Cereal foods

UNIVERSITY OF CAMBRIDGE

CEREALS 1971 – 1977

J. G. DAVIDSON and I. M. STURGESS

Agricultural Economics Unit
Department of Land Economy
16–21 Silver Street
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Agricultural Enterprise Studies
in England and Wales

Economic Report No. 47

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FOREWORD

Cereals provide about 20 per cent of the total farm output of England and Wales and 60 per cent of total crop output. So the financial health and productive performance of the cereals enterprises are of particular interest to farmers and to other decision makers in the ancilliary industries and Government. This has been especially the case in the nineteen seventies when marked swings in product prices and rapid inflation have made financial standards unusually perishable.

Accordingly, the results of the series of surveys, carried out between 1971 and 1977 and on which this report is largely based, have been already widely used. Between surveys, updated results have been frequently estimated. Also, several special analyses of the results have been made available for publication in other research reports. The extent of these services has been made possible by the enthusiasm and energy of the main author of this report.

It is now, however, an opportune time to present a more detailed and integrated review of the more enduring features and trends shown by the surveys. The opportunity for me to participate in this has been part of the rich legacy left by Dr. F.G. Sturrock, my predecessor as Director. The form and effectiveness of the surveys and of their path-breaking precursor, the national survey of the 1964 wheat crop, owe much to his breadth of vision and tenacity.

The investigations have been joint efforts of the departments of agricultural economics in the universities of Aberystwyth, Bristol, Cambridge, Exeter, Leeds, Manchester, London (Wye College), Newcastle, Nottingham and Reading, and the economics and statistics departments of the Ministry of Agriculture, Fisheries and Food. In the analysis of the results at Cambridge, a particular debt of gratitude is owed to Mr. M.C. Thompson for writing the necessary computer programs. The authors are also indebted to Mrs. Joy Meyrick for patiently deciphering and typing numerous drafts of this report. Finally we wish to record our thanks to the farmers, drawn by random sampling, whose co-operation in providing information over a period of years has made the whole exercise possible.

Ian M. Sturgess
Director, Agricultural Economics Unit

July 1978

Agricultural Enterprise Studies in England and Wales

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

The departments in different regions of the country conduct joint studies of those enterprises in which they have a particular interest. This community of interest is recognised by issuing enterprise studies reports prepared and published by individual departments in a common series entitled "Agricultural Enterprise Studies in England and Wales".

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

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CHAPTER 1 INTRODUCTION, OBJECTIVES AND SAMPLING

1.1 Introduction

This report is based on the findings of a series of studies dealing with the production of cereals in England and Wales over the period 1971 to 1977. The original survey was intended to cover only two harvest years. The aim was to undertake a full survey of a representative sample of cereal growers for the 1971 harvest year and to augment this with a more limited amount of information from the 1972 year. In the event the unprecedented rises in both prices and production costs of cereals in 1973 made the 1971 and 1972 results of largely historical interest. Also the information collected on levels of use of inputs became of limited use for subsequent estimation of current costs of production by applying updated input prices. It was therefore decided to survey again the sample of cereal producers during 1975/76. This study was intended to concentrate on the costs of production to measure, where possible, the effect of the price changes on the profitability of cereal production. As the situation continued to change, in 1977 information was collected on a postal survey to produce further estimates of production costs and to establish whether certain trends, apparent in 1975, were of longer term importance.

Although all these surveys have been separately analysed and the information produced made available in a limited form, this is the first time the complete results have been published in a single report.

1.2 Objectives

The primary objective of the surveys was to estimate the costs of and returns from growing cereals. The results of this part of the surveys are discussed in Chapters 2 and 3. There were two other main aims. The first was to examine differences in production and harvesting techniques between regions (Chapter 4) and by size of enterprise and intensity of production (Chapter 5). The second was to assess likely future changes in the area and location of land planted to cereals (Chapter 6).

To answer the questions posed in the first two objectives the study necessarily concentrated on collecting information from established cereal producers. These are mainly large farms in the eastern half of England. However, possible changes in the total area or location of cereal production could involve land on farms which now grow little or no cereals. In general these are smaller, livestock farms found mainly in the Western half of England and in Wales. Although small as individual units, in total these farms do occupy a significant area of land which could, in changed circumstances, become available to grow cereals. It was decided therefore to extend the original survey to include a sample of farms which grow little or no cereals. These farms were visited in early 1972. The objective of this part of the survey were

(a) to establish the present farming policy,
(b) to estimate the area which could technically become available to grow cereals, and
(c) to consider the feasibility, possible scale and location of any increased area of production.

1.3 Sampling

A representative national sample of cereal growers will give a heavy concentration of readings in those counties where cereals are grown most intensively and relatively few in the counties where cereals are grown least intensively. As the proportion of cereals in the crops and grass area by county is used to determine the three regions used in the regional comparison, it was necessary to over sample these counties where cereals are least intensively grown to give a comparable number of readings with the regions of more intensive production. For the cereal growers the total sample of 350 farms was drawn from holdings of 20 hectares and over growing more than four hectares of cereals. To provide the information on farms growing no cereals, or growing cereals only in very small amounts, a second sample of 300 farms was drawn from holdings of 20 hectares and over with less than four hectares of cereals. Both samples were stratified by scale of enterprise.

1.4 Collection of Data

Ten University departments took part in the collection of data. The timing and frequency of the visits were left to the individual department, but the records on completion were returned to Cambridge for processing. The questionnaires for the farms not growing cereals contained certain subjective questions and to reduce recorder error these were completed by only six field workers.

1.5 Analysis

A possible criticism of previous commodity studies is the limited value of published calculated values for other research work. Normally the need is for individual farm data which can be regrouped and analysed to suit particular requirements. If a survey is based on a large and representative sample there are obvious advantages in being able to recall individual farm data without reverting to the original records. To achieve this some form of computerised data handling becomes essential.

The scale of this current study, with about one million numbers in 1971, a further 600 thousand in 1972 and a similar total for 1975, necessitated a systematic framework so that the information could be fully utilised on this and other studies. With this in mind the raw data were loaded on to the computer, avoiding wherever possible any calculated values. This approach has subsequently enabled the information to be re-analysed in a variety of ways to suit the requirements of several other researchers.

The tables produced in this report are based, in the main, on an analysis of the data collected for the harvest years of 1971, 1972, 1975 and 1977. In some cases it has been necessary to use assumed rather than actual values; a list of these standards is appended. Many tables presented in the report give the mean of each variable together with the standard error of the mean in brackets. Where appropriate, comparisons between sub-samples are examined using analysis of variance to test whether or not the means are significantly different. The level of significance is shown by one, two or three asterisks indicating a percentage probability of 95.0, 99.0, 99.9.

Table 1.1 Standard Machinery Cost Factors used in 1971, 1972 and 1975 Surveys

Tractors				Machinery not specific to cereals		
Category		1971 and 1972	1975	Category	1971 and 1972	1975
		£ per hour			£ per hectare	
Wheeled				Rotavators and power-harrows	2.50	3.70
Horsepower				Ploughs	0.85	2.00
Greater than	Less than or equal to			Cultivators, spring tine and disc harrows, fertilizer distributors	0.50	0.75
–	50	0.30	0.70			
50	70	0.40	1.00	Harrows, rolls, trailers	0.25	0.25
70	90	0.50	1.20	Lorry used on farm only	2.50	5.00
100	–	0.90	1.45	Lorry used generally	5.00	11.10
Four wheel drive		0.90	1.45			
Crawlers						
Above 65 h.p.		0.90	2.25			
Others		0.70	1.45			

Conventions for Cost Calculation

Machinery specific to cereal production

Depreciation and repair cost per hectare of each machine was estimated by adding 20 per cent of the written down historic value to the recorded annual cost of repairs and then dividing this sum by the area of cereals to which it was applied. Where applicable a fuel cost per hectare was then added.

Labour

Where an hourly rate was not recorded, this was estimated by adding annual gross pay to employers social security contribution and the annual value of any cottage provided and divided by 1600 (40 weeks of 40 hours).

Labour and machinery inputs

The calculation of labour and machinery inputs, expressed as man and tractor hours per hectare, is based on a sample of farms which used no contract services. In certain tables therefore, the number of observations used to calculate man and tractor hours per hectare is different to the number of observations used to calculate the other means. In tables where this occurs the differences in observation numbers are shown separately.

Allocation of overhead costs

The share of general farm overheads is 15 per cent of fixed and variable costs.

CHAPTER 2 COSTS AND RETURNS OF CEREAL PRODUCTION 1971–1977

2.1 Introduction

The 1971 harvest year proved to be the end of a long period of relatively stable prices and the last year that the Cereal Deficiency Payment Scheme would effectively apply. From 1972, grain prices, influenced by world events, increased rapidly and by 1974 the price of soft milling wheat, for example, had more than doubled. At the same time production costs were also increasing, although less uniformly between producers than the value of output as the benefits of forward buying and the effects of reinvestment were exaggerated by the higher rate of inflation. By 1975 it became clear that cereal production was moving on to a new financial plateau, substantially different to that foreseen when entry of the UK into the EEC was being negotiated.

2.2 Costs and returns in current terms

The financial results relating to the seven crops recorded on the 1971 and 1972 surveys are appended in Tables 2.6 and 2.7. The results of the 1975 survey for three crops and the estimates based on the 1977 postal survey are appended in Tables 2.8 and 2.9. A summary of the key results giving details of changes in value from 1971 to 1977 is given in Tables 2.1 and 2.2. To avoid repetition, the comparisons in Tables 2.1 and 2.2 are limited to winter wheat and spring barley, the two major cereal crops grown in England and Wales. Together these two crops accounted for more than 85 per cent of the total cereal area in the 1971 and 1972 surveys.

Table 2.1 Surveyed Costs and Returns of Winter Wheat Production, Harvests of 1971, 1972, 1975 and 1977

						Indices of change (1971=100)			
	Unit	1971	1972	1975	1977	1971	1972	1975	1977
Yield	tonnes/ hectare	4.54	4.27	4.32	4.93	100	94	95	109
Price	£/tonne	31.98	35.39	64.71	80.00	100	111	202	250
Output		145.20	151.13	279.53	393.60	100	104	193	271
Variable costs	£	26.07	28.61	61.32	92.11	100	110	235	353
Gross margin	per	119.13	122.52	218.21	301.49	100	103	183	253
Fixed costs	hectare	55.17	57.90	105.37	165.47	100	105	191	300
Net margin		63.76	64.62	112.84	136.02	100	101	177	213
Total costs		81.24	86.51	166.69	257.58	100	106	205	317
Cost per tonne of grain	£/tonne	17.89	21.15	38.58	52.25	100	118	216	292

Table 2.2 Surveyed Costs and Returns of Spring Barley Production, Harvests of 1971, 1972, 1975 and 1977

						Indices of change (1971=100)			
	Unit	1971	1972	1975	1977	1971	1972	1975	1977
Yield	tonnes/ hectare	3.72	4.09	3.44	4.40	100	110	92	118
Price	£/tonne	28.03	33.02	62.77	70.00	100	118	224	250
Output		104.26	135.07	215.92	308.00	100	130	207	295
Variable costs	£	24.55	26.69	55.77	70.23	100	109	227	286
Gross margin	per	79.71	108.38	160.15	237.77	100	136	201	298
Fixed costs	hectare	57.10	59.62	103.14	153.48	100	104	181	169
Net margin		22.61	48.76	57.01	84.29	100	216	252	373
Total costs		81.65	86.31	158.91	223.71	100	106	195	174
Cost per tonne of grain	£/tonne	21.95	21.10	46.19	50.84	100	96	210	232

During the course of the study substantial changes in values have taken place. Over the period as a whole variable costs (mainly purchase costs of fertilizer, sprays and seed) have increased proportionately more than fixed costs. However between 1975 and 1977, fixed costs per hectare, especially for barley production, have increased somewhat faster than variable costs. Returns have also increased, but rather less rapidly than costs. For example, whilst the average output per hectare for wheat in 1975 and 1977 was 127 per cent higher than the average output for 1971 and 1972, total costs per hectare increased by 153 per cent. Over the corresponding period the output of barley went up by 118 per cent whilst costs increased by 127 per cent. The effect of these changes on net margins, expressed as a percentage of output, is shown in Table 2.3.

Table 2.3 Net Margin as a Percentage of Output of Winter Wheat and Spring Barley

	1971	1972	1975	1977
		Per Cent		
Wheat	43.9	42.7	40.4	34.6
Barley	21.7	36.1	26.4	27.4

Interpretation of the movement of net margin in relation to output is complicated by the instability of yields in the years compared. This is particularly noticeable with barley where the yield rose by 10 per cent between 1971 and 1972, was 16 per cent lower in 1975 than 1972, and in 1977 was 28 per cent above the low of 1975. The effect of yield variation may be crudely dampened by comparing output and net margin averages of 1975 and 1977 with the averages of 1971 and 1972. Such a comparison shows some decline in net margins as a percentage of output, particularly of wheat. Although the average yield of wheat for 1975 and 1977 was five per cent above the average of 1971 and 1972, the corresponding net margin, as a percentage of output, declined from 43 to 37 per cent. A similar comparison for barley shows a rather smaller decline from 29 to 27 per cent, even though the average yield was no higher in the later period.

2.3 Costs and returns deflated

The rapid rises in the costs of production and the value of output were of course associated with a higher overall rate of price inflation. Over the period as a whole the general retail price level more than doubled, the annual average compound rate of increase being over 14 per cent. Hence changes in individual items of costs and returns are best examined in terms of pounds of constant purchasing power. In Table 2.4 and 2.5 the costs and returns have been deflated, using the Retail Price Index, with its base transferred to January 1978. This effectively converts the values in the years prior to 1977/78 into pounds of broadly the same purchasing power as in the 1977 harvest year.

Table 2.4 Real Costs and Returns of Winter Wheat Production, Harvests of 1971, 1972, 1975 and 1977 (in £ of 1977/78 purchasing power)

						Indices of change (1971=100)			
	Unit	1971	1972	1975	1977	1971	1972	1975	1977
Yield	tonnes/ hectare	4.54	4.27	4.32	4.93	100	94	95	109
Price	£/tonne	72.9	74.5	82.5	80.0	100	102	113	110
Output		330.8	318.2	356.5	393.6	100	96	108	119
Variable costs	£	59.4	60.2	78.2	92.1	100	101	138	155
Gross margin	per	271.4	257.9	278.3	301.5	100	95	103	111
Fixed costs	hectare	125.7	121.9	134.4	165.5	100	97	107	132
Net margin		145.2	136.0	143.9	136.0	100	94	99	94
Total costs		185.1	182.1	212.6	257.6	100	98	115	139
Product cost	£/tonne	40.8	42.6	49.2	52.3	100	104	121	128
Current value of £ in terms January 1978 purchasing power	pence	43.9	47.5	78.4	100.0	100	108	179	228

Table 2.5 Real Costs and Returns of Spring Barley Production, Harvests of 1971, 1972, 1975 and 1977 (in £ of 1977/78 purchasing power)

	Unit	1971	1972	1975	1977	Indices of change (1971=100) 1971	1972	1975	1977
Yield	tonne/ hectare	3.72	4.09	3.44	4.40	100	110	92	118
Price	£/tonne	63.8	69.5	80.0	70.0	100	109	125	110
Output		237.5	284.4	275.2	308.0	100	120	116	130
Variable costs	£	55.9	56.2	71.1	70.2	100	101	127	126
Gross margin	per	181.6	228.2	204.3	237.8	100	126	113	131
Fixed costs	hectare	130.1	125.5	131.6	153.5	100	96	101	118
Net margin		51.5	102.7	72.7	84.3	100	199	141	164
Total costs		186.0	181.7	202.7	223.7	100	98	109	120
Product cost	£/tonne	50.0	44.4	58.9	50.8	100	89	118	102
Current value of £ in terms January 1978 purchasing power	pence	43.9	47.5	78.4	100.0	100	108	179	228

Over the period, costs of production, per hectare and per tonne, have risen in real as well as in money terms. The total costs of production of wheat per hectare rose, in real terms, by 15 per cent between 1971 and 1975 and a further 21 per cent between 1975 and 1977. For barley the real costs of production rose less rapidly, by nine per cent between 1971 and 1975 and by 10 per cent between 1975 and 1977.

At the same time, the prices of wheat and barley have risen in terms of pounds of constant purchasing power, although far less regularly. In 1977/78 the prices for wheat and barley in real terms are 10 per cent above those for the 1971 harvest. They are, however, below the comparable prices received for the 1975 crops. In 1977/78 margins have been boosted by the higher yields rather than prices obtained, especially for barley. The net margin of barley for 1977 in real terms, is 16 per cent above the figure for 1975 and yet is still considerably below that for 1972, the previous year of high yield. By contrast the yield of wheat has varied less than that of barley and, as a result, the values of output and margins have been more regular. Although the value of output has risen by 18 per cent between 1971 and 1977, increases in costs, especially fertilizer and sprays, have resulted in an estimated net margin from the 1977 crop, in terms of constant purchasing power, six per cent less than that from the 1971 crop.

A comparison of net margins in current and real terms, for the four survey years is shown diagrammatically in Figure 2.1. Over the period as a whole, the margins from wheat production have been substantially better than from barley. This advantage has been due more to the consistently greater yields of wheat rather than obvious differences in production costs or markedly higher prices for wheat as opposed to barley. A second diagram, Figure 2.2, compares the net margins for wheat and barley for individual years throughout the period of the study. (Margins for years when surveys were not made have been estimated by the procedure described in Chapter 3). The effect of the increase in prices on net margins in 1973/74 is very obvious. Since 1973 the increase in costs has substantially reduced net margins. So much so that in real terms the net margin for wheat in 1977 was below that for 1971. Barley has shown a more marked increase in net margin although in 1977 part of the improvement is due to higher than average yields. If, for example, barley yields had followed a more constant trend over the period, increasing at say two per cent per annum, then the net margin for 1977 would have been almost 20 per cent lower.

2.4 Appended figures and tables

Fig. 2.1. Comparison of net margins in current and real terms (1970/71 harvest year = 100.)

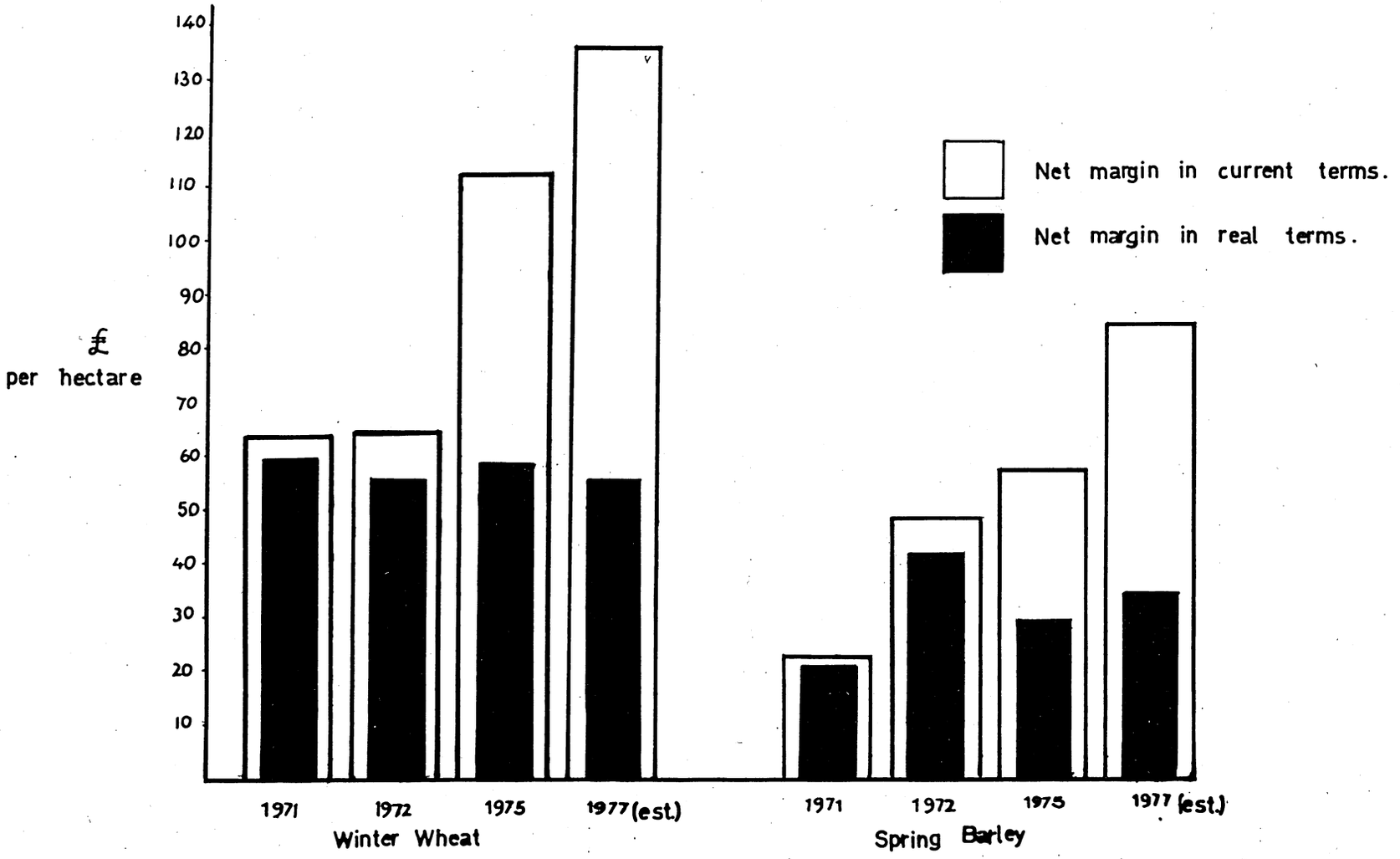


Fig. 2.2. Comparison of net margins in terms of £ of constant purchasing power.

