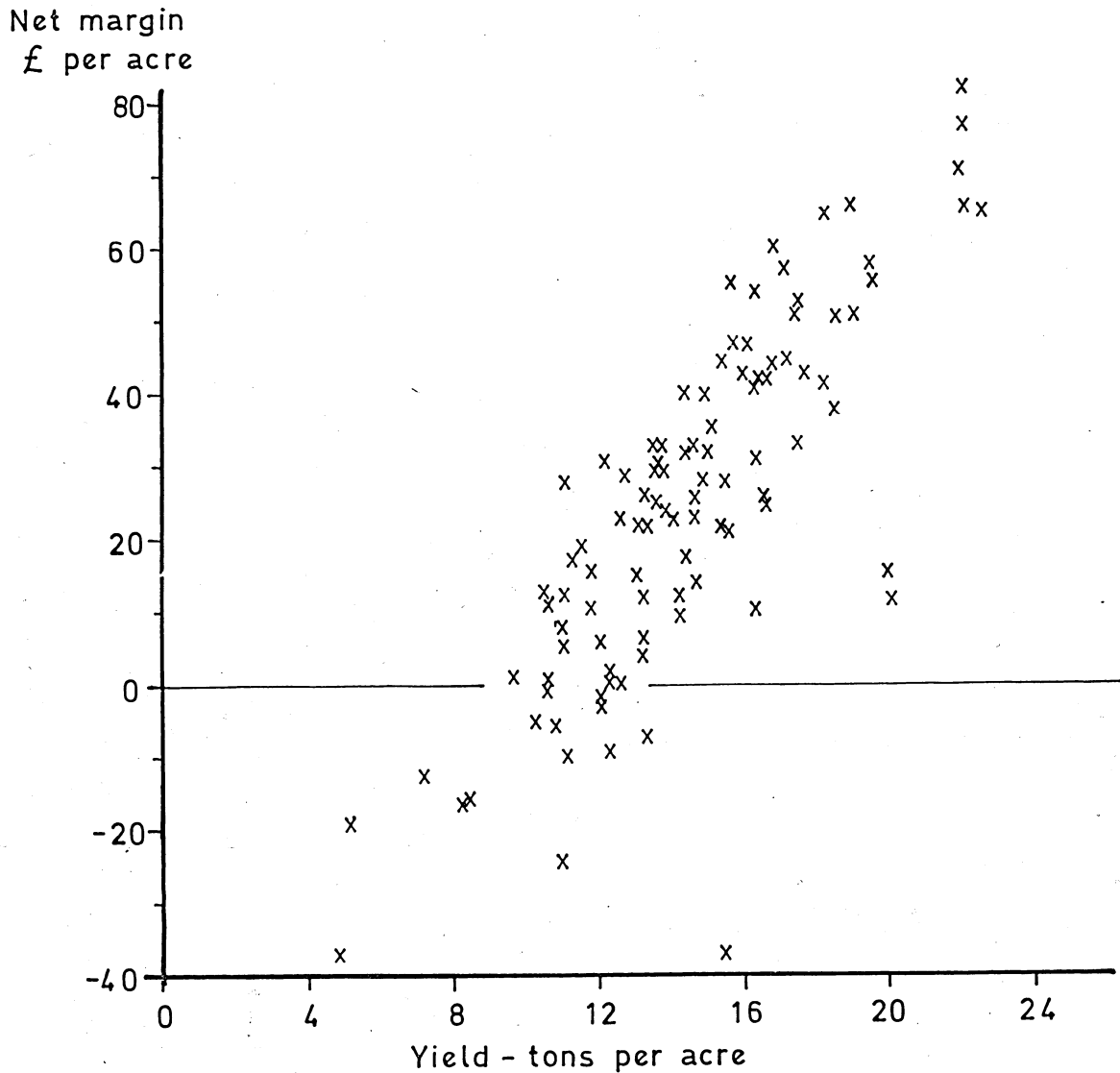


Table 1.1 Costs per Acre (Weighted by Grower)

	<i>Small</i>	<i>Medium</i>	<i>Large</i>
Acres of sugar beet:	1-20	20-50	50 and over
Number of farms	20	32	52
Yield per acre (tons)	15.6	15.1	13.5
Sugar content	17.2%	17.1%	17.1%
Gross output	£115.2	£114.2	*£100.5
<i>Variable Costs:</i>			
Seed	4.6	4.0	3.6
Fertiliser	13.6	13.0	12.1
Sprays	4.2 ¹	4.0	4.1
	£22.2	£21.0	£19.8
Gross Margin A ¹	£93.0	£93.2	*£80.7
Contract haulage	12.2	8.4	5.3
Contract other	6.5	2.1	0.7
Casual labour	3.3	2.6	2.4
Regular labour bonus	—	0.9	1.6
Miscellaneous	—	0.5	0.7
	£22.0	£14.5	£10.7
Gross Margin B ¹	£71.0	£78.7	£70.0
<i>Fixed Costs:</i>			
Regular labour	14.9	12.7	14.7
Haulage (own lorries)	—	1.4	1.6
S.B. machinery	1.7	***4.7	3.8
Share of other implements	***2.0	1.3	1.2
Tractors	7.8	6.9	7.0
Machinery (total)	11.5	14.3	13.6
FYM line B/slag, etc.	0.6	0.5	0.6
Rent and rates	10.2	8.9	9.1
Other overheads	***12.5	10.8	10.3
Total fixed costs	£49.6	£47.2	£48.5
<i>Summary:</i>			
Gross Output (receipts) ¹	£115.2	£114.2	£100.5
Total Costs ¹	**£93.8	***£82.8	£78.8
NET MARGIN ¹	£21.4	£31.5	£21.4

Gross Margin A. This is a useful standard when comparing different farms or groups.

Gross Margin B. This is the figure that would be used in planning or programming individual farms.

¹ Rounding errors occur in different calculations involved and produce errors in sub totals.