Table 2.6 Financial Results of Cereal Crops of 1971

	Winter Wheat		Spring Wheat		Winter Barley		Spring Barley		Winter Oats		Spring Oats		Mixed Corn	
Yield tonnes per Ha	4.54	(0.06)	3.46	(0.19)	3.90	(0.80)	3.72	(0.04)	4.03	(0.12)	3.92	(0.11)	3.95	(0.10)
	£		£		£		£		£		£		£	
Value of output	145.20	(1.53)	120.14	(5.29)	110.75	(2.10)	104.26	(1.11)	116.93	(3.19)	110.29	(2.15)	112.73	(4.08)
Variable costs														
Seed	9.14	(0.17)	10.08	(0.57)	9.14	(0.32)	8.55	(0.15)	8.48	(0.30)	10.08	(0.30)	9.02	(0.57)
Fertilizer	11.27	(0.30)	10.13	(0.86)	11.52	(0.42)	9.98	(0.20)	10.35	(0.52)	8.87	(0.40)	7.86	(0.86)
Sprays	2.99	(0.17)	2.35	(0.40)	3.29	(0.35)	2.64	(0.12)	2.22	(0.20)	1.73	(0.17)	1.51	(0.32)
Contract	1.98	(0.27)	1.80	(0.89)	1.75	(0.49)	2.59	(0.27)	1.75	(0.52)	2.45	(0.44)	2.79	(0.89)
Miscellaneous	0.69	(0.07)	0.94	(0.27)	0.57	(0.07)	0.79	(0.05)	0.84	(0.12)	0.79	(0.10)	1.09	(0.15)
Total	26.07	(0.47)	25.30	(1.21)	26.27	(0.89)	24.55	(0.40)	23.64	(0.82)	23.92	(0.69)	22.27	(1.58)
Gross margin	119.13	(1.66)	94.84	(5.31)	84.48	(2.13)	79.71	(1.19)	93.29	(3.39)	86.37	(2.30)	90.46	(4.87)
Fixed costs														
Labour	8.45	(0.27)	8.90	(1.36)	8.77	(0.35)	9.14	(0.30)	9.39	(0.74)	8.72	(0.37)	10.65	(0.82)
Machinery	17.12	(0.40)	17.17	(1.01)	18.24	(0.57)	19.15	(0.35)	18.88	(0.84)	17.72	(0.62)	21.18	(1.31)
Rent and rates	19.00	(0.44)	18.68	(0.86)	17.94	(0.59)	18.16	(0.37)	18.16	(0.67)	16.98	(0.64)	16.11	(1.19)
Share of farm overheads	10.60	(0.15)	20.15	(0.32)	10.68	(0.20)	10.65	(0.10)	10.51	(0.25)	10.10	(0.17)	10.53	(1.08)
Total	55.17	(0.84)	55.26	(2.37)	55.63	(1.11)	57.10	(0.72)	56.94	(1.68)	53.52	(1.16)	58.47	(3.01)
Net margin	63.96	(1.70)	39.58	(5.73)	28.85	(2.42)	22.61	(1.33)	36.35	(3.66)	32.85	(2.50)	31.99	(4.65)
Average hectares of crop	47.5		16.8		13.6		52.2		16.0		10.8		10.5	
Number of observations	224		29		79		299		65		104		20	

Table 2.7 Financial Results of Cereal Crops of 1972

	Winter Wheat		Spring Wheat		Winter Barley		Spring Barley		Winter Oats		Spring Oats		Mixed Corn	
Yield tonnes per Ha	4.27	(0.06)	3.67	(0.13)	4.16	(0.10)	4.09	(0.05)	4.34	(0.10)	4.33	(0.10)	3.74	(0.16)
	£		£		£		£		£		£		£	
Value of output	151.13	(2.97)	134.45	(5.34)	127.93	(4.23)	135.07	(1.85)	138.01	(3.48)	138.51	(4.13)	128.32	(4.47)
Variable costs														
Seed	9.71	(0.25)	11.19	(0.44)	9.27	(0.40)	8.85	(0.17)	9.56	(0.64)	8.92	(0.30)	8.55	(0.64)
Fertilizer	13.42	(0.40)	10.72	(0.67)	13.96	(0.44)	11.64	(0.25)	13.02	(0.64)	9.79	(0.52)	9.32	(0.96)
Sprays	3.53	(0.20)	2.77	(0.40)	3.73	(0.30)	3.16	(0.15)	2.50	(0.30)	2.42	(0.30)	1.48	(0.27)
Contract	1.51	(0.27)	0.37	(0.27)	1.33	(0.44)	2.30	(0.32)	1.46	(0.57)	2.13	(0.47)	4.65	(1.28)
Miscellaneous	0.44	(0.07)	0.25	(0.10)	0.64	(0.12)	0.74	(0.05)	0.64	(0.10)	0.89	(0.15)	1.36	(0.25)
Total	28.61	(0.57)	25.30	(0.99)	28.93	(0.74)	26.69	(0.40)	27.18	(1.04)	24.15	(0.89)	25.36	(1.83)
Gross margin	122.52	(3.06)	109.15	(5.59)	99.00	(4.27)	108.38	(1.88)	110.83	(3.68)	114.36	(4.30)	102.96	(4.62)
Fixed costs														
Labour	9.24	(0.30)	9.14	(3.06)	9.71	(0.47)	9.91	(0.27)	10.01	(0.54)	10.18	(0.57)	12.16	(1.26)
Machinery	18.01	(0.47)	20.11	(0.84)	19.05	(0.84)	20.04	(0.37)	21.55	(1.01)	18.88	(0.72)	21.30	(1.41)
Rent and rates	19.37	(0.47)	21.70	(1.43)	18.78	(0.74)	18.41	(0.40)	17.82	(0.72)	17.27	(0.69)	15.52	(1.04)
Share of farm overheads	11.28	(0.15)	11.44	(0.32)	11.47	(0.20)	11.26	(0.10)	11.48	(0.27)	10.57	(0.22)	11.15	(0.40)
Total	57.90	(0.96)	62.39	(2.32)	59.01	(1.43)	59.62	(0.74)	60.86	(1.75)	56.90	(1.41)	60.13	(3.01)
Net margin	64.62	(3.11)	46.76	(6.15)	39.99	(4.03)	48.76	(1.90)	49.97	(3.90)	57.46	(4.55)	42.83	(4.65)
Average hectares of crop	56.9		16.7		15.9		51.8		13.0		10.8		10.8	
Number of observations	192		29		71		255		55		79		25	

Table 2.8 Financial Results of Crops of Winter Wheat, Spring Barley and Spring Oats Crops of 1975

	Winter Wheat		Spring Barley		Spring Oats	
Yield tonnes per Ha	4.32	(0.08)	3.44	(0.05)	3.58	(0.10)
	£		£		£	
Value of output	279.53	(4.57)	215.92	(3.19)	206.78	(6.57)
Variable costs						
Seed	19.18	(0.42)	18.41	(0.37)	21.55	(0.72)
Fertilizer	26.00	(0.86)	23.92	(0.74)	21.50	(1.24)
Sprays	11.02	(0.62)	7.71	(0.40)	4.87	(0.77)
Contract	3.98	(0.82)	4.15	(0.64)	2.79	(1.06)
Miscellaneous	1.14	(0.10)	1.58	(0.10)	1.88	(0.15)
Total	61.32	(1.48)	55.77	(1.11)	52.59	(1.98)
Gross margin	218.21	(4.99)	160.15	(3.51)	154.19	(6.28)
Fixed costs						
Labour	16.80	(0.67)	18.31	(0.57)	19.30	(0.96)
Machinery	33.09	(1.09)	32.77	(0.99)	32.84	(1.36)
Rent and rates	33.73	(0.96)	31.33	(0.84)	32.94	(1.58)
Share of overheads	21.75	(0.32)	20.73	(0.27)	20.66	(0.44)
Total	105.37	(2.13)	103.14	(4.27)	105.74	(2.89)
Net margin	112.84	(5.14)	57.01	(3.73)	48.45	(7.07)
Average hectares of crop	58.2		61.4		9.8	
Number of observations	136		179		57	

Table 2.9 Estimated Financial Results of Winter Wheat and Spring Barley Crops of 1977

	Winter Wheat	Spring Barley
Yield tonnes per Ha	4.92	4.40
	£	£
Value of output	393.60	308.00
Variable costs		
Seed	20.50	20.00
Fertilizer	34.18	27.19
Sprays	30.15	18.24
Contract	5.98	3.00
Miscellaneous	1.30	1.80
Total	92.11	70.23
Gross margin	301.49	237.77
Fixed costs		
Labour	20.90	23.70
Machinery	59.97	49.60
Rent and rates	51.00	51.00
Share of farm overheads	33.60	29.18
Total	165.47	153.48
Net margin	136.02	84.29

CHAPTER 3 ESTIMATING CURRENT COSTS OF PRODUCTION

3.1 Introduction

One important effect of the rapid inflation during the course of the survey was to emphasise the comparatively short life of financial standards for estimating current costs of production. In this case the scale of the monetary changes were such that the financial estimates for the 1971 and 1972 harvest years bore little relationship to the actual position in 1974. As a result the decision was taken to re-analyse the survey data into physical standards. With the information in this form, it became possible to reprice the physical inputs at current values to produce an updated financial estimate of production costs.

3.2 Repricing of inputs

The accuracy of repricing varied according to the detail in which physical inputs were recorded. On the survey the weight of seed used was recorded and fertilizers and sprays were divided into different categories of chemicals and application rates. Here repricing could be done fairly accurately. For items of fixed costs a cruder approach was required, involving the use of aggregate indices. Where these factors are generally applied, ignoring possible changes in relative prices, it is difficult to measure the accuracy of the estimates.

A repricing of historical inputs does assume that there has been no change in technology. At a time when the fortunes of cereal producers are changing rapidly, this may not be the case.

Using this method of repricing, estimates of production costs were produced, at intervals during the period under study. However it was not possible to check the accuracy of these estimates until the 1975 survey results became available. An example of the cost estimates produced when the information recorded on the 1971–1972 surveys was repriced at 1975 values is shown in Table 3.1 and compared with actual results from the 1975 survey.

Table 3.1 Comparisons of Estimated and Surveyed Costs of Wheat and Barley Production in 1975

	Winter Wheat		Spring Barley	
	Estimated	Surveyed	Estimated	Surveyed
	£ per hectare			
Variable costs				
Seed	18.53	19.18	17.17	18.41
Fertilizer	28.66	26.00	24.23	23.92
Sprays	6.38	11.02	5.43	7.71
Contract	3.07	3.98	4.28	4.15
Miscellaneous	0.99	1.14	1.38	1.58
Total variable costs	57.63	61.32	52.49	55.77
Fixed costs				
Labour	18.05	16.80	19.24	18.31
Machinery	32.82	33.09	34.12	32.77
Rent and rates	31.72	33.73	30.21	31.33
Share of farm overheads	21.03	21.75	20.41	20.73
Total fixed costs	103.62	105.37	103.98	103.14
Total costs	161.25	166.69	156.47	158.91

In total the estimated fixed and variable costs are similar to the actual survey results, although the components have some compensating errors. It is apparent that the up-dating procedure does not take account of changes in technology over the period, for example an increase in the volume of spraying and a reduction in the man hour requirements. The use of a factor to reprice the two main items of fixed costs, machinery and rent has, despite possible doubts, produced estimates which are very similar to the 1975 survey results. The accuracy of other estimates will partly depend on the amount of time which lapses between the collection of data and the up-dating.

In spite of certain shortcomings, the method could be used at intervals to replace full surveys. The up-dated costs could be related to MAFF estimates of yield and prices, when these became available in the

autumn, to produce a financial statement for that year. The more doubtful areas, for example changes in technology, could be checked with a limited survey or possibly by discussion with trade organisations which supply farm requisites.

3.3 Estimating costs of production in 1977

In estimating the costs of production for 1977, the up-dating procedure was reinforced with information collected by postal survey and the use of MAFF estimates of yields and prices. It was apparent that the harvest of 1977 had posed particular problems for producers; there was also the need to confirm that the changes which occurred between 1971 and 1975 were continuing. The financial estimates for 1977 have already been shown as part of a series in the appendices to Chapter 2. To allow a comparison to be made with results from the 1975 survey these results are repeated and appended in Table 3.2.

In the main the increase in costs from 1975 to 1977 is the result of higher input prices rather than changes in cultivation practices. Most of the changes which have taken place relate to the production of wheat, which is becoming increasingly concentrated in the main cereal producing areas. There is evidence from the study as a whole to suggest that, as cereals are grown more intensively, additional inputs, particularly fertilizer and sprays, will be required to maintain yields. The indications are that some of the changes which are occurring in the production of wheat relate closely to the increase in total wheat area. For barley, grown more extensively and decreasing in total area, the changes in cultivation practices are likely to occur less quickly.

Table 3.2 Comparison of Estimated Financial Results for 1977 with the Results from an Identical Sample of Farms in 1975

	Winter Wheat		Spring Barley	
	1977 Estimates	1975 Identical sample	1977 Estimates	1975 Identical sample
Yield tonnes per hectare	4.92	4.46	4.40	3.54
		£ per hectare		
Value of output	393.60	287.41	308.00	223.29
Variable costs				
Seed	20.50	19.18	20.00	18.29
Fertilizer	34.18	25.40	27.19	23.13
Sprays	30.15	10.80	18.24	8.18
Contract	5.98	4.52	3.00	2.20
Miscellaneous	1.30	0.99	1.80	1.36
Total variable costs	92.11	60.89	70.23	53.16
Gross margin	301.49	226.52	237.77	170.13
Fixed costs				
Labour	20.90	16.98	23.70	18.58
Machinery	59.97	39.56	49.60	34.45
Rent and rates	51.00	34.92	51.00	32.79
Share of overheads	33.60	22.85	29.18	20.86
Total fixed costs	165.47	114.31	153.48	106.68
Net margin	136.02	112.21	84.29	63.45

CHAPTER 4 A REGIONAL COMPARISON OF PRODUCTION

4.1 Introduction

In the period since the war agricultural production has become specialised at both farm and regional levels. One result is that cereals have become increasingly concentrated in the Eastern region and parts of central and southern England. Of the hypotheses offered to explain this change, two of the more obvious are that yields are higher in the east and that the climate is more suitable for cereal growing. So far as yields are concerned, the evidence given in Table 4.1 does not show a marked advantage in those regions where cereals are most intensively grown. The effect of climate can be demonstrated more positively. Figure 4.1 shows that the proportion of cereals in the crops and grass area is negatively correlated to the level of annual rainfall. As can be seen from the rainfall distribution map (Fig. 4.2), the areas of more intensive cereal production are associated with the drier parts of the country. Climatically the major cereal producing areas probably have a permanent advantage over the remainder of England and Wales. In the future the development of new varieties, which will adapt better to the less favourable conditions, may reduce this advantage. One of the main objectives of the surveys was to extend knowledge of differences in regional cereal production beyond that obtainable from existing statistics. It was hoped that this approach might offer some further explanation for the concentration of cereal production in eastern England.

Table 4.1 Indices of Cereal Yields by MAFF Regions, 5 Year Average 1972–1976

MAFF region	Wheat	Barley	Oats	Proportion of cereals in crops and grass area
	England and Wales average = 100			
Northern	105	109	107	80
Yorks and Lancs	104	107	106	112
Eastern	103	100	102	175
East Midland	99	101	103	136
South Eastern	97	96	102	118
West Midland	95	98	101	81
South Western	93	39	94	66
Wales	90	97	81	23

Source: MAFF Agricultural Statistics

For comparative purposes, the counties of England and Wales were divided into three regions based on the proportion of cereals in the total crops and grass area of each county. As shown in Figure 4.3 the regions could be crudely labelled eastern, central and western. The division is based on the old county boundaries as the original sample was drawn before the 1972 Local Government reorganisation.

To focus the comparison more precisely on regional differences in cereal production, counties were combined to give

- a cereal intensive group, having more than 40 per cent of the total crops and grass area under cereals,
- a cereal extensive group, with less than 20 per cent cereals and
- an intermediate group, where cereals occupied between 20 and 40 per cent of the total crops and grass area.

This procedure produced a well defined group of western cereal – extensive counties and another group of contiguous eastern and southern counties where cereals are grown intensively. The intermediate group does not constitute one clear geographic region, but is fragmented by the group of cereal intensive counties which stretches from Leicestershire to Hampshire. (Fig. 4.3). A full list of the counties included in the regions is appended in Table 4.11.

Fig. 4.1

Relationship between the percentage area of crops and grass under cereals and annual rainfall by county.
(England and Wales)

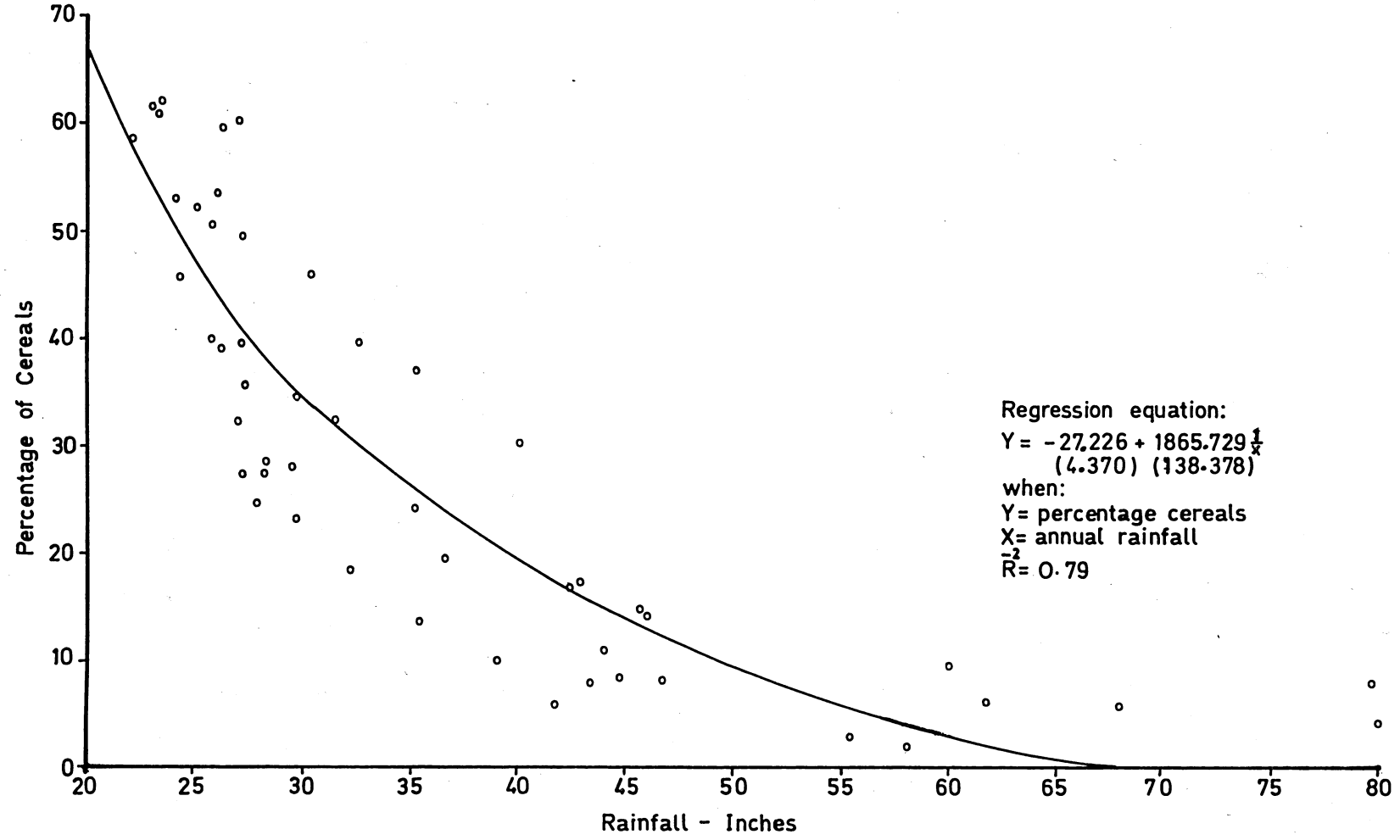


Fig. 4.3 Intensive, extensive and intermediate cereal growing regions of England and Wales.

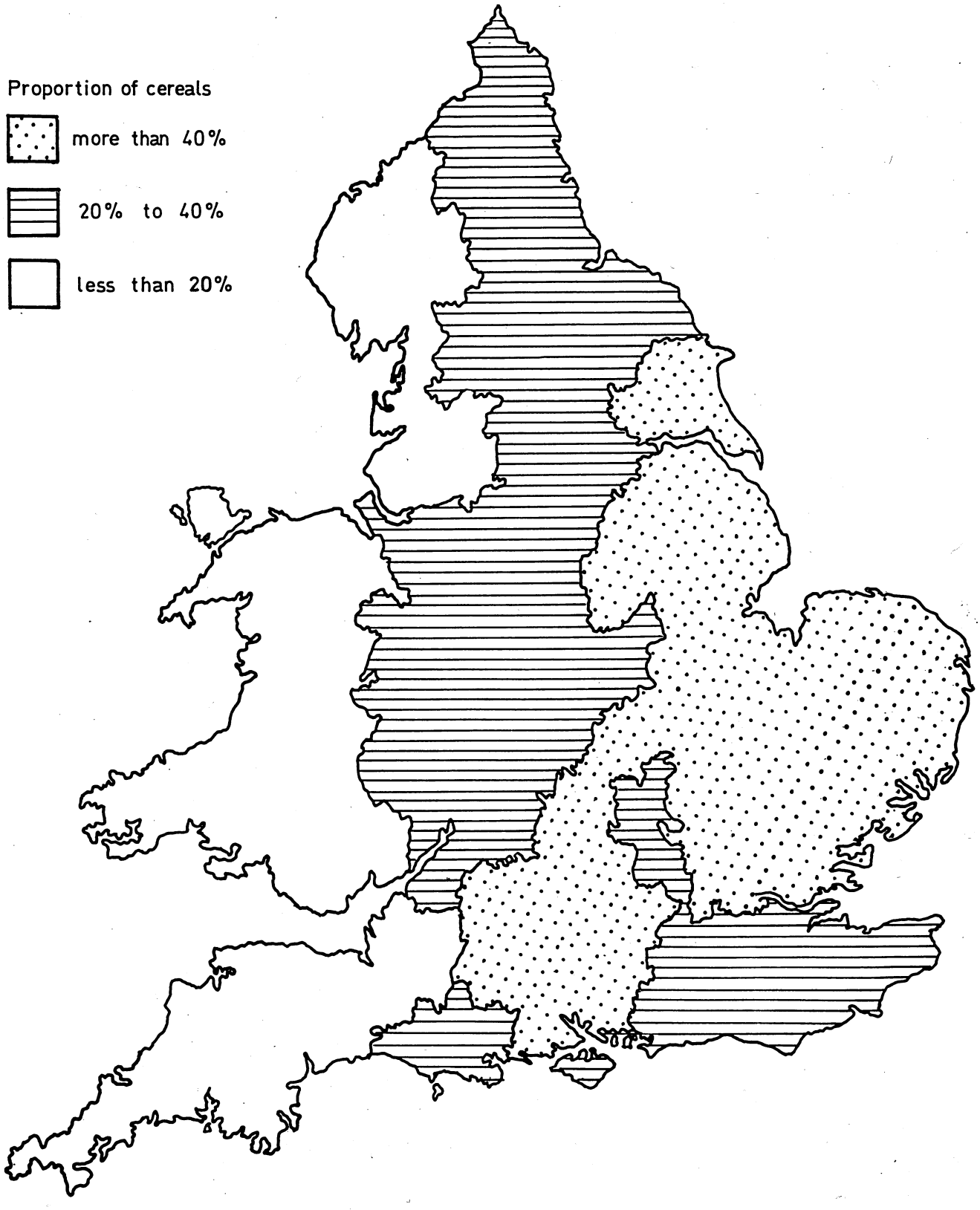
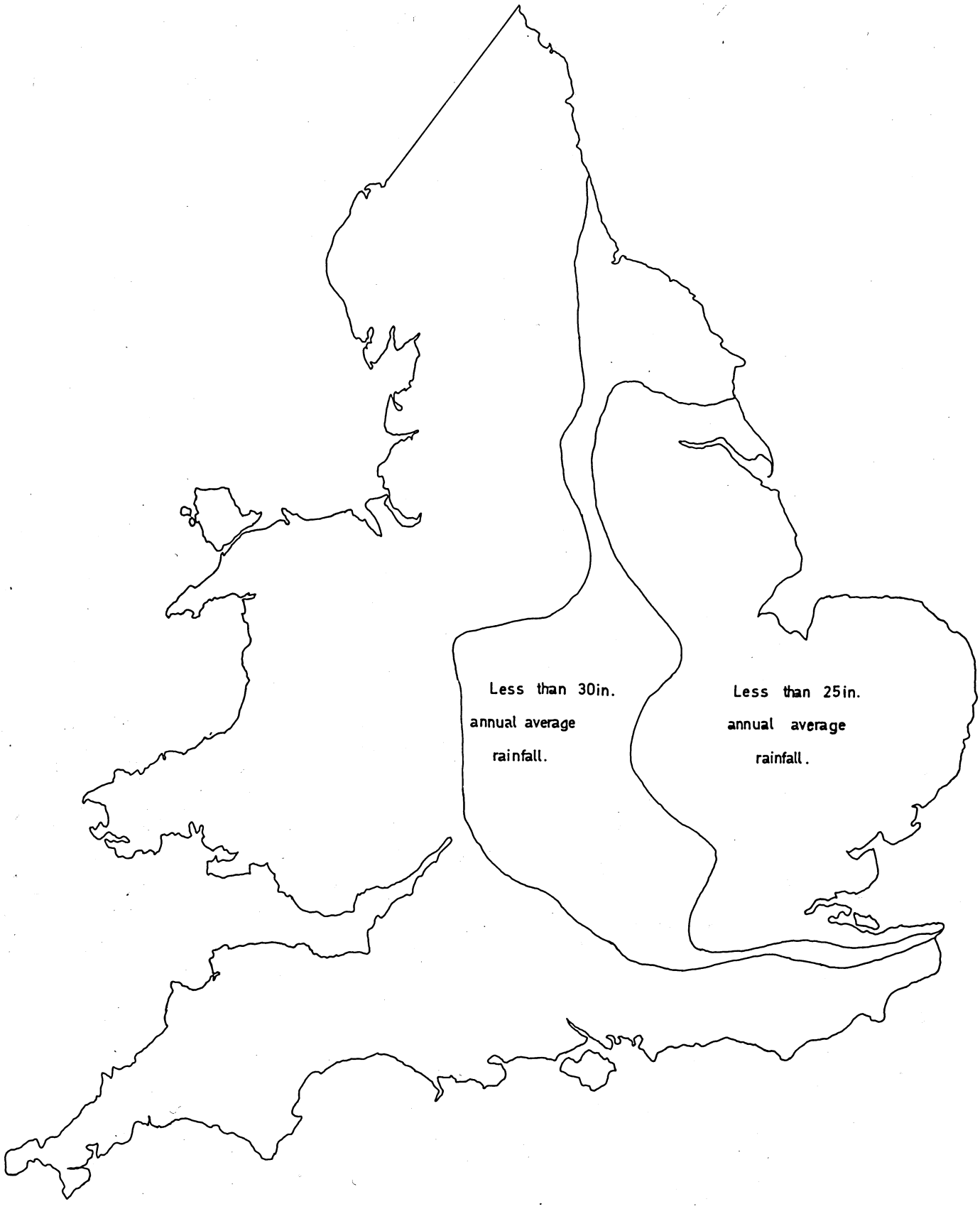


Fig. 4.2. Areas of England and Wales distinguished by typical lowland rainfall.



4.2 Results of the regional comparison

Because financial comparisons tend to mask the relatively small differences in techniques between the regions, the information from the original survey has been re-analysed into a physical form. The results of the regional analysis, for the six main cereal crops, are appended in Table 4.9 and Table 4.10. As in Chapter 2, the main comparison of performance is limited to spring barley and winter wheat. This again avoids the duplication of tables and the use of smaller sub-samples which are statistically less reliable and which, in some cases, confuse rather than clarify regional variations. For example, with the exception of spring barley, all the cereal crops in the least intensive counties had a significantly lower yield. However as spring barley accounts for more than two thirds of the total cereal area in this region, it is clearly the ability to grow this crop in competition with the other regions that is of major importance.

Certain key factors which explain some of the variation in production between the regions are given in Tables 4.2 and 4.3, expressed as indices of the England and Wales means.

Table 4.2 Indices of Regional Differences in Surveyed Yields and Inputs of Winter Wheat

Per hectare	England & Wales	Intensive counties	Intermediate counties	Least intensive counties
	England and Wales mean = 100			
Yield	100	104	96	90
Total fertilizers	100	100	98	105
Nitrogen	100	104	94	91
Phosphate	100	95	102	124
Potash	100	96	103	116
Total sprays	100	102	93	100
Wild oat sprays	100	142	9	59
Growth regulators	100	87	97	176
Man hours	100	95	109	108

Table 4.3 Indices of Regional Differences in Surveyed Yields and Inputs of Spring Barley

Per hectare	England & Wales	Intensive counties	Intermediate counties	Least intensive counties
	England and Wales mean = 100			
Yield	100	102	99	99
Total fertilizers	100	105	106	87
Nitrogen	100	111	106	78
Phosphate	100	99	105	97
Potash	100	100	106	95
Total sprays	100	111	93	87
Wild oat sprays	100	187	7	23
Fungicides	100	141	90	41
Man hours	100	92	112	107

4.3 Winter wheat production

For winter wheat (Table 4.2) yields were significantly higher in the cereal intensive counties compared with the cereal extensive counties, although in total the costs of production were very similar – in £ of 1977/78 purchasing power £81.52 per hectare (intensive) and £82.38 per hectare (extensive). However, there are differences in the physical inputs which make up these financial totals. For example more nitrogen per hectare was used in the intensive counties but application of phosphate and potash were lower than in the cereal extensive counties. Similarly whilst the total volume of sprays varied little between the regions, there was clearly a greater need to control wild oats in the most intensive counties, whereas the least intensive, in keeping with the reduced dressings of nitrogen, used proportionately more growth regulators. In general the survey produced little evidence to explain the differences in yield; climate would appear to be a major factor.

4.4 Spring barley production

In contrast to winter wheat there was no significant difference in the yield of spring barley between the regions. There were nevertheless more obvious differences in inputs. For example growers of spring barley in the intensive cereal counties used per hectare, 21 per cent more fertilizer and 28 per cent more sprays. As yields were similar, some of the increased inputs can be explained by the more fundamental differences between the regions, particularly the differing intensity of cropping and stocking (Table 4.4). In the intensive counties, cereals occupied 60 per cent of the crops and grass area on the sample farms, compared with only 38 per cent on the farms in the least intensive counties. In the main cereal growing areas, barley normally occupies the worst position in the rotation, frequently grown as the third or fourth cereal in a succession of white straw crops. In the areas where cereals are grown more extensively, spring barley is often the first or second cereal after a break and benefits from the increased levels of fertility and the reduced incidence of soil-borne diseases. At present this potential yield advantage of barley in the cereal extensive counties is being masked by the increased use of fertilizer and sprays in the more intensive areas.

Table 4.4 Cropping Patterns, Stocking Rates, and Labour on Surveyed Farms in Regions of Different Intensity of Cereal Growing, Mean of 1971 and 1972 Crop Years

	Unit	Most intensive counties	Intermediate counties	Least intensive counties
Crops and grass area	Hectares per farm	240.4	186.6	89.8
Cereal crops	Per farm average	60.4	54.7	38.1
Other arable	percentage of	17.2	8.6	5.5
Temporary grass	total crops and	12.7	16.9	22.4
Permanent grass	grass area	9.7	19.8	34.0
Dairy cows		5.0	6.6	14.1
Dairy followers		4.3	5.0	10.5
Beef cows		1.4	2.0	3.1
Beef stores	Per farm average	8.2	12.0	18.9
Ewes	number per 100	9.0	17.2	43.4
Store lambs	hectares	19.4	0.9	13.5
Sows		2.8	2.1	0.8
Fattening pigs		12.7	22.1	16.5
Poultry		136.2	200.3	138.1
Family labour	Per farm average full time man equivalents	0.2	0.2	0.7
Regular hired labour	per 100 hectares	1.0	0.7	0.6

4.5 Labour and machinery inputs

Other areas of possible differences were considered in the analysis. The number of man hours required per hectare is greater in the cereal extensive than in the cereal intensive counties, more especially for spring barley. In part this can be explained by the labour required to handle an increasing amount of straw (Tables 4.5 and 4.10) as this by-product becomes more valuable as the importance of livestock increases. There was less evidence (Table 4.6) to show that the slightly lower total number of man hours required in the intensive counties was associated with a higher level of investment in specialist cereal machinery. Although by 1975 a large difference had emerged, there was insufficient evidence to decide whether this was largely the result of inflation coupled with a more rapid turn-over of machinery, or part of a longer term trend.

Table 4.5 Labour Inputs in Total and where Straw Handling is excluded, by Region, Mean of 1971 and 1972 Crop Years

	England and Wales		Most intensive counties		Intermediate counties		Least intensive counties		Between groups maximum significant difference
1 Winter wheat									
Total man hours per ha	17.0	(0.44)	16.2	(0.49)	18.6	(1.15)	18.3	(1.07)	**
Man hours excluding straw handling	13.7	(0.33)	13.5	(0.34)	14.0	(0.89)	14.0	(1.01)	
Number of observations	224		143		56		25		
2 Spring barley									
Total man hours per ha	18.4	(0.48)	16.9	(0.71)	20.6	(1.06)	19.7	(0.69)	***
Man hours excluding straw handling	13.9	(0.41)	13.1	(0.65)	14.6	(0.78)	14.9	(0.59)	*
Number of observations	282		147		62		73		

Table 4.6 Average Stocks of Machinery Specific to Cereal Production per Surveyed Farm in Regions of Different Intensity of Cereal Growing, Mean of 1971 and 1972 Crop Years

	England & Wales		Most intensive counties		Intermediate counties		Least intensive counties	
	£ per hectare, valued at historic cost							
At 1971	43.34	(1.26)	45.07	(1.66)	40.53	(2.67)	45.44	(2.94)
At 1975	65.26	(3.11)	72.80	(4.40)	56.54	(6.47)	55.28	(7.02)
(Percentage change 1975 on 1971)	(51)		(62)		(39)		(22)	

4.6 Storage and marketing

Grain storage, not included in the comparison of investment in machinery, has become an integral part of cereal production and, as such, can affect a marketing strategy. The survey showed (Table 4.7) that farms in the most intensive counties have a volume of storage per cereal hectare greater than farms in the least intensive areas, by something over half a tonne per cereal hectare. This appears to have some effect on the pattern of sales where a greater proportion of grain is sold off the farm early in the season in the least intensive counties. A complete pattern of sales for the three regions is shown in Figure 4.4.

Fig. 4.4. Sales of grain off the farm by region. Average of 1971 and 1972 survey years September to August years.

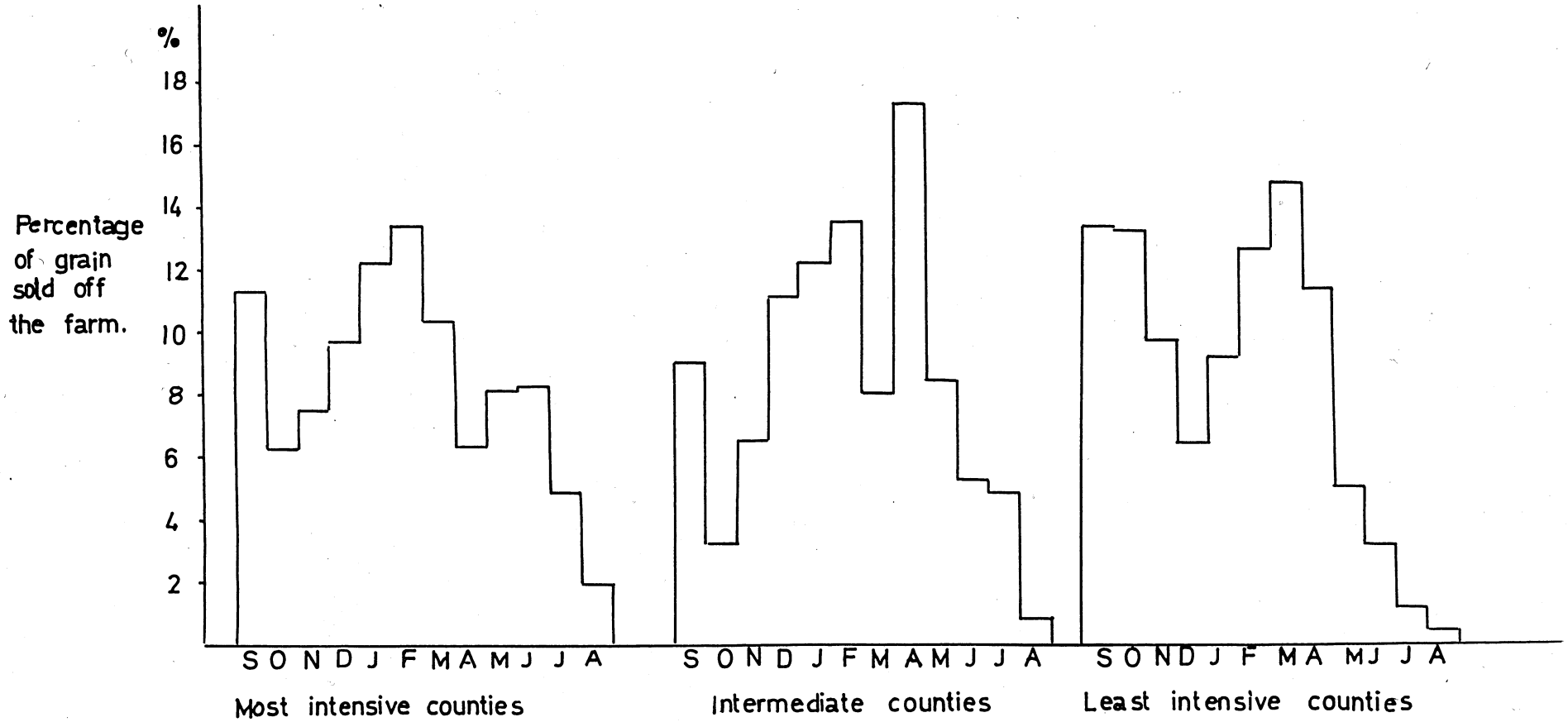


Table 4.7 Average Storage Capacity, Sales Pattern and Prices Received per Surveyed Farm in Regions of Different Cereal Growing Intensity, Mean of 1971 and 1972 Crop Years

	Unit	Most intensive counties	Intermediate counties	Least intensive counties
Storage capacity	tonnes per cereal hectare	3.68	3.58	3.11
Sales made by				
October	per cent	17	12	26
December	of total	35	29	42
February	annual sales	60	55	64
Average price for	£ per tonne			
Winter wheat	(including deficiency	33.88	34.29	34.43
Spring barley	payment)	31.14	30.12	34.33

4.7 Implications for the future

An important point to emerge from the regional comparisons are the basic differences in the wheat and barley situations. Probably the most important is that wheat appears to grow less well, despite similar levels of inputs, on the western side of England and in Wales. By contrast, barley does not show a similar reduction in yields and moreover needs considerably less inputs. The overall effect of higher wheat yields becomes more apparent when the individual cereals are combined, on an area weighted basis, to give an average cereal yield by region. (Table 4.8). From this comparison it can be seen that the most intensive counties have a more marked advantage over the intermediate and cereal extensive counties.

Table 4.8 The Average Yield of all Cereals, Area Weighted, by Region, Mean of 1971 and 1972 Survey Years

England and Wales	Most intensive counties	Intermediate counties	Least intensive counties
	tonnes per hectare		
4.14	4.27	4.04	3.85

The variation in wheat yields between the regions does reduce, in the cereal-extensive counties, the current advantage of wheat over barley. The implication of this is that any extension of the total wheat area is more likely to be in the cereal-intensive counties. In these counties it is probable that any additional wheat will replace barley in the rotation. As wheat begins to occupy less favourable positions in the rotation, more fertilizers and sprays will be required to maintain yields.

4.8 Appended tables

Table 4.9 Average Physical Characteristics per Surveyed Farm of Cereal Growing Enterprises in Regions of Different Cereal Growing Intensity, Means of 1971 and 1972 Crop Years

Section 1: Winter Wheat

	Unit	England & Wales		Most intensive counties		Intermediate counties		Least intensive counties		Between region maximum significant difference
Yield	tonnes per hectare	4.44	(0.04)	4.60	(0.05)	4.26	(0.09)	3.98	(0.16)	***
Seed		188.3	(1.38)	188.7	(1.88)	188.4	(2.64)	186.0	(4.77)	
Fertilizer	kg									
Nitrogen	per	91.4	(2.01)	94.8	(2.70)	86.4	(3.63)	83.6	(5.96)	*
Phosphate	hectare	44.3	(1.51)	42.1	(1.83)	45.0	(2.72)	55.0	(6.93)	***
Potash		38.9	(1.27)	37.3	(1.66)	40.2	(2.66)	45.0	(3.92)	*
Area sprayed for										
Annual weeds		84.6	(1.87)	85.3	(2.18)	82.1	(4.67)	85.6	(6.48)	
Couch		0.3	(0.24)	0.3	(0.33)	0.6	(0.64)	–		
Wild oats	per	7.9	(1.08)	11.2	(1.58)	0.7	(0.54)	4.7	(3.32)	***
Blackgrass	cent	2.6	(0.58)	3.5	(0.82)	1.3	(1.14)	–		*
Aphids	of total	0.5	(0.27)	0.6	(0.43)	0.3	(0.34)	–		
Area sprayed with										
Cycocel		7.2	(1.13)	6.3	(1.30)	7.0	(2.42)	12.7	(4.98)	**
Fungicide		2.9	(0.79)	2.0	(0.69)	5.6	(2.85)	2.3	(2.22)	*
Grammoxone		1.7	(0.62)	1.2	(0.55)	2.6	(1.49)	2.2	(2.22)	
Labour input	Man hours per hectare	17.0	(0.44)	16.2	(0.49)	18.6	(1.15)	18.3	(1.07)	**
Machinery input	Tractor hours per hectare	13.6	(0.39)	12.9	(0.41)	14.5	(1.00)	15.6	(1.18)	**
Area of crop	Hectares	53.4	(3.06)	66.4	(4.45)	38.8	(4.65)	14.2	(1.98)	
Number of observations		373		240		88		45		
Observations for labour and machinery inputs		224		143		56		25		

Section 2: Spring Barley

	Unit	England & Wales		Most intensive counties		Intermediate counties		Least intensive counties		Between region maximum significant difference
Yield	tonnes per hectare	3.91	(0.03)	3.94	(0.05)	3.89	(0.07)	3.86	(0.06)	
Seed		175.1	(2.64)	174.0	(4.90)	179.5	(3.51)	173.9	(2.01)	
Fertilizer	kg									
Nitrogen	per	72.1	(1.30)	79.9	(1.89)	76.7	(2.48)	56.5	(2.30)	***
Phosphate	hectare	38.9	(0.68)	38.7	(0.90)	41.0	(1.07)	37.6	(1.49)	*
Potash		39.4	(0.75)	39.4	(1.04)	41.9	(1.48)	37.5	(1.51)	*
Area sprayed for										
Annual weeds		85.7	(1.39)	88.5	(1.83)	87.3	(2.77)	80.1	(3.21)	**
Couch		0.2	(0.20)	–		0.1	(0.12)	0.5	(0.38)	
Wild oats	per	8.2	(0.93)	15.3	(1.74)	0.6	(0.39)	1.9	(0.96)	***
Blackgrass	cent of total	0.7	(0.31)	1.3	(0.53)	0.1	(0.06)	0.2	(0.23)	*
Area sprayed with										
Fungicides		8.3	(1.02)	11.7	(1.69)	7.5	(2.24)	3.4	(1.36)	***
Grammoxone		3.2	(0.66)	1.2	(0.43)	3.8	(1.52)	6.0	(1.84)	***
Labour input	Man hours per hectare	18.4	(0.48)	16.9	(0.71)	20.6	(1.06)	19.7	(0.69)	***
Machinery input	Tractor hours per hectare	14.3	(0.30)	12.8	(0.35)	16.1	(0.77)	15.9	(0.57)	***
Area of crop	Hectares	50.0	(2.52)	66.0	(3.90)	54.2	(6.74)	21.4	(2.06)	
Number of observations		499		244		104		151		
Observations for labour and machinery inputs		282		147		62		73		

Section 3: Spring Oats

	Unit	England & Wales		Most intensive counties		Intermediate counties		Least intensive counties		Between region maximum significant difference
Yield	tonnes per hectare	4.10	(0.08)	4.37	(0.10)	4.06	(0.17)	3.62	(0.15)	***
Seed		192.8	(2.26)	185.8	(2.64)	205.2	(4.64)	197.0	(5.52)	***
Fertilizer	kg									
Nitrogen	per	57.7	(2.32)	62.4	(3.04)	60.2	(7.04)	46.9	(4.05)	***
Phosphate	hectare	35.1	(1.28)	36.4	(1.66)	32.5	(2.99)	34.3	(3.14)	
Potash		36.3	(1.38)	38.3	(1.97)	33.3	(3.07)	34.5	(3.24)	
Area sprayed for										
Annual weeds		72.7	(3.33)	76.1	(4.69)	66.6	(8.02)	70.6	(7.15)	
Area sprayed with	per cent									
Cycocel	of total	1.8	(0.84)	2.0	(1.34)			2.8	(2.17)	
Fungicide		1.2	(1.46)	2.3	(1.63)					
Grammoxone		4.0	(1.56)	1.7	(1.26)	9.1	(5.08)	4.8	(3.05)	*
Labour input	Man hours per hectare	17.7	(0.64)	16.3	(0.77)	20.1	(1.67)	18.6	(1.22)	*
Machinery input	Tractor hours per hectare	13.8	(0.48)	12.8	(0.62)	16.0	(1.26)	14.6	(0.77)	*
Area of crop	Hectares	10.1	(0.87)	13.4	(0.33)	7.7	(1.15)	5.7	(0.56)	
Number of observations		164		86		33		45		
Observations for labour and machinery inputs		103		56		22		25		

Section 4: Spring Wheat

	Unit	England & Wales		Most intensive counties		Intermediate counties		Least intensive counties		Between region maximum significant difference
Yield	tonnes per hectare	3.60	(0.12)	3.76	(0.14)	3.63	(0.20)	3.14	(0.48)	**
Seed		204.6	(4.02)	205.9	(5.52)	195.8	(8.16)	214.7	(8.66)	
Fertilizer	kg									
Nitrogen	per	67.4	(4.46)	65.0	(6.36)	89.4	(10.53)	47.4	(9.78)	**
Phosphate	hectare	34.3	(2.58)	31.5	(3.99)	47.7	(4.37)	26.2	(4.87)	***
Potash		37.3	(3.05)	32.0	(4.40)	57.0	(5.97)	27.6	(4.91)	***
Area sprayed for										
Annual weeds	per cent	83.6	(5.62)	77.8	(9.88)	95.6	(10.76)	85.0	(11.30)	*
Wild oats	of total	6.3	(3.14)	8.9	(5.40)			6.9	(6.91)	
Labour input	Man hours per hectare	17.2	(0.96)	16.6	(1.22)	14.7	(0.76)	21.4	(2.60)	*
Machinery input	Tractor hours per hectare	13.4	(0.68)	12.3	(0.78)	13.0	(0.73)	16.5	(2.02)	*
Area of crop	Hectares	15.0	(2.35)	15.0	(3.16)	19.4	(6.43)	10.1	(2.57)	
Number of observations		45		25		11		9		
Observations for labour and machinery inputs		31		16		8		7		

Section 5: Winter Barley

	Unit	England & Wales		Most intensive counties		Intermediate counties		Least intensive counties		Between region maximum significant difference
Yield	tonnes per hectare	4.05	(0.07)	4.09	(0.09)	4.24	(0.20)	3.74	(0.13)	***
Seed		178.3	(2.76)	174.5	(3.64)	183.3	(7.03)	188.3	(4.64)	
Fertilizer	kg									
Nitrogen	per	89.8	(2.42)	91.2	(3.09)	95.5	(4.50)	79.7	(7.19)	*
Phosphate	hectare	49.3	(1.67)	50.3	(2.34)	44.0	(3.23)	49.5	(4.51)	
Potash		47.1	(1.77)	46.2	(2.40)	44.4	(3.34)	52.5	(5.33)	
Area sprayed for										
Annual weeds		89.4	(2.87)	90.0	(3.60)	94.6	(5.58)	83.3	(9.83)	
Wild oats	per cent	5.9	(2.04)	7.6	(2.77)			4.2	(4.17)	
Blackgrass	of total	3.7	(1.46)	5.5	(2.41)					
Area sprayed with										
Fungicide		16.1	(2.88)	19.0	(4.12)	7.4	(5.45)	12.5	(6.90)	
Grammoxone		2.2	(1.32)	2.1	(1.49)			4.2	(4.17)	
Labour input	Man hours per hectare	17.3	(0.70)	16.1	(0.84)	20.7	(2.06)	17.9	(1.06)	*
Machinery input	Tractor hours per hectare	14.3	(0.70)	12.9	(0.71)	17.7	(2.26)	15.5	(1.44)	*
Area of crop	Hectares	15.0	(1.04)	17.4	(1.56)	11.7	(1.26)	7.7	(0.81)	
Number of observations		128		86		18		24		
Observations for labour and machinery inputs		82		51		16		15		

Section 6: Winter Oats

	Unit	England & Wales		Most intensive counties		Intermediate counties		Least intensive counties		Between region maximum significant difference
Yield	tonnes per hectare	4.25	(0.08)	4.34	(0.11)	4.45	(0.19)	3.82	(0.15)	***
Seed		185.8	(2.51)	184.5	(3.14)	182.0	(4.64)	192.1	(5.52)	
Fertilizer	kg									
Nitrogen	per	71.3	(2.90)	76.8	(5.08)	74.8	(4.62)	60.9	(5.85)	**
Phosphate	hectare	47.6	(2.37)	45.3	(3.34)	49.9	(3.34)	48.3	(6.14)	
Potash		43.2	(2.42)	40.2	(3.60)	43.8	(4.07)	46.4	(5.65)	
Area sprayed for Annual weeds	per cent of total	80.5	(3.76)	87.0	(5.20)	89.8	(5.70)	63.9	(8.68)	***
Area sprayed with Cycocel		6.5	(2.35)	8.5	(4.29)	7.4	(5.14)	3.2	(3.23)	
Labour input	Man hours per hectare	18.1	(0.99)	16.1	(1.43)	17.3	(1.98)	21.9	(1.50)	*
Machinery input	Tractor hours per hectare	14.5	(0.84)	12.9	(0.71)	13.3	(1.65)	18.1	(1.33)	*
Area of crop	Hectares	13.8	(1.34)	17.0	(2.32)	17.0	(2.74)	6.5	(1.12)	
Number of observations		99		41		27		31		
Observations for labour and machinery inputs		67		26		22		19		

Table 4.10 Crop Composition and Product Disposal on Surveyed Aggregate* Cereal Growing Enterprises in Regions of Different Cereal Growing Intensity, Means of 1971 and 1972 Crop Years

	Unit	Most intensive counties	Intermediate counties	Least intensive counties	England & Wales
Area in					
Winter wheat		44.6	33.0	13.0	39.2
Spring wheat	per cent	1.0	2.1	1.8	1.3
All wheat	of total	45.6	35.1	14.8	40.5
Spring barley	surveyed	45.0	54.6	65.7	49.0
Winter barley	cereal	4.2	2.0	3.7	3.7
All barley	area**	49.2	56.6	69.4	52.7
Spring oats		3.2	2.5	5.2	3.2
Winter oats		2.0	4.4	4.1	2.7
All oats		5.2	6.9	9.3	5.9
Proportion of grain sold	per cent				
Wheat	of total	97.0	96.4	77.1	95.2
Barley	sales	76.7	70.5	50.9	68.0
Oats		48.8	56.9	27.6	44.2
All grain		85.2	79.4	53.3	78.4
Disposal of straw					
Wheat straw					
Baled		31	46	73	39
Burnt		66	54	27	59
Ploughed in		3	0	0	2
Barley straw	per cent				
Baled	of estimated	56	83	96	67
Burnt	production	41	16	4	31
Ploughed in		3	1	0	2
Oats straw					
Baled		56	59	99	70
Burnt		41	41	1	29
Ploughed in		3	0	0	1
All straw					
Baled		43	66	93	52
Burnt		54	33	7	45
Ploughed in		3	1	0	3

* For the purpose of this table, production surveyed in each region is regarded as being made on one regional 'farm'.
** Residual area is mixed corn.

Table 4.11 Counties Included in the Three Regions

(1) **Most intensive counties** (More than 40 per cent cereals)

Bedford, Berkshire, Cambridgeshire and Isle of Ely, Essex, Hampshire, Hertford, Huntingdon, Lincolnshire (Lindsey, Kesteven and Holland), Norfolk, Northampton, Nottingham, Oxford, Rutland, Suffolk, Wiltshire, Yorkshire (East Riding).

(2) **Intermediate counties** (from 20 to 40 per cent cereals)

Buckingham, Cheshire, Derbyshire, Gloucester, Dorset, Durham, Hereford, Isle of Wight, Kent, Leicester, Northumberland, Shropshire, Stafford, Surrey, Sussex, (East and West), Warwick, Worcester, Yorkshire, (North and West Riding).

(3) **Least intensive counties** (less than 20 per cent cereals)

Cornwall, Cumberland, Devon, Lancashire, Somerset, Westmorland and all Wales.

CHAPTER 5 IMPACT OF SIZE AND INTENSITY OF PRODUCTION

5.1 Introduction

Two important changes have taken place in the pattern of cereal production since the war. The first, a change in the location of cereal growing, was discussed in Chapter 2. The second is a change in the distribution of cereal area between farms, as cereal production has become increasingly concentrated on the larger holdings. For example, since 1962 the proportion of the cereal area on farms of more than 120 hectares has increased from about 45 per cent to a little over 60 per cent. As the number of farms over 120 hectares has not kept pace with the increase in total cereal area, the effect of the change is two-fold. Cereals are now grown in larger units and occupy a bigger proportion of the crops and grass area on the larger farms. The purpose of this chapter is firstly to assess whether yields, levels of physical inputs and marketing practices vary between enterprises of different sizes and, secondly to consider the effect of increasing the proportion of cereals in the total crops and grass area.

5.2 Results of analysis by size of enterprise

The original sample was stratified into six groups by size of cereal enterprise ranging from farms with less than 20 hectares of cereals to those with over 200 hectares. Details of the six size groups are shown in Table 5.1.

Table 5.1 Size Strata of Survey of Cereal-Producing Farms

Group number	Cereal area in 1971 from - to	Group number	Cereal area in 1971 from - to
	hectares		hectares
1	4.0 - 19.9	4	80.0 - 119.9
2	20.0 - 39.9	5	120.0 - 199.9
3	40.0 - 79.9	6	200.0 and over

Using this stratification the information collected on the original surveys has been re-analysed by size of cereal enterprise. As in previous chapters the results are confined to the two most important cereal crops, spring barley and winter wheat.

5.3 Financial results by size of enterprise

The financial results for the six size groups, expressed as indices of the total sample mean, are given in Table 5.2. The evidence from the table suggests that certain economies of size do exist in that farms with more than 80 hectares of cereals had, on average, better results than the farms with less than 80 hectares of cereals. This applies to both winter wheat and spring barley. However the pattern of improvement as size increases is not uniform over the whole range. It is apparent that the farms growing from 20 to 40 hectares of cereals had uniformly poorer results than the other five size groups. By contrast the two groups of farms which grow from 80 to 200 hectares of cereals had a consistently better performance than the other four size groups. With beyond 200 hectares of cereals, there is some indication that farms begin to show certain diseconomies of size; on the farms surveyed, generally, increased costs were not offset by higher yields.

5.4 Physical inputs by size of enterprise

To consider possible differences, other than financial, between the size groups, the information has been re-analysed to compare different levels of physical inputs. The full results of this analysis are appended in Table 5.8, 5.9 and 5.10. For comparative purposes, certain key factors are shown in Table 5.3 in the form of indices where the total sample mean is used as a base of 100.

In some respects the results of this analysis are less conclusive than the comparison of costs and returns. In terms of apparent advantage to the different size groups, certain trends move in opposite directions, while others show a less clear relationship to size of enterprise. For example whilst there were significant differences between size groups of both wheat and barley, the variation occurred more

Table 5.2 Indices of Costs and Returns of Winter Wheat and Spring Barley Production, by Size of Enterprise, Average of 1971 and 1972 Crop Years

	Unit	Total sample mean	Index	Cereal enterprise size group					
				Less than 20 ha	20 up to 40 ha	40 up to 80 ha	80 up to 120 ha	120 to 200 ha	200 ha and over
				Total sample mean = 100					
Section 1: Winter wheat									
Yield	tonnes per hectare	4.44	100	101	91	95	106	103	102
Price	£ per tonne	33.41	100	96	99	102	102	103	103
Output		148.32	100	95	89	96	106	104	104
Variable costs		27.18	100	98	101	101	95	99	104
Gross margin		121.13	100	95	86	94	108	105	104
Fixed costs	£ per hectare	57.97	100	91	101	101	99	97	105
Total costs		85.15	100	93	101	101	98	98	105
Net margin		63.16	100	99	72	88	116	113	102
Section 2: Spring barley									
Yield	tonnes per hectare	3.91	100	99	95	99	103	103	99
Price	£ per tonne	30.36	100	97	101	102	103	104	103
Output		118.69	100	95	94	100	105	106	101
Variable costs		25.65	100	107	102	99	96	97	99
Gross margin		93.01	100	92	92	100	107	109	101
Fixed costs	£ per hectare	58.24	100	100	103	99	98	97	103
Total costs		83.89	100	102	103	99	97	97	102
Net margin		34.77	100	78	73	102	123	128	97

Table 5.3 Indices of Yields and Physical Inputs of Winter Wheat and Spring Barley Production, by Size of Cereal Enterprise Mean of 1971 and 1972 Crop Years

	Unit	Total sample mean	Index	Less than 20 ha	20 to 40 ha	40 to 80 ha	80 to 120 ha	120 to 200 ha	200 ha and over
			Total sample mean = 100						
Winter wheat yield	tonnes per	4.44	100	101	91	95	106	103	102
Spring barley yield	hectare	3.91	100	99	95	99	103	103	99
Combined wheat and barley yield		4.18	100	96	90	96	103	102	100
Winter wheat fertilizer	total kg fertilizer	174.6	100	51	87	99	101	114	117
Spring barley fertilizer	per hectare	150.4	100	71	94	105	111	117	111
Winter wheat sprays	percentage of	107.7	100	77	82	101	105	94	118
Spring barley sprays	area sprayed	105.3	100	82	99	103	103	106	112

Table 5.4 Labour Inputs in Total and where Straw Handling is excluded, by Size of Enterprise, Mean of 1971 and 1972 Crop Years

Cereal enterprise size group	Less than 20 ha		20 to 40 ha		40 to 80 ha		80 to 120 ha		120 to 200 ha		200 ha and over		Within group maximum significant difference
1. Winter wheat													
Total man hours per ha.	17.2	(1.58)	22.5	(2.13)	17.7	(0.82)	16.7	(0.77)	15.5	(1.03)	15.7	(0.85)	***
Man hours excluding straw handling	13.1	(0.97)	16.7	(1.49)	14.3	(0.69)	13.1	(0.43)	12.7	(0.76)	13.7	(0.64)	***
Number of observations	9		13		70		53		53		45		
2. Spring barley													
Total man hours per ha.	22.4	(1.18)	21.9	(1.05)	16.5	(0.48)	17.5	(1.01)	15.7	(0.86)	17.2	(2.10)	***
Man hours excluding straw handling	17.6	(0.96)	14.6	(0.66)	12.5	(0.36)	13.7	(0.73)	12.1	(0.60)	14.2	(2.09)	***
Number of observations	30		38		83		58		57		43		

between the intermediate groups rather than between the extremes. However the combined wheat and barley yield shows a more positive advantage for the larger enterprises. More obvious was the increase in the amounts of fertilizers and sprays applied per hectare as the size of enterprise became larger, even though in financial terms total variable costs per hectare tended to decrease with size.

There was a general decline in the inputs of labour, expressed as man hours per hectare in Table 5.4, as the size of enterprise became larger. This reduction in man hours is partly but not completely explained by the increased labour requirement to bale straw on the smaller farms, where this by-product is usually more in demand. However for both wheat and barley there are indications that savings in labour inputs as the size of enterprise increases continue only up to 200 hectares of cereals.

Other evidence from the survey supports this suggestion of possible diseconomies of size beyond 200 hectares of cereals. Where stocks of machinery specific to cereal production were valued at historic cost by size of cereal enterprise, there were only small differences in the capital invested per hectare on farms up to 200 hectares of cereals. Beyond this point however the level of investment increased significantly so that the farms with more than 200 hectares of cereals had stocks of machinery valued at almost 50 per cent more per hectare than the average of the farms with less than 200 hectares of cereals. Part of this difference may be explained by the largest farms having more modern and therefore more expensive machinery. Part is probably due to the current tax laws which encourage the transfer of income into capital assets by those paying higher tax rates.

5.5 Results of analysis by intensity of production

A second objective of this chapter is to consider the effect on yields and levels of inputs where the proportion of cereals in the crops and grass area is increased. To consider this point, the original survey data has been re-analysed by intensity of production with the sample farms allocated to six groups by the proportion of cereals in the crops and grass area. The groups ranged from farms with less than 20 per cent of cereals in the crops and grass area to those with over 80 per cent.

5.6 Financial results by intensity of production

The financial results for the six groups of farms of increasing cereal intensity are shown in Table 5.5 as indices of the total sample mean. When the three groups which have more than 50 per cent of cereals were compared, it is apparent that the more intensive producers achieved markedly better results, in terms of gross and net margins, than the less intensive producers. Within the upper group there is some evidence to suggest that the most intensive producers, those with over 80 per cent of cereals, grew wheat rather less successfully. This may be the effect of a high proportion of cereals in the crops and grass area in reducing the availability of rotational crops to precede wheat. By contrast for spring barley the most intensive producers achieved the best results in terms of output, gross and net margin. For the most intensive growers of all, variable costs show some deviation from the overall tendency to decrease with intensity.

However, as fixed costs continued to reduce as cereals were grown more intensively, in terms of total costs the farms in the over 80 per cent cereals group had an overall cost advantage. The reduction in fixed costs was not only the result of fewer hours of labour and machinery inputs. The value of stocks of machinery, specific to cereal production were also significantly lower (about 20 per cent less) on farms with more than 80 per cent of cereals compared with the average of the less intensive farms. This is in direct contrast to the comparison by size of cereal enterprise.

5.7 Physical inputs by intensity of production

Some of the effects of increasing the proportion of cereals in the crops and grass area become more apparent when the information is compared in physical rather than financial terms. The results of this analysis are appended in Table 5.11, 5.12 and 5.13. Again for ease of comparison certain key factors are shown in Table 5.6 in the form of indices where the total sample mean is used as a base of 100. For example there was an obvious increase in the amounts of fertilizer and sprays applied as cereals became more intensive; by contrast, the inputs of labour and machinery decreased with intensity (Table 5.7). There is however little evidence to suggest that yields are adversely affected as cereals become more important in the cropping pattern; for both wheat and barley the lower yields were found in those groups where cereals were relatively less important. Possibly more important in terms of yield, is the fact that the most intensive cereal producers had a lower proportion of winter wheat in the total cereal area than the intermediate groups (from 35 to 80 per cent cereals). As wheat has a yield advantage over barley, this effectively reduced the combined cereal yield of the most intensive group.

Table 5.5 Indices of Costs and Returns of Winter Wheat and Spring Barley, by Intensity of Production, Average of 1971 and 1972 Crop Years

	Unit	Total sample mean	Index	Proportion of cereals in the crops and grass area					
				Less than 20 % cereals	From 20 to 35% cereals	From 35 to 50% cereals	From 50 to 65% cereals	From 65 to 80% cereals	Over 80% cereals
			Total sample mean = 100						
Section 1: Winter wheat									
Yield	tonnes per hectare	4.44	100	98	103	95	102	101	99
Price	£ per tonne	33.41	100	95	99	101	102	103	102
Output		148.32	100	92	99	95	102	102	99
Variable costs		27.18	100	100	103	100	99	98	104
Gross margin		121.13	100	90	99	93	102	103	99
Fixed costs	£ per hectare	57.97	100	100	94	107	99	100	96
Total costs		85.15	100	97	97	104	99	99	98
Net margin		63.16	100	81	103	81	105	106	101
Section 2: Spring barley									
Yield	tonnes per hectare	3.91	100	102	98	98	101	100	101
Price	£ per tonne	30.36	100	98	102	100	102	103	104
Output		118.69	100	98	98	97	102	102	103
Variable costs		25.65	100	106	103	101	98	98	102
Gross margin		93.01	100	96	96	95	103	103	104
Fixed costs	£ per hectare	58.24	100	96	104	105	100	97	92
Total costs		83.89	100	99	104	104	99	97	95
Net margin		34.77	100	97	83	79	107	112	124

Table 5.6 Indices of Yields and Physical Inputs of Winter Wheat and Spring Barley Production, Mean of 1971 and 1972 Crop Years

	Unit	Total sample mean	Index	Proportion of cereals in the crops and grass area					
				Less than 20% cereals	From 20 to 35% cereals	From 35 to 50% cereals	From 50 to 65% cereals	From 65 to 80% cereals	Over 80% cereals
			Total sample mean = 100						
Winter wheat yield	tonnes per	4.44	100	98	103	95	102	101	99
Spring barley yield	hectare	3.91	100	102	98	98	101	100	101
Combined wheat and barley yield		4.18	100	95	97	96	101	100	98
Winter wheat fertilizer	total kg fertilizer	174.6	100	56	90	89	100	107	118
Spring barley fertilizer	per hectare	150.4	100	70	91	101	102	112	116
Winter wheat sprays	percentage of	107.7	100	93	92	85	105	104	110
Spring barley sprays	area sprayed	105.3	100	72	92	93	107	112	113

Table 5.7 Labour Inputs in Total and where Straw Handling is excluded, by Intensity of Production, Mean of 1971 and 1972 Crop Years

	Less than 20%		From 20% to 35%		From 35% to 50%		From 50% to 65%		From 65% to 80%		Over 80%		Within group maximum significant difference
1. Winter wheat													
Total man hours per hectare	15.9		22.6	(2.54)	15.6	(0.79)	19.3	(1.01)	16.1	(0.59)	15.4	(0.94)	***
Man hours excluding straw handling	11.0		17.4	(2.31)	13.7	(0.52)	13.7	(0.71)	13.1	(0.50)	13.3	(0.83)	***
Number of observations	1		15		69		40		83		34		
2. Spring barley													
Total man hours per hectare	24.0	(1.41)	20.8	(0.94)	15.7	(0.69)	19.9	(0.98)	17.9	(1.12)	12.9	(0.56)	***
Man hours excluding straw handling	19.0	(1.33)	14.7	(0.70)	12.5	(0.46)	14.4	(0.81)	13.8	(1.10)	11.2	(0.45)	***
Number of observations	13		41		74		52		86		39		

5.8 Conclusions

Several important conclusions have emerged from the two analyses presented in this chapter. There is some question whether economies of size extend beyond 200 hectares of cereals. As the proportion of cereals in the crops and grass area on a farm increases, more fertilizer and sprays are required to maintain yield; the proportion of wheat is also likely to decrease, which may reduce the overall cereal yield. Clearly this constraint does not apply on farms where the soil type and climate are suitable for continuous wheat production. There were indications that the size of enterprise of the cereal intensive farms, when combined with a high degree of specialisation, results in a more nearly optimum unit size for cereal production than that of the largest farms surveyed. Inputs of seed, fertilizer and sprays are similar for the largest and for the most intensive cereal enterprises whilst the proportion of cereals in the crops and grass area is markedly different. It is probable that the larger enterprises could further intensify the proportion of cereals in the crops and grass area without a loss in yield or the need to increase inputs.

5.9 Appended Tables

Table 5.8 Average Physical Characteristics per Surveyed Farm of Winter Wheat Production by Size of Enterprise, Mean of 1971 and 1972 Crop Years

Group by size of cereal enterprise	Unit	Less than 20 ha		20 to 40 ha		40 to 80 ha		80 to 120 ha		120 to 200 ha		Over 200 ha		Within group maximum significant difference
Average area winter wheat	hectares	6.6	(0.59)	9.8	(1.16)	23.6	(1.26)	41.2	(2.07)	55.8	(3.71)	138.7	(9.72)	
Yield	tonnes per hectare	4.48	(0.14)	4.05	(0.17)	4.22	(0.08)	4.69	(0.10)	4.56	(0.10)	4.53	(0.09)	***
Seed		189.5	(3.77)	185.8	(3.01)	186.0	(2.26)	188.3	(3.77)	187.0	(2.51)	189.5	(5.02)	
Fertilizer	kg per													
Nitrogen	hectare	50.2	(7.80)	71.9	(6.50)	88.9	(3.36)	91.3	(4.24)	105.1	(3.92)	108.3	(4.73)	***
Phosphate		26.0	(9.26)	42.3	(5.79)	44.1	(2.89)	44.2	(2.60)	51.0	(3.59)	48.6	(2.52)	***
Potash		13.3	(3.40)	37.3	(5.20)	39.0	(2.41)	40.3	(2.51)	43.4	(2.82)	46.7	(2.76)	***
Area sprayed for														
Annual weeds		73.0	(8.35)	75.9	(7.41)	88.0	(3.21)	86.3	(3.21)	77.4	(4.59)	95.6	(3.90)	***
Wild oats		2.9	(2.86)	2.9	(2.94)	7.0	(1.81)	8.0	(2.89)	13.5	(2.96)	8.0	(2.42)	***
Blackgrass	per cent	–		–		2.1	(1.00)	2.3	(1.47)	5.4	(1.98)	3.0	(1.14)	***
Aphids	of total	–		–		0.1	(0.07)	0.4	(0.04)	0.2	(0.21)	1.6	(1.30)	**
Area sprayed with														
Cycocel		3.6	(3.57)	4.5	(3.75)	7.7	(2.22)	9.6	(3.12)	2.1	(1.22)	11.0	(2.88)	***
Fungicide		–		4.7	(3.37)	1.2	(0.91)	3.2	(2.65)	2.1	(1.18)	5.2	(2.27)	**
Grammoxone		3.6	(3.57)	0.3	(2.02)	2.2	(1.16)	3.5	(1.91)	0.3	(0.26)	2.2	(1.50)	*
Labour input	man hours per hectare	17.2	(1.58)	22.5	(2.13)	17.7	(0.82)	16.7	(0.72)	15.5	(1.03)	15.7	(0.85)	***
Machinery input	tractor hours per hectare	14.4	(0.94)	21.2	(2.56)	14.4	(0.68)	12.9	(0.45)	12.1	(0.84)	11.6	(0.68)	***
Number of observations		28		34		114		74		72		78		
Observations of labour and machinery inputs		9		13		70		53		53		45		

Table 5.9 Average Physical Characteristics per Surveyed Farm of Spring Barley Production by Size of Enterprise, Mean of 1971 and 1972 Crop Years

Groups by size of cereal enterprise	Unit	Less than 20 ha		20 to 40 ha		40 to 80 ha		80 to 120 ha		120 to 200 ha		Over 200 ha		Within group maximum significant difference
Average area spring barley	hectares	7.4	(0.48)	19.2	(0.85)	31.3	(1.29)	53.3	(2.69)	82.0	(3.95)	148.6	(9.91)	
Yield	tonnes per hectare	3.88	(0.08)	3.71	(0.08)	3.88	(0.07)	4.02	(0.08)	4.04	(0.08)	3.88	(0.09)	***
Seed		179.5	(3.01)	178.3	(2.89)	182.0	(9.54)	168.2	(2.89)	169.5	(3.64)	170.7	(4.77)	*
Fertilizer	kg per hectare													
Nitrogen		47.3	(2.81)	63.1	(3.23)	74.4	(2.01)	84.2	(2.77)	86.0	(2.86)	83.9	(3.72)	***
Phosphate		29.8	(2.00)	38.4	(1.64)	41.2	(1.46)	41.3	(1.15)	44.4	(1.29)	41.3	(1.77)	***
Potash		29.1	(1.83)	39.3	(1.95)	42.2	(1.73)	41.3	(1.54)	44.2	(1.52)	41.9	(1.93)	***
Area sprayed for	per cent of total													
Annual weeds		82.0	(4.18)	88.6	(3.18)	84.9	(2.72)	86.1	(3.12)	84.4	(3.48)	91.2	(3.72)	**
Wild oats		1.2	(0.87)	1.8	(1.32)	10.8	(2.15)	8.5	(2.29)	17.0	(3.34)	10.7	(2.61)	***
Area sprayed with														
Fungicide		2.2	(1.54)	7.0	(2.70)	9.2	(2.10)	10.0	(2.83)	10.0	(2.70)	13.2	(3.08)	***
Grammoxone		1.1	(1.10)	6.5	(2.50)	3.7	(1.47)	4.3	(1.69)	0.8	(0.61)	3.0	(1.62)	***
Labour input	man hours per hectare	22.4	(1.18)	21.9	(1.05)	16.5	(0.48)	17.5	(1.01)	15.7	(0.86)	17.2	(2.10)	***
Machinery input	tractor hours per hectare	17.6	(0.82)	18.3	(0.90)	13.1	(0.41)	13.3	(0.67)	12.3	(0.67)	11.6	(0.66)	***
Number of observations		91		78		133		83		75		76		
Observations of labour and machinery inputs		30		38		83		58		57		43		

Table 5.10 Comparison of Crop Area and Product Disposal on Farms of Differing Sizes of Cereal Enterprises, Mean of 1971 and 1972 Crop Years

Groups by size of cereals enterprise	Unit	Less than 20 ha	20 to 40 ha	40 to 80 ha	80 to 120 ha	120 to 200 ha	Over 200 ha
Area in cereals	per cent of crops and grass area	19.5	37.8	49.5	58.1	66.5	60.4
Area in							
Winter wheat	per cent of	15.3	14.9	33.1	35.3	34.5	44.0
Spring barley	cereal area	56.4	67.3	51.7	51.3	52.8	45.9
Proportion of grain sold							
Winter wheat	per cent of	89.6	97.0	94.9	96.4	97.6	96.0
Spring barley	total sales	28.6	47.8	68.7	65.1	81.0	81.6
Disposal of straw							
Wheat straw							
Baled	per cent	83	73	51	38	32	34
Burnt	of area	17	16	47	62	66	63
Ploughed in		0	11	2	0	2	3
Barley straw							
Baled	per cent	95	94	81	67	64	57
Burnt	of area	5	6	16	31	34	40
Ploughed in		0	0	3	2	2	3

Table 5.11 Average Physical Characteristics per Surveyed Farm of Winter Wheat by Intensity of Production, Mean of 1971 and 1972 Crop Years

Proportion of cereals in crops and grass area	Unit	Less than 20%		From 20% to 35%		From 35% to 50%		From 50% to 65%		From 65% to 80%		Over 80%		Within group maximum significant difference
Average area winter wheat	hectares	6.8	(0.27)	27.6	(6.70)	46.0	(9.48)	61.7	(4.86)	58.7	(5.48)	44.1	(6.57)	
Yield	tonnes per hectare	4.34	(0.10)	4.57	(0.20)	4.22	(0.12)	4.51	(0.06)	4.49	(0.08)	4.49	(0.08)	***
Seed		183.3	(2.51)	192.1	(11.30)	187.0	(2.51)	193.3	(2.51)	182.0	(2.51)	183.3	(2.51)	***
Fertilizer	kg per													
Nitrogen	hectare	76.2	(17.69)	77.1	(8.91)	82.8	(4.61)	87.7	(3.64)	102.2	(2.90)	104.6	(6.20)	***
Phosphate		10.9	(11.00)	46.9	(9.04)	39.0	(3.85)	45.7	(2.51)	44.6	(2.22)	52.6	(3.85)	***
Potash		10.9	(11.00)	34.0	(5.30)	33.9	(2.74)	41.0	(2.20)	39.7	(2.22)	49.5	(4.12)	***
Area sprayed for														
Annual weeds		100.0		81.8	(9.02)	80.1	(4.53)	88.9	(3.02)	83.2	(5.53)	87.9	(5.19)	**
Wild oats		–		3.4	(1.87)	2.5	(1.58)	8.5	(1.94)	11.4	(2.42)	11.0	(3.75)	***
Blackgrass	per cent	–		0.7	(0.68)	3.1	(1.49)	1.8	(0.92)	3.8	(1.28)	3.0	(1.62)	*
Aphids	of total	–		–		0.1	(0.11)	–		0.7	(0.73)	0.3	(0.29)	*
Area sprayed with														
Cycocel		–		8.9	(5.64)	1.9	(0.77)	7.27	(1.95)	10.1	(2.60)	8.4	(3.58)	***
Fungicide		–		3.6	(3.57)	1.9	(1.32)	4.0	(1.92)	2.5	(1.08)	0.9	(0.67)	*
Grammoxone		–		1.1	(1.07)	1.5	(1.29)	2.2	(1.07)	0.5	(0.41)	6.7	(3.45)	***
Labour input	man hours per hectare	15.9		22.6	(2.54)	15.6	(0.79)	19.3	(1.01)	16.1	(1.01)	15.4	(0.94)	**
	tractor hours per hectare	12.6		17.9	(1.84)	12.6	(0.67)	15.8	(1.05)	12.6	(0.53)	12.0	(0.71)	**
Machinery input		3		28		79		134		106		48		
Number of observations														
Observations of labour and machinery inputs		1		15		69		40		83		34		

Table 5.12 Average Physical Characteristics per Surveyed Farm of Spring Barley by Intensity of Production, Mean of 1971 and 1972 Crop Years

Proportion of cereals in crops and grass area	Unit	Less than 20%		From 20% to 35%		From 35% to 50%		From 50% to 65%		From 65% to 80%		Over 80%		Within group maximum significant difference
Average area spring barley	hectares	7.4	(0.95)	26.5	(5.55)	39.8	(4.23)	63.0	(5.15)	75.0	(6.52)	77.7	(6.72)	
Yield	tonnes per hectare	3.97	(0.11)	3.84	(0.09)	3.83	(0.07)	3.95	(0.07)	3.92	(0.07)	3.95	(0.10)	*
Seed		185.8	(3.77)	177.0	(5.02)	173.2	(2.51)	169.5	(2.51)	179.5	(11.30)	174.5	(5.02)	*
Fertilizer	kg per													
Nitrogen	hectare	44.1	(4.23)	62.3	(3.64)	70.7	(3.00)	77.2	(2.50)	82.7	(1.66)	84.9	(3.79)	***
Phosphate		30.6	(3.10)	37.4	(1.74)	39.3	(1.61)	37.3	(1.10)	43.9	(1.07)	44.7	(2.76)	***
Potash		31.0	(3.09)	37.0	(1.76)	41.4	(1.82)	38.5	(1.34)	42.2	(1.32)	44.9	(3.13)	***
Area sprayed for														
Annual weeds		74.9	(6.23)	85.3	(3.82)	83.4	(3.13)	87.0	(2.59)	90.3	(2.65)	89.0	(3.99)	***
Wild oats	per cent of total	–		3.4	(1.83)	4.4	(1.34)	10.0	(2.14)	14.7	(2.45)	13.5	(3.45)	***
Area sprayed with														
Fungicide		–		3.9	(1.95)	6.2	(2.15)	10.4	(2.06)	12.7	(2.62)	13.1	(4.07)	***
Grammoxone		1.1	(1.12)	3.8	(2.18)	3.5	(1.53)	5.5	(1.71)	0.6	(0.41)	3.9	(2.03)	***
Labour input	man hours per hectare	24.0	(1.41)	20.8	(0.94)	15.7	(0.69)	19.9	(0.98)	17.9	(1.12)	12.9	(0.56)	***
Machinery input	tractor hours per hectare	18.5	(1.01)	16.6	(0.64)	12.5	(0.58)	15.8	(0.82)	13.4	(0.49)	10.3	(0.52)	***
Number of observations		47		72		100		142		111		56		
Observations of labour and machinery inputs		13		41		74		52		86		39		

Table 5.13 Comparison of Crop Area and Product Disposal on Farms with Differeing Intensity of Cereal Production, Mean of 1971 and 1972 Crop Years

Proportion of cereals in Crops and grass area	Unit	Less than 20%	From 20% to 35%	From 35% to 50%	From 50% to 65%	From 65% to 80%	Over 80%
Average area of crops and grass	hectares	84.2	134.8	199.1	227.4	208.8	157.0
Area in							
Winter wheat	per cent of	4.0	22.9	40.7	40.8	35.7	26.9
Spring barley	cereal area	51.0	61.2	46.6	46.9	51.6	54.8
Proportion of grain sold							
Winter wheat	per cent of	33.4	98.4	90.6	97.4	97.1	99.0
Spring barley	total sales	6.9	54.7	60.0	76.1	76.1	91.9
Disposal of straw							
Wheat straw							
Baled	per cent	100	58	62	37	26	19
Burnt	of area	0	42	38	60	70	77
Ploughed in		0	0	0	3	4	4
Barley straw							
Baled	per cent	100	71	80	71	60	52
Burnt	of area	0	29	20	28	35	45
Ploughed in		0	0	0	1	5	3

CHAPTER 6 FUTURE LEVELS OF CEREAL PRODUCTION

6.1 Introduction

The likely change in the area of land under cereals was a matter of considerable debate in the period preceding entry of the UK into the EEC. More recently, interest has been stimulated anew by the publication of the Government's White Paper, Food from Our Own Resources. Therefore, this question has been one continuing focus of the surveys reported in this bulletin. The projected possible rates of growth in the production and area of cereals given in Food from Our Own Resources and the associated report of the Farmers' Unions, also published in 1975, provide a background against which the projections emerging from these surveys may be set.

The Government considered it possible that production of cereals in the United Kingdom as a whole could increase to 17.8 million tonnes by 1980. This level of production would be 17 per cent above the average of the harvest years 1973 to 1975, implying a projected compound growth rate of about 2½ per cent. The Unions' projections were more conditional but broadly in line, suggesting for 1979 a production of between 17.5 and 18.4 million tonnes. The Unions projected an increase in area of cereals as well as in yield and this was supported by the Government White Paper.

The Unions' alternative projections of cereal area in 1979, associated with different assumptions on the growth of cattle numbers were, in metric terms, about 3.8 and 4.1 million hectares. The mid-point of their projections, 3.95 million hectares, represents an increase of approaching a quarter of a million hectares, or 6 per cent, on the 1973-75 average planting of 3.72 million hectares. In 1976/77 and 1977/78 the cereal area planted averaged slightly below that of this base period, 1973/74 to 1975/76 – by about one half of one per cent in the United Kingdom and by one per cent in England and Wales. Whether this represents a true stagnation in area or a pause before a rise is a question on which the surveys here reported throw some direct light.

The contributions of the surveys to the projection of yield changes are more limited but our own expectations are presented here to round out the forecast picture.

6.2 Likely increase in cereal yield

The mid-point of the Unions' implicit projections of the total yield of cereals in the UK in 1979 is 4.55 tonnes per hectare. This is nearly 8 per cent above the base level, the average of the two years 1973/74 and 1974/75, of 4.23 tonnes per hectare. The projected annual growth rate is thus about one and a half per cent. In the period between 1966/67 – 1968/69 and the base period the growth in yield was nearer 2 per cent a year. The projected rate of growth is thus reasonably conservative and in our view is likely to be valid for England and Wales when extended to 1985.

Despite an apparent pause in the sixties, there is now little evidence that a plateau in yields of wheat and barley is imminent (Figure 6.1). Plant breeders continue to introduce higher yielding varieties, and it is likely that growers will go on adopting them. A major change to varieties which will produce grain of a known quality as opposed to quantity is not likely. At present the premiums offered for hard milling wheats are rarely sufficient to offset the probable reduction in yield. Moreover, climatically, the UK is less suited to the production of hard milling wheat than North America or, to a lesser extent, France. The production of consistently hard and strong wheat with low alpha-amylase content can not be guaranteed. As far as barley is concerned, it is likely that most high yielding varieties will in future also have reasonable malting characteristics. By and large, therefore, it is likely to continue to be in the producer's interests to concentrate on the higher yielding varieties. (Varieties grown by the survey sample for the 1971 and 1975 harvests are shown in appended Table 6.8).

It is likely also that the potential productivity of new varieties will be somewhat better exploited as knowledge of the best complementary cultivation techniques improves. Certainly, the surveys have revealed considerable scope for overall improvement by reducing the variation in yield between growers. Of the main cereal crops recorded the top five per cent of the growers produced twice the yields of the bottom five per cent. The yield of cereals in total will also be increased over the next five to ten years by some further transfer of cereal-growing land from barley to wheat. For some years the traditional constraint of a single wheat in the rotation has been giving way to multiple wheats which have replaced part of the spring barley area. Thus between the harvest year 1967 and 1977, the proportion of wheat in the total area of main cereals in England and Wales increased from 28 per cent to 39 per cent. The area of barley, which grew rapidly in the late fifties and early sixties, partly at the expense of oats and partly as an increment to the total area of cereals, has consequently, in a period of largely static cereal area, tended to decline both absolutely and as a share of the total cereal area. (Figure 6.2).

Fig. 6.1. Wheat, barley and wheat, barley and oat yields for England and Wales.

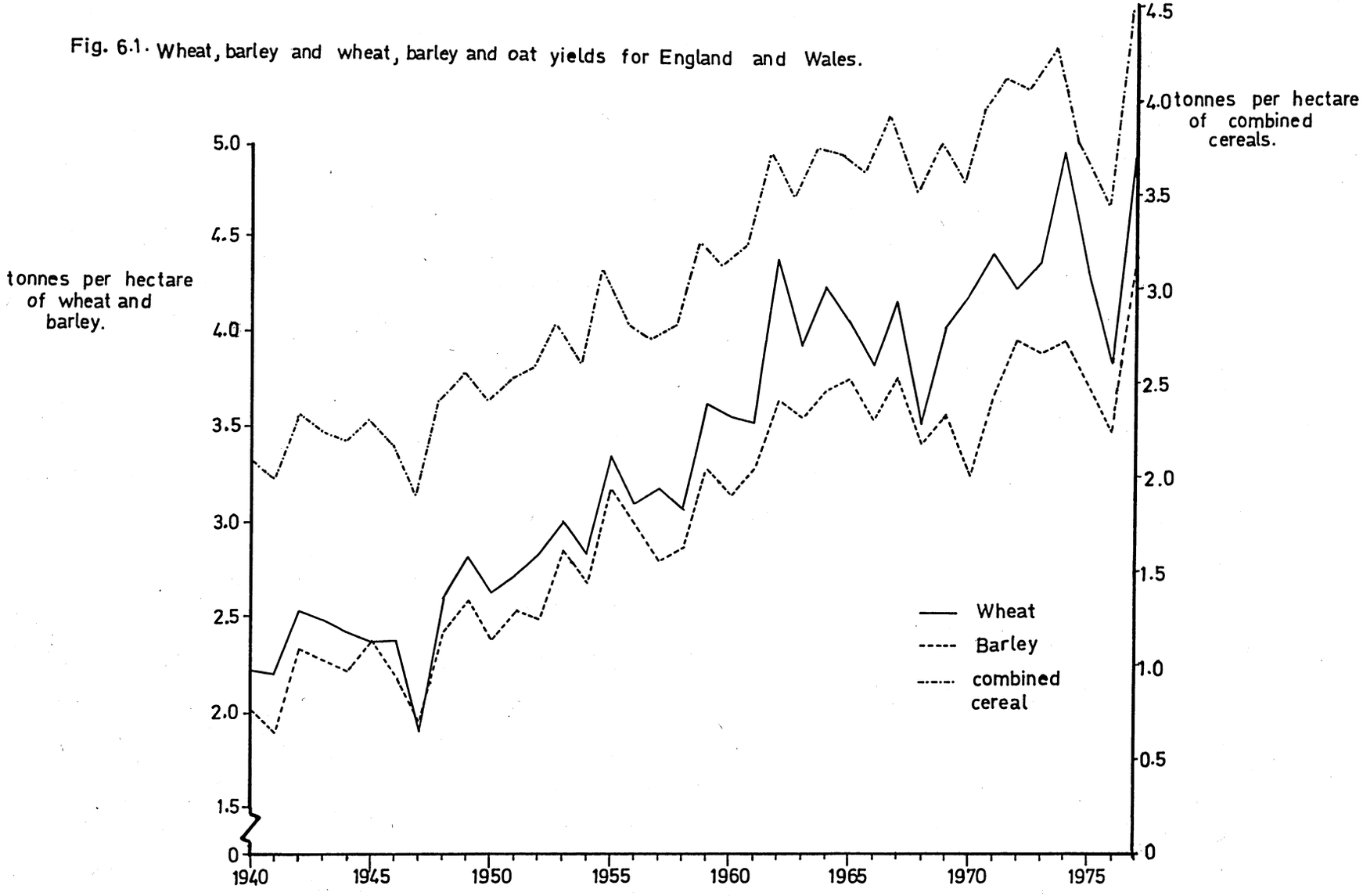
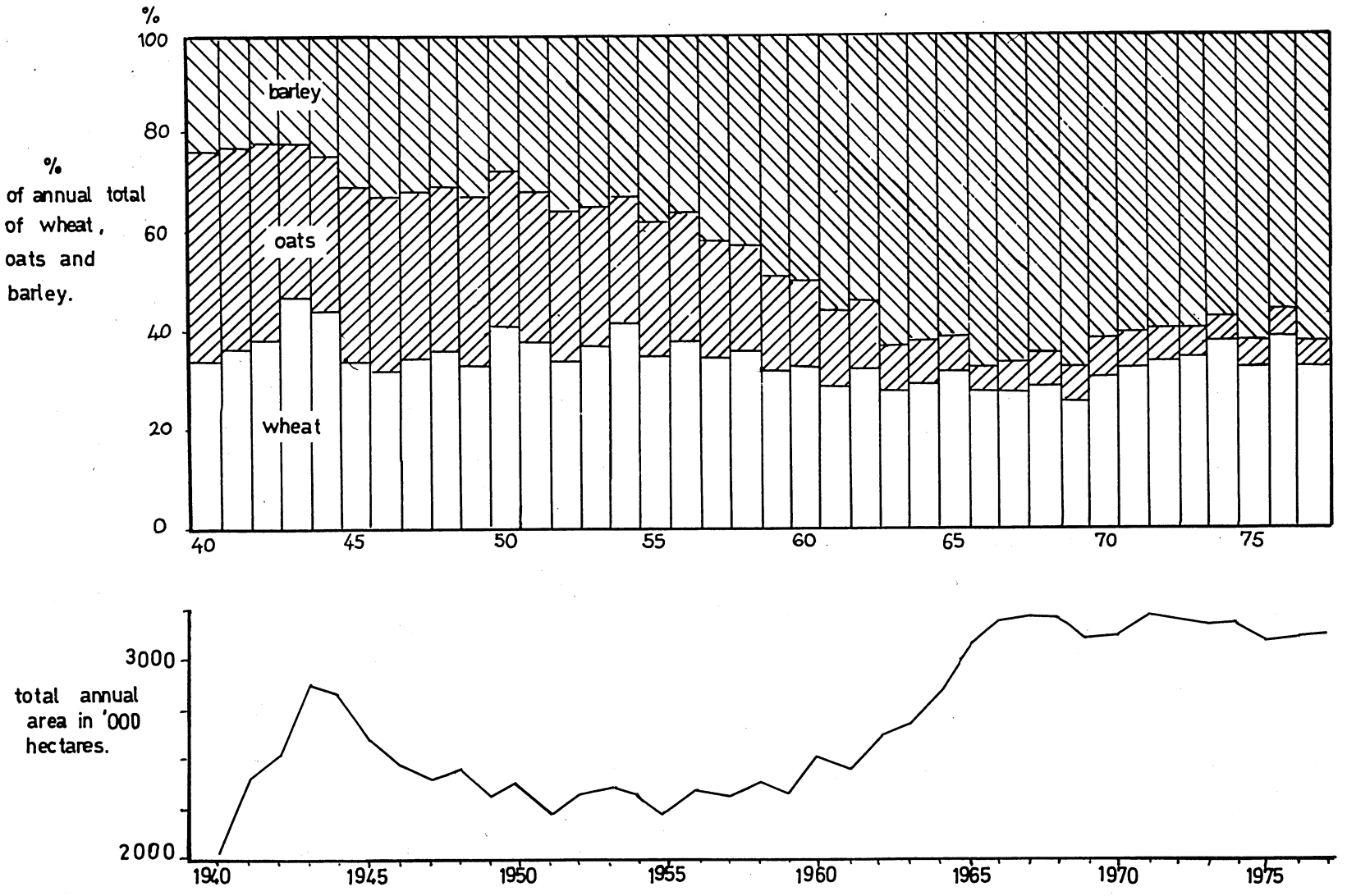


Fig. 6.2. Changes in composition of the area. (harvest years.)



A continuation of this switch from spring barley to winter wheat will have the effect of increasing production of cereals in total so long as wheat maintains its advantage in yield (Table 6.1).

Table 6.1 Comparison of Surveyed per Farm Average Yields of Winter Wheat and Spring Barley, Harvests of 1971, 1972, 1975 and 1977

	Unit	Harvest year				4 year simple average
		1971	1972	1975	1977	
Winter wheat yield	tonnes	4.54	4.27	4.32	4.93	4.52
Spring barley yield	per	3.72	4.09	3.44	4.40	3.91
Wheat *minus* barley yields	hectare	0.82	0.18	0.88	0.53	0.61
Wheat divided by barley yields		1.22	1.04	1.26	1.12	1.16

There will be a limit to this process since the production of wheat is concentrated into an area where soil conditions and climate are most suitable for the crop. Also an extension of its area could reduce the yield advantage of wheat over barley.

In all, it seems probable that yield increase alone, arising from the availability and better use of improved seeds and other inputs, and some change in the composition of the cereal area, will cause production of cereals in England and Wales to rise by nearly 2 million tonnes or about 15 per cent between now and 1985. If the cereal area were to remain at its recent level of about 3.2 million hectares, production, on this projection of yield, would be about 14.7 million tonnes, compared with a mean production of 12.7 million tonnes in 1976/77 – 1977/78.

6.3 General prospects for increased area of cereals

The rise in production of cereals to 1985, from yield increase is, we believe, unlikely to be augmented much by an expansion of area. During the past ten years plantings of cereals have remained on a plateau of around three and a quarter million hectares. This is about five per cent above the previous peak in 1943/44, when planting was subject to government direction. Once these regulations were relaxed, the area under cereals dropped rapidly and continued to decline, at a decreasing rate through the nineteen fifties. (Figure 6.3).

Between 1960 and 1967, the cereal area increased by about three quarters of a million hectares but has since levelled off.

In the early nineteen seventies, when the entry of the UK into the EEC was being negotiated, a further period of increase in the cereal area was widely expected as a result of higher prices under the CAP. Since 1972 the value of grain, influenced by world prices, has increased more rapidly than could reasonably have been expected prior to the UK joining the Common Market. However by 1975 it was clear that the total cereal area had responded very little to the stimulus of higher prices. A possible explanation is that changes in technology have a more significant effect than relative prices. This view is reinforced by other evidence. For example the area of barley increased substantially during a period when the guaranteed price was being reduced. The more recent increase in the winter wheat area can be related to the introduction of varieties with a greater resistance to disease and the availability of chemicals to control diseases and weeds associated with multiple cropping.

Whether or not increased cereal areas are likely, from farmers previously not producing cereals including cereals in the rotation and as a result of further intensification from established growers, are questions considered in the following two sections.

6.4 Introduction of cereals by farms not now growing them

To investigate the technical, structural and managerial potential for the introduction of cereal growing as a new enterprise, a sample of 300 farms, who were not growing cereals (or growing only an insignificant amount) were contacted at the time of the original survey. From these 248 usable returns were obtained. More than half of the sample of farms drawn were in the Western extensive cereal growing region, as defined in section 4.8, and 90 per cent were in the Western and Central regions combined. Details of the per farm average cropping and stocking patterns of the surveyed farms are given in Table 6.2. The sample of farms over 120 hectares is small and heterogeneous, and the averages are heavily affected by the inclusion of two horticultural farms.

Fig. 6.3.

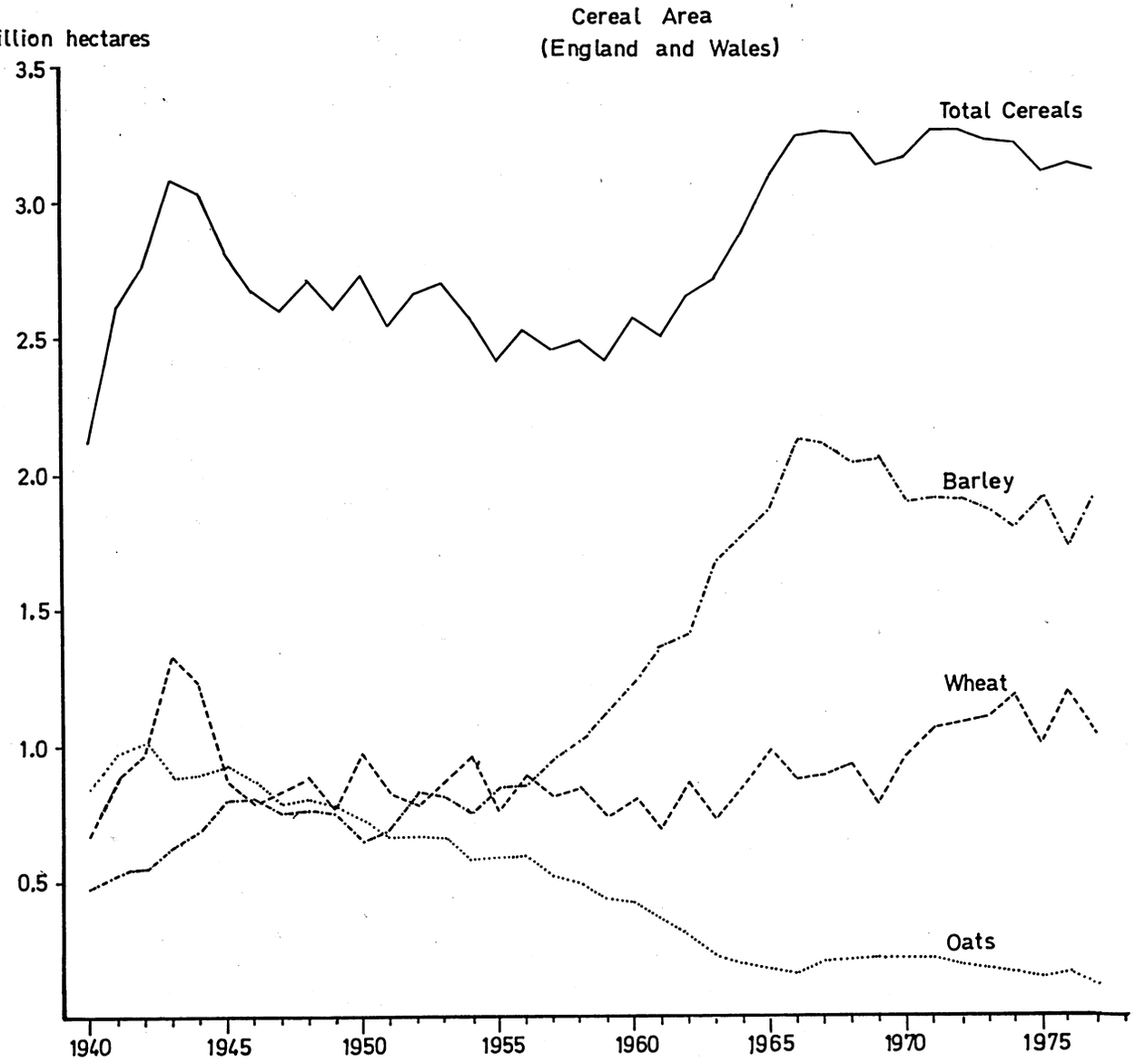

Cereal Area
(England and Wales)
million hectares
3.5
3.0
2.5
2.0
1.5
1.0
0.5
Total Cereals
Barley
Wheat
Oats
1940
1945
1950
1955
1960
1965
1970
1975

Table 6.2 Average per Farm Cropping and Stocking Patterns and Labour Availability of Sample of Farms not Growing Cereals, by Area Size Group

	Crops and grass area size group (hectares)			
	20 up to 40	40 up to 60	60 up to 120	120 and above
Sample descriptions				
Number of observations	105	61	63	19
Crops and grass area per farm (hectares)	32.5	52.9	76.5	155.8
Cropping pattern	per cent of total crops and grass			
Permanent grass	75.5	81.2	77.5	68.2
Temporary grass	15.7	13.2	12.6	13.1
Arable for fodder	1.7	0.7	2.5	1.9
Cereals*	1.7	2.3	0.3	2.4
Cash roots and horticulture	2.3	0.1	1.8	9.0
Land let	2.2	2.5	3.5	5.5
Other	0.9	0	1.8	0
Crops and grass	100.0	100.0	100.0	100.0
Rough grazing etc.	hectares per farm			
Rough grazing	10.6	16.5	52.5	21.8
Common land	2.7	19.9	24.8	0
Grass keep	1.5	4.4	5.7	4.8
Grazing livestock	per 100 hectares of crops and grass			
Dairy cows	80.3	67.7	39.3	40.8
Dairy followers	48.4	48.4	13.3	15.8
Beef cows	13.1	12.1	28.7	22.2
Beef ex cows	39.3	35.6	63.0	45.0
Grass ewes	74.9	89.2	194.0	120.8
Hill ewes	90.4	76.1	91.9	52.9
Store ewes	57.8	58.6	112.2	18.8
Total grazing livestock units**	210.0	170.5	191.0	127.1
Pigs and poultry	head per farm			
Sows	0.4	0.1	0.8	0
Fattening pigs	5.5	15.1	13.2	77.9
Poultry	55.8	55.4	217.3	170.0
Labour	persons per 100 hectares			
Family	4.0	2.7	1.7	0.5
Hired: stockmen	0.5	0.5	0.7	0.7
Hired: general	0.2	0.5	0.7	0.7
Total	4.7	3.7	3.2	2.0

* Farms growing less than 4 hectares of cereals were included in the sampling universe.

** Dairy cow equivalents; conversion factors used were dairy followers and all beef animals 0.6, grass ewes 0.14, hill ewes 0.12, and store lambs 0.04.

The cropping pattern for the farms of up to 120 hectares was more uniform, with permament pasture accounting for at least three quarters of the crops and grass area, and arable crops, including temporary grass, less than one quarter. As might be expected on farms having such a high proportion of permament pasture, production from grazing livestock was overwhelmingly the most important source of income. The smaller farms were, in the main, specialist dairy farms; as the size of farm increased, mixed livestock with sheep was a progressively more common pattern. A second comparison, of stocking and cropping on a regional basis, between the cereal sample and the sample without cereals is shown in Table 6.3.

Considered in conjunction with Table 6.2 the main differences between the samples of farms growing and not growing cereals are readily observable.

(i) The farms not growing cereals had a much smaller area of crops and grass. In the Western region, the surveyed farms not producing cereals had on average little more than half the crops and grass area of the cereal-growing farms, and in the Central region of intermediate cereal growing intensity nearer a third. In the Eastern region the difference was even more pronounced, the farms which did not grow cereals having only a quarter of the crops and grass area of the cereal growing farms. In all regions combined, two thirds of the farms not producing cereals had less than 60 hectares of crops and grass.

(ii) In the regions where there are significant areas of rough grazing, these were more likely to be found on the farms not growing cereals. The higher proportion of marginal land may well indicate that the potential arable land is of poorer quality.

(iii) The main difference in land use, particularly in the Eastern and Central regions, was the greater proportion of permament pasture for the farms not growing cereals. This reflects a past increase in specialisation on the cereal-growing farms through the ploughing up of permanent pasture. The counterpart of this specialisation on the farms not producing cereals was documented by answers to specific survey questions. These generally revealed a past change from mixed farming to specialist livestock production with most of this change taking place when the national cereal area was increasing.

Despite the apparent disadvantages of farm size, location and possibly climate, over 90 per cent of the farmers not growing cereals considered it possible to grow cereals at varying degrees of intensity on their farms. The survey indicated that 63 per cent of the crops and grass area was able to grow rotational crops and 55 per cent could grow cereals on an annual basis. The judgements of farmers were to a degree reinforced by the physical features of the sample farms recorded in the survey. These are presented in the form of distributions in appended Table 6.9. The distributions suggest that the majority of the farms are level or rolling with no serious drainage problems, located below the 500 ft contour, with a soil type classified as light to medium heavy. On the other hand the majority of farms have less than 6 inches of topsoil and a rainfall in excess of 35 inches a year. Multiplied up by the inverse of the sampling fraction, the survey responses suggest that, in England and Wales as a whole, about 650 thousand hectares of land on farms not producing cereals could be returned from grassland to arable and grow cereals.

In the immediate future, however, the exploitation of this potential appears likely to be severely limited by shortages of relevant managerial skills and equipment. In a somewhat longer perspective, the size of the farms not growing cereals in relation to their natural resources is likely to prove a tight constraint. Though all the farmers surveyed had some experience of growing cereals either on their own holdings or during their training period prior to taking their own farms, many of them knew little about modern cultivation techniques. Some co-operators indeed had given up cereal production at a time when the combine was an innovation rather than normal practice. The specialisation in livestock production which has taken place has also resulted in a lack of equipment for arable farming. Of the total farms surveyed, only 29 per cent had a drill, whilst only 4 per cent had equipment to harvest cereals. Two thirds of the farmers had basic cultivation equipment but many of the implements recorded on the survey were old and infrequently used since the change-over from mixed farming to specialisation in livestock, and were not of the standard normally associated with a modern arable farm.

Storage facilities available for increased cereal production were likewise seriously deficient. Before the introduction of the combine, cereal crops required more labour but very little specialist equipment. When cut with a binder, the crop would be stacked, without the need for artificial drying, and threshed as required during the winter. Since the introduction of the combine, much of the grain harvested is too wet for safe storage. Thus there is a need for a drier, equipment to handle the grain in bulk and adequate storage capacity. Of the farmers not growing cereals, only 23 per cent considered it possible to handle and store grain in bulk, as opposed to sacks. When related to the area technically available for cereal growing, the total capacity recorded is equivalent to only one and a quarter tonnes of storage per cereal hectare, compared with four tonnes capacity on the cereal growing farms. If it is assumed that four tonnes of storage per cereal hectare is the required unit capacity, the total capacity available would provide storage for only 180 thousand hectares of cereals. This is less than 30 per cent of the area technically available for cereal growing on farms not producing cereals.

Table 6.3 Comparisons of Average per Farm Cropping, Stocking and Labour Characteristics between Samples of Cereal Growing Farm and Farms not Growing Cereals*, by Regions**

	Eastern cereal intensive*		Central intermediate*		Western cereal extensive*	
	No cereals**	With cereals	No cereals**	With cereals	No cereals**	With cereals
Sample descriptions						
Number of observations	24	159	92	72	132	94
Crops and grass area per farm (hectares)	59.5	240.6	66.0	186.7	50.2	89.9
Cropping pattern			per cent of total crops and grass			
Permanent grass	64.9	9.7	76.5	19.8	78.7	34.0
Temporary grass	19.5	12.7	11.4	16.9	14.7	22.4
Arable ex cereals	15.6	15.0	3.0	8.6	2.8	5.5
Cereals	0	60.4	2.6	54.7	1.0	38.1
Other	0	2.2	6.5	0	2.8	0
Crops and grass	100.0	100.0	100.0	100.0	100.0	100.0
Rough grazing etc.			hectares per farm			
Rough grazing	0	2.0	27.5	4.1	24.9	8.1
Common land	1.7	0	23.3	0	6.9	0
Grass keep	1.7	0	3.0	0	4.5	0
Grazing livestock			per 100 hectares of crops and grass			
Dairy cows	56.6	12.4	56.3	16.3	57.1	34.8
Dairy followers	35.6	10.6	31.4	12.4	35.1	25.9
Beef cows	9.4	3.5	20.8	4.9	22.0	7.7
Beef ex cows						
Grass ewes	16.8	22.2	58.2	***	219.2	***
Hill ewes	0	0	105.0	***	77.6	***
(Total ewes)	(16.8)	(22.2)	(162.2)	(42.5)	(296.8)	(107.2)
Store lambs	0	47.9	25.7	2.2	106.5	33.4
Total grazing livestock units****	121.5	38.1	136.4	50.0	163.8	98.1
Pigs and poultry			head per farm			
Sows	1.0	6.9	1.5	5.2	2.7	2.0
Fattening pigs	1.2	31.4	54.1	54.6	91.7	40.8
Poultry	418.8	336.6	383.3	494.9	531.3	341.2
Labour			persons per 100 hectares			
Family	1.9	0.5	2.0	0.5	2.7	1.7
Hired: stockmen	1.2	0.5	0.7	0.2	0.7	0.2
Hired: general	1.0	2.0	1.0	1.5	0.5	1.2
Total	4.1	3.0	3.7	2.2	3.9	3.1

* For definitions of regions see Figure 4.3 and p. 24

** Farms growing less than 4 hectares of cereals included in sampling universe.

*** Not distinguished.

**** Dairy cow equivalents Conversion factors as for Table 6.2.

The shortage of implements and storage capacity could be rectified by re-equipping. However, it would be difficult to justify any substantial investment in cereal machinery and storage on such small farm areas. Moreover a structural upheaval great enough to say, double the average size of such farms over the next five to ten years seems unlikely.

If small farms, which since the war have come increasingly to specialize on grazing livestock, were to switch much of their land into cereal production, their output would generally not be high enough to yield their operators satisfactory levels of living. There is also a further consideration. The survey indicated that only 60 per cent of the crops and grass area on farms not producing cereals could be arable and grow rotational crops, compared with almost 90 per cent for the sample of farms growing cereals. With only two thirds of the area suitable for arable cropping, some form of mixed farming would be essential. It is doubtful whether this form of diversification on small farms makes the best use of available resources. This line of reasoning was substantially supported by the farmers' answers to survey questions on their reasons for not growing cereals. Apart from a lack of machinery the reason most often cited was that livestock production was more profitable.

To summarize and extend the main points of this section, farms not now producing cereals in England and Wales have the physical potential to bring some two thirds of a million hectares into cereal production. Indeed most of these farms have produced cereals well within living memory. Results of the sample survey of farms not then growing cereals indicate that even as late as 1955, 80 per cent of them had had an average 14 per cent of their crops and grass area under cereals. This fraction was however smaller than in the period of war-time direction of cropping. Once cropping restrictions were relaxed, most such farms began to return their land under cereals to grassland. The two decades following 1955 have seen a continuing specialisation of such farms into grazing livestock production.

Where farms have a limited crops and grass area, current practices favour continued specialisation in livestock rather than diversification into mixed farming. In addition to considerations of output intensity, the present level of mechanisation in cereal growing requires larger areas to be economic compared with the binder and threshing machine. Contractors can of course, reduce the need to invest in specialist equipment particularly for harvesting. However, in an industry where farmers have been encouraged to provide grain storage and handling facilities on-farm, the marginal producer is less well placed than say his French counterpart. It might also be argued that farms with a higher proportion of rough grazing are situated in areas of below average fertility and therefore less suited to arable farming.

The unsuitability of the machinery, operators' expertise, and, above all, the structure of such farms for cereal production was confirmed in this survey by the small proportion of the sample of farmers not then growing cereals (less than 10 per cent) who expressed an intention to begin unconditionally the production of cereals. The national picture might suggest that even the one per cent or so increase in cereal area thus entailed has not in fact materialised. For the future our belief is that the small specialist livestock producing farms in the more westerly areas which do not now grow cereals are unlikely to start doing so on a significant scale in the period to 1985.

6.5 Possibilities of increased cereal plantings by established cereal producers

If there were to be a substantial expansion of the cereal area up to 1985, it would therefore be most likely to come from established producers of cereals. Within this group, expansion would be most likely on the larger holdings in which production of cereals has become increasingly concentrated (Table 6.4).

The majority of these larger farms have a mixed rotation, using grassland or other arable crops as breaks to cereals. The extent of any increase will depend on whether alternative crops are available to be replaced and how far intensification can go before yields diminish or the required level of inputs is significantly increased. In the comparison of scale and intensity of production there was a noticeable similarity in the levels of inputs and output between the more intensive and large scale producers. The evidence indicated that the large scale cereal grower could intensify production, at existing levels of inputs, without a significant loss in yield. To consider which crops could be replaced the cropping and stocking of all farms in the survey with more than 60 hectares of crops and grass is compared, in Table 6.5, with that of the most intensive cereal producers within that group.

The most obvious differences between groups is the much larger area of grass on the over 60 hectare holdings as a whole. This crop has already been replaced by cereals on the more intensive farms. As the second most important crop on the larger farms, grassland is the most likely crop to be replaced if cereal production is to increase further. This would be possible if livestock production could be intensified on to a smaller area of grass. The evidence from Table 6.5 suggests that the most intensive growers already make more effective use of grassland than larger cereal producers as a whole.

Table 6.4 Distribution of Areas of Barley and Wheat in England and Wales by Farm Size Group

1. Percentage composition

Proportion of total plantings by farm size groups specified

	Wheat					Barley				
For harvest in	Less than 60 ha	60 to 120 ha	120 to 200 ha	200 ha and over	Total area 000 ha	Less than 60 ha	60 to 120 ha	120 to 200 ha	200 ha and over	Total area 000 ha
1963	20.6	27.6	22.6	29.2	744	24.3	28.6	21.8	25.3	1679
1964	19.4	27.4	23.0	30.2	855	23.8	29.0	21.7	25.5	1775
1965	18.4	27.2	23.5	30.9	985	23.6	28.6	22.0	25.8	1883
1966	16.0	25.0	24.1	34.9	879	22.9	28.4	22.2	26.5	2140
1967	14.5	24.3	24.5	36.7	900	21.4	27.8	22.7	28.0	2114
1968	13.8	23.9	24.3	38.0	942	20.6	27.5	22.7	29.2	2058
1969	12.0	22.4	24.4	41.2	795	19.6	27.0	22.7	30.1	2068
1970	11.4	21.1	23.7	43.8	969	18.5	25.9	22.6	33.0	1906
1971		Figures not available			1097		Figures not available			2288
1972	11.1	19.9	23.2	45.8	1094	18.0	25.2	22.2	34.6	1905
1973	10.7	15.3	23.1	46.8	1115	17.9	25.3	22.1	34.7	1874
1974	10.7	19.5	22.9	46.9	1200	18.5	25.5	22.0	34.0	1812

2. Average enterprise size in hectares

	Wheat					Barley				
1963	4.45	11.60	22.52	52.73	744	6.11	18.87	40.14	92.39	1679
1964	4.76	12.99	25.29	59.37	855	6.31	20.04	41.56	95.74	1775
1965	5.24	14.71	28.78	66.36	985	6.71	21.16	43.80	98.65	1883
1966	5.11	13.94	27.13	65.10	879	7.35	23.99	49.25	109.26	2140
1967	5.12	14.17	28.28	67.36	900	7.48	23.89	49.36	110.13	2114
1968	5.70	15.17	29.36	69.47	942	7.94	23.91	48.68	104.81	2058
1969	5.47	13.61	26.03	62.62	795	8.20	24.53	49.47	110.32	2068
1970	5.91	15.22	30.00	74.45	969	8.15	23.19	46.24	102.83	1906
1971		Figures not available			1097		Figures not available			2288
1972	6.44	16.73	32.55	82.66	1094	8.18	22.89	45.01	102.04	1905
1973	6.81	17.39	33.83	85.35	1115	8.25	22.77	44.32	99.55	1874
1974	7.12	18.38	35.66	90.29	1200	8.15	22.11	42.40	93.66	1812

Table 6.5 A Comparison of the per Farm Average Cropping and Stocking Patterns of all Surveyed Cereal-Growing Farms with those of the most Cereal Intensive Farms

	All holdings with over 60 hectares of crop and grass	Holdings with more than 80% of crops and grass area in cereals
Sample descriptions		
Number of observations	199	61
Average area of crops and grass (hectares)	256	157
Cropping pattern	**per cent of total crops and grass area**	
Cereals	58.9	88.1
Permanent grass	12.8	2.1
Temporary grass	14.5	3.0
Potatoes	3.1	2.0
Sugar Beet	3.0	1.6
Beans	1.5	2.0
Peas	1.2	0.1
Roots, Kale, etc.	1.6	0.5
Other and fallow	3.3	0.6
Total crops and grass	100.0	100.0
Grazing livestock	**per 100 hectares of crops and grass**	
Dairy cows	13.8	5.9
Dairy followers	10.9	0
Beef cows	3.7	13.6
Beef ex cows	24.7	25.6
Ewes	31.4	26.2
Store lambs	37.8	93.4
Total grazing livestock units*	43.2	34.9
Stocking rate	**per hectare of grass and fodder crops**	
Total grazing livestock units	1.5	6.2

* Dairy cow equivalents calculated as for Table 6.2

On average the larger cereal growing farms required 0.61 hectares of grass and fodder crops per livestock unit at the time of the original survey. However this mean concealed a wide range of stocking rates, from 0.4 hectares to 1.6 hectares per livestock unit. To consider the reasons for this variation the cropping and stocking of farms with an above average stocking rate was compared with those farms where the stocking rate was below average.

Climate or below average fertility could explain some of the variation in stocking rates. However if the percentage of rough grazing can be used as an indication of average fertility, there is little to choose between the samples. The more densely stocked farms with an average of 0.5 forage hectares per livestock unit had, on average, 2.4 per cent of rough grazing on their land. The less densely stocked farms with an average of 0.9 forage hectares per livestock unit had 4.7 per cent of rough grazing land. Similarly the geographic distribution of the two samples does not suggest any particular climatic advantage for either group. Of the well stocked farms 38 per cent were in the Western region but so also were 30 per cent of the poorly stocked farms. Likewise the proportion of farms with better than average stocking in the Eastern region at 39 per cent was close to that region's share of the farms with below average stocking rates.

There were only minor differences in the cropping, the below average producers having less potatoes and sugar beet. The main identifiable differences therefore was in the main types of livestock kept. The farms with above average stocking rates surveyed tended to concentrate on dairying whereas farms with a below average intensity of stocking had more beef cattle and sheep in their grazing livestock, in terms of livestock units, – almost 60 per cent compared to only about 40 per cent on the densely stocked farms. The management problem of intensifying the production of beef and sheep is more difficult than is the case with dairying. It is possible also that the farms producing mainly beef and sheep may be unsuited to the production of grass at the levels required for intensive dairying. These considerations make the

calculation of the area of grassland that could be made available for alternative cropping, if farms with below average stocking rates were to raise their stocking rates to the average level, a more than usually academic exercise. The quarter of a million hectares of potential extra cereal area thus calculated is, in our view, very much an outside limit to the cereal area of England and Wales there might be released by reducing the variation in stocking rates. In practice, the area thus released for cereals by 1985 is likely to be only a fraction of this amount. This marginal increase in cereal area could be augmented by some overall improvement in stocking rates but these are likely to be used mainly to accommodate some increases in livestock numbers.

If a calculation similar to that made above is made for farms of less than 60 hectares the resulting potential extra cereal area of 0.4 million hectares would have to be considered even more of an outside limit. These are predominantly livestock farms, two thirds of them in the Western region. They have many of the characteristics of the farms not growing cereals, described in section 6.3, including a shortage of grain handling and storage (less than 2.5 tonnes per cereal hectare). The evidence from the survey of the farms not growing cereals, supported by the changing structure of cereal production at the national level (Table 6.4), suggests that such farms are more likely to specialise in livestock production rather than increase cereal plantings.

The general conclusion is that any increase in cereal area from farms now growing cereals is likely to be very small and largely confined to the larger farms. This conclusion is based on the assumption that cattle and sheep enterprises, and in particular dairying, do not within the next five years become considerably less profitable than at present. The present states of agricultural politics in both the UK and the EEC make such a squeeze very unlikely. It may nevertheless be of interest to consider the short term potential for increasing the cereal area on larger farms already growing some cereals, if there were a sustained and marked fall in the unit returns from grazing livestock.

In this situation, the resulting increase in cereal area would depend on the availability of land, machinery, labour and storage capacity. Rotational constraints aside, a considerable amount of land would appear to be available. The original survey indicated that almost 90 per cent of the crops and grass area on farms then growing cereals could grow cereals compared with the 56 per cent of the area being used at that time. Scaled up this suggests a potential availability of 3.5 million extra hectares. Since the cereal area has changed little since 1971 this estimate is still broadly valid.

Labour, in a change to a more labour extensive cropping pattern, would be unlikely to be a restriction. Machinery potentially could be more of a constraint. However, most of the farms surveyed in 1971 had spare capacity in machinery, in total sufficient to handle about an extra million hectares. Survey estimates of investment since then indicate that this situation of spare capacity still prevails.

The main constraint on expansion would appear to be the availability of storage and associated handling equipment. Our survey results suggest that in 1975 the per farm average capacity of specialist cereal storage on cereal growing farms with over 60 hectares of crops and grass was 4.50 tonnes per cereal hectare (Table 6.6). Of this capacity only a tenth had been installed in the previous five years. However, nearly 40 per cent had been installed in the period 1966 to 1971 and a further 30 per cent in the preceding 5 years, so that only a fifth of the capacity was more than 15 years old.

Table 6.6 Distribution of Surveyed Average per Farm Storage Capacity on Cereal Growing Farms of more than 60 Hectares by Intensity in Relation to Cereal Area, 1971

Group	Proportion of farms	Average area of cereals per farm	Average per farm intensity of storage capacity
Tonnes per cereal hectare	per cent	hectares	tonnes per cereal hectare
None	16.6	50	0
Less than 2.5	9.4	90	1.56
2.5 up to 3.75	18.4	184	3.54
3.75 up to 5.0	31.8	133	3.99
5.0 and over	23.8	96	7.33

The recent mean total cereal has been about four tonnes per hectare of which probably no more than about a half a tonne per hectare leaves farms at harvest. Given that some extra capacity is required to accommodate variations between seasons in production at regional and individual farm levels, this availability of about 4.50 tonnes capacity per cereal hectare appears to be barely adequate for the existing cereal area, let alone a greatly expanded area.

It might be argued that, at least as a provisional measure, increased grain production could be stored in the more general purpose type of buildings with which many farms are equipped. A Government survey, carried out in 1972 estimated that there was then about, 3.3 million tonnes of such temporary storage capacity on farms. Certainly, in favourable harvests when the moisture content of grain is naturally at a safe level, such storage could be used for feed grains for at least part of the season without great loss of quantity. However, in most seasons especially in the regions where land is most available for expansion of the cereal area grain needs to be dried prior to storage. In recent years, the increasing use of systems where grain is dried in store, relatively slowly, has reduced the capacity of farms to dry cereals in batches for transfer to other storage space. The existing drying capacity on farms is therefore, almost certainly inadequate to dry any substantial increase in cereal production rapidly enough to avoid deterioration in a temporary store. The conclusion must be that any marked expansion in cereal area would have to be accompanied by investment in additional storage. Presently the cost would be at least £160 per cereal hectare and, given that in many cases extra drying, cleaning and conveying equipment would be required, more likely closer to £275 per cereal hectare.

The force of storage capacity as a constraint to expansion of cereal production is probably increased by the uneven distribution of permanent storage between farms. Some farms have a serious lack of capacity while others have more than enough, certainly in relation to their present area and possibly even to their conceivable future area. The situation found by survey in 1971 is summarised in Table 6.6.

Regional surveys carried out more recently by the Unit suggest that this uneven distribution of storage between farms still persists. Its significance would be reduced if it were usual for one farmer to lend storage to others. This we believe is not common and in any event would be very difficult with on-floor storage.

6.6 Projected cereal area to 1985

Despite the considerable technical potential for increasing cereal area, on both farms currently growing cereals and farms which do not, the actual changes in total cereal area up to 1985 are likely to be relatively small. In total about 4.1 million extra hectares in England and Wales are considered technically available for the production of cereals. Of this, about 1.3 million hectares, could come from larger cereal producing farms if the proportion of cereals in the crops and grass area were increased from its present level of less than 60 per cent and to the technically possible 90 per cent. A further 2.2 million hectares of land suitable for conversion from grass to cereals production exists on farms with less than 60 hectares of crops and grass, now growing some cereals. The remaining 0.65 million hectares could come from the grassland area of small specialist livestock producing farms.

The probability of the small specialist livestock producer starting to grow cereals has already been discounted. As the smaller farms now producing some cereals are similar in many respects to the specialist livestock producer, it is likely that these farms will if anything increase livestock production at the expense of cereals.

On the larger farms (those in excess of 60 hectares) it is unlikely that cereals will replace virtually all the alternative crops, and any large expansion would be impossible without huge investment in extra storage capacity. A more realistic suggestion, as discussed in detail in section 6.5, is that some larger farms, where the grassland area is less well utilised, could improve stocking rates and so release part of the grassland area for the production of cereals. Such a change would make possibly 250 thousand hectares of grassland available for cereal production. However, this will depend on the ability of these farms to improve the productivity of their grassland. Such an improvement may be difficult and it seems unlikely to us that more than one fifth (50 thousand hectares) of this potential will become available for the production of cereals.

Thus far the tacit assumption has been that the structures of the farm size in England and Wales will not change. This is almost certainly not the case, for as the annual census figures show, farms are getting bigger. The survey results presented in Chapter 5 showed that as farms get larger cereals occupy a greater proportion of the crops and grass area. Thus some increase in the total cereal area of England and Wales may be expected as farms get larger.

More than 80 per cent of the total cereal area is now grown on farms of more than 60 hectares. Over the past decade these farms have increased their share of the total crops and grass area by about 60 thousand hectares per annum. In the change to larger units a greater proportion of this land is likely to grow cereals. The location of the change in farm size will obviously affect what proportion of the restructured area goes into cereals. In the cereal-intensive counties, where many small farms already have a relatively high proportion of cereals, it is unlikely that more than 10 per cent of the area will actually change to cereal production. In the extensive counties the proportion could be as high as 40 per cent and even 45 per cent in the intermediate counties.

Allowing for this effect of regional variation, we suggest that about one third of the land which is likely to be amalgamated into larger units can be expected to grow cereals. For England and Wales this would give an annual increase area of about 20 thousand hectares and a total of about 150 thousand hectares by 1985. Clearly this type of analysis over simplifies a complex problem which alone merits a separate enquiry. Nonetheless, we are confident that the main source of any future increase in cereal area is likely to come from the restructuring of farm sizes rather than an improvement in grassland productivity.

We estimate, therefore, that by 1985, the area of cereals is not likely to increase by more than 200 thousand hectares. The bulk of this increase could be the result of changes in the structure of farm sizes, the remainder coming from some improvement in grassland productivity. This projection implies an average rate of growth in cereal plantings over the next five to ten years of about three quarters of one per cent a year. This is about only half the growth rate projected by the Farmers' Union in 1975.

When combined with our projection of yield, this projected area implies a production of cereals in England and Wales in 1985 of about 15¼ million tonnes. This would be about 2½ million tonnes and 20 per cent above the average level of the 1976 and 1977 harvests.

Table 6.7 Proportions of Wheat, Barley and Oats in Combined Total Area of Plantings

Harvest year	Total area of wheat, barley and oats	Proportions of		
		Wheat	Barley	Oats
	Thousand hectares	(per cent of England and Wales total)		
1940	2029	33.88	24.32	41.80
1941	2395	36.21	22.70	41.09
1942	2533	38.23	21.81	39.90
1943	2850	46.61	22.14	31.25
1944	2839	43.70	24.55	31.75
1945	2619	33.73	30.68	35.59
1946	2487	32.28	32.62	35.10
1947	2396	35.07	31.76	33.17
1948	2461	36.00	31.22	32.78
1949	2321	33.14	32.90	33.96
1950	2372	40.94	27.73	31.33
1951	2201	37.90	31.89	30.21
1952	2315	34.35	36.33	29.32
1953	2362	36.75	34.72	28.53
1954	2317	41.56	32.76	25.68
1955	2224	34.50	38.38	27.12
1956	2359	38.02	36.40	25.58
1957	2326	35.39	41.62	22.99
1958	2385	35.92	42.90	21.18
1959	2333	32.00	48.67	19.33
1960	2492	32.56	45.71	17.73
1961	2448	28.64	56.15	15.17
1962	2605	33.33	54.43	12.24
1963	2673	27.83	62.84	9.33
1964	2846	30.05	62.41	7.54
1965	3066	32.14	61.45	6.41
1966	3153	27.52	67.06	5.40
1967	3226	27.91	65.54	6.55
1968	3214	29.31	64.06	6.63
1969	3052	25.71	66.89	7.40
1970	3110	31.18	61.34	7.48
1971	3216	32.98	59.70	7.32
1972	3209	34.10	59.40	6.50
1973	3184	35.02	58.89	6.09
1974	3185	37.67	56.91	5.42
1975	3093	32.57	62.34	5.09
1976	3124	38.58	55.92	5.50
1977	3139	33.47	62.20	4.33

Table 6.8 Distribution by Variety Planted of Surveyed Areas of Winter Wheat, Spring Barley and Spring Oats for 1971 and 1975 Harvests

Winter Wheat'

1971 harvest	Per cent	1975 harvest	Per cent
Joss Cambier	39.13	Maris Huntsman	38.60
Cappelle	27.69	Boquet	14.11
Cama	11.49	Atou	9.15
Maris Ranger	11.39	Maris Templar	6.93
Champlein	4.6	Cappelle	6.10
Maris Widgeon	4.2	Flinor	5.15
Other Varieties (5)	1.5	Champlein	3.51
		Maris Nimrod	2.64
		Chalk	2.06
		Maris Ranger	1.86
		Mega	1.77
		Maris Freeman	1.76
		Maris Widgeon	1.47
		Other Varieties (7)	4.88

Spring Barley

1971 harvest	Per cent	1975 harvest	Per cent
Sultan	28.53	Julia	20.21
Proctor	17.00	Mink	12.22
Julia	15.60	Mazurka	10.84
Zephyr	11.12	Proctor	10.26
Vada	10.06	Tern	9.35
Deba Abed	4.38	Golden Promise	5.94
Golden Promise	4.32	Lofa Abed	4.76
Midas	2.04	Zephyr	4.37
Ruby	1.06	Hassan	4.29
Crusader	1.00	Wing	4.03
Other Varieties (11)	4.89	Universe	3.08
		Vada	2.07
		Berac	1.86
		Midas	1.50
		Abacus	1.24
		Armelle	1.11
		Other Varieties (14)	2.87

Spring Oats

1971 harvest	Per cent	1975 harvest	Per cent
Astor	51.14	Maris Tabard	28.31
Condor	21.07	Astor	26.70
Mostyn	18.02	Mostyn	22.74
Forwards	5.54	Selma	6.78
Other Varieties (4)	4.23	Forwards	6.55
		Other Varieties (4)	7.46

Table 6.9 Distribution by Selected Physical Characteristics of Crops and Grass Area of Farms not Growing Cereals

Altitude		Rainfall		Soil type	
Feet above sea level	**Per cent**	**Inches**	**Per cent**		**Per cent**
Below 250	38	Below 25	5		
250 up to 500	26	25 up to 30	20	Light	17
500 up to 750	20	30 up to 35	23	Light-medium	28
750 up to 1000	13	35 up to 40	17	Medium-heavy	27
1000 and above	3	40 up to 45	25		
		45 and above	20		
Total crops and grass area	100	Total crops and grass area	100	Total crops and grass area	100

Soil depth		Drainage		Topography	
Inches	**Per cent**		**Per cent**		**Per cent**
Below 4	29	No problem	56	Level	45
4 up to 6	30	Drainage problems		Rolling	25
6 up to 8	5	easily improved	17	Hills	23
8 up to 10	16	possible to improve	21	Steep	7
10 and above	10	impossible to improve	6		
Total crops and grass area	100	Total crops and grass area	100	Total crops and grass area	100

CHAPTER 7 SUMMARY AND CONCLUSIONS

7.1 Introduction

The section or sections to which the numbered summary points mainly refer are shown in parentheses after each point.

7.2 Methodology

1. The report is based mainly on the findings of surveys of a representative sample of 350 holdings of 20 hectares or more in size and growing more than four hectares of cereals (1.2).

2. Surveys by personal visit were carried out on production harvested in 1971, 1972 and 1975 and by post on production for the 1977 harvest, with the principal objective of monitoring trends in costs of, and returns from, growing cereals (1.1, 1.2).

3. To assist in the assessment of likely future changes in the area and location of land planted to cereals a sample of 300 holdings over 20 hectares but with less than four hectares of cereals was also surveyed, (1.2, 1.3).

4. Other main objectives of the surveys were to examine differences in production and harvesting techniques and costs between cereal growing regions, and by size of enterprise and intensity of production (1.2).

5. To facilitate further statistical analysis, the data handling was done on an electronic computer.

7.3 Costs and returns

6. Though data on costs and returns of other cereal crops are presented for the 1971, 1972 and 1975 harvest years, results for 1977 and the discussion of trends are confined to spring barley and winter wheat (barley and wheat for short); these two main crops occupied more than 85 per cent of the surveyed cereal area (2.2).

7. Between 1971 and 1977 as a whole, variable costs per hectare have increased faster than fixed costs, though between 1975 and 1977, the reverse has occurred, especially for barley (2.2).

8. Total costs per hectare have tended to increase more than output, so that when allowance is made for yield variation, net margins (the returns to farmers' managerial and capital inputs), as a proportion of output, have declined, particularly for wheat (2.2).

9. When the effect of inflation of the general price level (on average 14 per cent a year) is excluded by expressing costs and returns in real terms of pounds of constant purchasing power, net margins in 1977 were lower than in the early 1970's (2.3).

10. This decline in real net margin is most marked and clear cut in the case of wheat; despite a rise in real output of 18 per cent between 1971 and 1977, increases in costs per hectare, especially of fertilizer and sprays have caused the real net margin to be six per cent lower in 1977 than in 1971 (2.3).

11. In terms of pounds of 1977/78 purchasing power, the average cost of production per tonne of wheat is estimated in 1977 to have been, despite a good yield, £11 (36 per cent) higher than in 1971 and £3 (16 per cent) higher than in 1975 (2.3).

12. Margins for wheat have been consistently above those for barley – because of higher yields rather than difference in price – cost relations (2.3).

13. Estimation of costs and returns for years between surveys show 1973/74 to have been a short-lived period of exceptional prosperity for cereal growers (2.3).

7.3 Accuracy of updating procedures

14. A comparison of costs obtained by

(i) re-pricing recorded 1971/72 physical inputs at 1975 prices, and

(ii) raising fixed costs by published aggregate indices

with estimates obtained by survey suggested that this method of making current cost estimates between surveys is not likely to be seriously misleading (3.2).

15. The main errors of detail will arise where there are rapid changes in techniques as in this case in the amount of sprays used (3.2).

16. Intermediate possibilities are follow-up surveys confined to topics where great changes are suspected and broader interim surveys of original samples done by post. Use of the second technique on the 1977 harvest year indicated that the main increase in production costs since 1975 had occurred for wheat, and were associated with higher input prices rather than changes in levels of use (3.3).

7.4 Comparisons between regions of different intensity of cereal production

17. The counties of England and Wales (prior to reorganisation) were divided into three regions, the cereal-intensive (more than 40 per cent of crops and grass area in cereals), the intermediate (20 to 40 per cent) and the cereal-extensive (less than 20 per cent). The counties proved to be mainly contiguous (Fig. 4.3) and the regions may be alternatively called Eastern, Central and Western zones (4.1).

18. Analysis of published data shows that typical level of lowland rainfall explains regional differences in cereal intensity better than relative yield (4.1).

19. The survey results indicated significantly higher yields of (winter) wheat in the Eastern cereal-intensive counties than in the Western cereal-extensive counties, despite the total value of inputs being similar.

20. The yield of barley did not differ significantly between regions but growers in the Eastern zone used much more fertilizer and sprays to attain this yield; this reflects the poorer rotational position of barley in the cereal intensive counties. (4.4).

21. More man hours per hectare were used in the cereal-extensive counties than in the cereal-intensive counties; this difference is only in part explained by the greater proportion of straw that is baled (4.5).

22. By 1975, farms in the Eastern zone had a much higher stock per hectare of machinery specific to cereal growing, though this may not be a permanent difference (4.5).

23. Farms in the most intensive cereal-growing counties had about half a tonne per hectare more storage capacity than those in the least intensive where, correspondingly, a higher proportion of cereal deliveries were made early in the season. (4.6).

24. The most striking feature of the regional comparison is the difference between wheat and barley. Whereas wheat grows less well in the Western zone, despite a similar level of inputs, barley does not show a similar reduction in yields and needs less inputs (4.7).

25. The advantage of the Eastern zone in wheat production made its total cereal yield 6 per cent above that of the Central zone and 11 per cent above that of the Western zone (4.7).

26. A further implication is that any extension of the total wheat area is likely to be in the cereal-intensive counties, replacing barley in the rotation and therefore being grown with higher applications of fertilizer and sprays (4.7).

27. Detailed regional differences found in the production of spring wheat, winter barley, and spring and winter oats are tabulated without comment (4.8).

7.5 Impact of size and intensity of cereal production

28. Post-war changes in the location and degree of specialisation of cereal production have caused cereals to be grown in larger units and to occupy a bigger proportion of the area on the larger farms (5.1).

29. Cereal enterprises of more than 80 hectares of cereals showed better financial results than those of below 80 hectares, but some diseconomies of size were apparent on enterprises of over 200 hectares, whose higher costs were not offset by higher yields (5.3).

30. Farms growing between 20 and 40 hectares of cereals obtained poorer results from them than did those with both larger and smaller enterprises (5.3).

31. Applications of fertilizer and sprays increased with size of enterprise, but not their cost, indicating a substantial purchasing advantage for larger buyers (5.4).

32. Even net of straw handling time, inputs of labour per hectare declined with enterprise size – up to 200 hectares (5.4).

33. Farms with over 200 hectares of cereals had a much greater accumulated investment in machinery specific to cereals than farms with smaller cereals enterprises (5.4).

34. The profitability of cereal growing appeared to be more closely related to intensity than to size of enterprise (5.6).

35. For growers with over 80 per cent of cereals in their crops and grass areas, variable costs, which generally declined with intensity, tended to be higher than for growers with a cereal intensity of 60 to 80 per cent. Lower fixed costs however gave them an overall cost advantage (5.6).

36. The more intensive cereal growers used fewer labour and machinery inputs than the average of the less intensive and, in addition, had, in value terms, a lower stock of machinery (5.6).

37. The more intensively cereals were grown, the more fertilizer and sprays were used but the lower the labour and machinery time put in (5.7).

38. Compared to the intermediate group of farms, classified as those with 35 to 80 per cent of crops and grass area in cereals the most intensive cereal producers had a lower proportion of winter wheat in their area, which had the effect of lowering average total cereal yield (5.7).

39. The analysis suggests that the larger cereal growing enterprises in England and Wales could further increase the portion of their area in cereals without loss in yield or increase in inputs (5.8).

7.6 Future levels of cereal production

40. Evidence drawn from sources other than the surveys leads us to accept as reasonable and extendable to 1985 the Farmers 'Unions' 1975 projection of a one and a half per cent annual increase in the total cereal yield. Breeders will continue to introduce higher yielding varieties and farmers continue to adopt them (6.2).

41. The surveys revealed considerable scope for overall increase in yields by a reduction in the dispersion between farms (6.1).

42. Some of the future increase in total cereal yield will come from a further switching of cereal area from spring barley into winter wheat (the surveyed yield of which was, on average, 16 per cent higher) (6.2).

43. The effect of yield increase, which on its own would, on our projection, increase cereals production in England and Wales by about 2 million tonnes, is in our view unlikely to be much augmented by an increase in cereal area (6.3).

44. To help assess the area of cereals likely to be planted in future by farms not currently growing them, a random sample of 300 farms was surveyed and their characteristics compared with those of the main sample of cereal growing farms (6.4).

45. The farms not growing cereals were smaller, mainly in the western zone, and had a higher proportion of permanent pasture and probably also of marginal land (6.4).

46. Assessments of surveyed farmers, the past cropping histories of their farms and their physical features, when combined, suggest a *technical* potential for an additional 650 thousand hectares of cereal area to be withdrawn from grassland (6.4).

47. The immediate prospects of a switch to cereal growing are severely limited by the dearth of machinery, storage and expertise (6.4).

48. The structure of these farms presents a more fundamental barrier. A reversion to mixed farming on such small farms would not give a high enough output to yield their operators a satisfactory level of living while the enterprise size would be too small in relation to the capacity of modern machinery. These views were generally supported by direct survey responses, even though given at a time when farmers' expectations of cereal prices were more optimistic than at present (6.4).

49. Any expansion in cereal area is therefore most likely to come from established producers of cereals, on the larger holdings in which production of cereals has become increasingly concentrated and from farms with similar basic characteristics emerging from the process of structural change. Farms of less than 60 hectares growing some cereals are unlikely to expand their cereal area for reasons similar to those applying to farms not growing cereals (6.5, 6.6).

50. Large farmers growing cereals at lower levels of intensity would increase their cereal area without great loss of yield, and the range of stocking rates found at first sight suggests a considerable potential for release of grassland to cereals by more intensive stocking (6.5).

51. However, the more lightly stocked land appears to be mainly carrying beef cattle and sheep and it is technically unrealistic to expect a stocking rate comparable to that on dairy units to be achieved. Also some increase in livestock numbers is likely (6.5).

52. Our best guess is that between now and 1985, on existing farms now growing cereals, only about 125 thousand hectares are likely to be switched from grassland into cereals. This projection presupposes that there is not a profit squeeze on production from grazing livestock, in particular milk, of an order that is at present, for political reasons, inconceivable (6.5).

53. In such a situation land would not be a constraint. Operators' responses indicated that as much as three and a half million hectares could be diverted from grass (and alternative arable crops, mainly sugar beet and potatoes) (6.5).

54. Machinery availability would be more tightly constraining but, even so, there is probably sufficient excess capacity to handle a further million hectares of cereals. A far more binding constraint on expansion in a situation of drastically changed relative prices, would be storage capacity and particularly drying capacity. This appears to be barely adequate for the existing cereal area, and so investment in storage of between £160 and £275 per additional cereal hectare would be required to accommodate a significant expansion in that area (6.5).

55. In technical terms the potential extra area of land that could be planted to cereals in England and Wales is as much as 4.1 million hectares; of this total 1.3 million could come from cereal growing farms with over 60 hectares of crops and grass, 2.2 million from smaller farms now growing some cereals and about 0.6 million hectares from small specialist livestock producing farms. (6.6).

56. Since smaller farms are more likely to specialise further in livestock production than to introduce or expand cereal production the main economic potential for expansion lies on existing larger farms *via* an increase in grassland stocking rates, but more especially from the restructuring of smaller farms to sizes which make cereal production viable. (6.6).

57. It is suggested that by 1985 restructuring of farms could bring a further 150 thousand hectares of land into cereals production, to which might be added a further 50 thousand hectares through the effects of improved grassland productivity.

58. The projections of yield and area, combined, imply a production of cereals in 1985 of about 15¼ million tonnes, about 2½ million tonnes and 20 per cent above the average of the 1976 and 1977 harvests.

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