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Economic Report No. 13

BREAK CROPS

An economic study in Southern England,
with a technical appraisal from A.D.A.S.

J. A. L. Dench with
A. K. Giles, H. Casey, D. J. Ansell, J. A. Burns, J. Wright,
E. G. Hunt, Miss W. Brooker and R. G. Hughes (A.D.A.S.)

University of Reading
Department of Agricultural Economics
and Management

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FOREWORD

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

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

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

PREFACE AND ACKNOWLEDGEMENTS

In recent years this Department has undertaken a number of studies into the economics of individual break-crops. During the course of this work it became increasingly apparent that some more comprehensive study of the whole subject of break-crops would be worthwhile. This report summarises the results of such a study. It is in five sections, comprising an introduction, a technical appraisal, a review of farmers' practices, a presentation of management data, and a consideration of marketing and prospects. To some extent each section is independent of the others. The Report is accompanied by a separately presented bibliography.

The Department wishes to thank the many farmers in the South of England who helped to provide the raw material for Sections III and IV, and those individuals in the seed trade and certain marketing organisations who were consulted in the preparation of Section V. Thanks are also due to colleagues in the Universities of Exeter, Bristol, Nottingham, Cambridge and London (Wye College) who facilitated our introduction to farmers located in their 'territory'; also to many members of A.D.A.S. who helped us to identify the light-land parishes on which the study has been largely concentrated.

Special personal thanks are due to Mr. R.G. Hughes (Regional Crop Specialist, S.E. Region, A.D.A.S.) who has kindly contributed the technical appraisal in Section II; to Mr. J.D. Sykes (Wye College), Mr. W.L. Hinton (Cambridge University) and Mr. W.S. Senior (Nottingham University) who, respectively, have provided the data in Section IV relating to maize, field scale vegetables and field beans.

The many contributions from within this Department have been as follows:-

Design of study: J.A.L. Dench and A.K. Giles

Field Work: J.A.L. Dench (supervisor), E.G. Hunt, Miss W. Brooker, J.A. Burns and D.J. Ansell

Computing consultant: H. Casey

Authors or compilers of sections: A.K. Giles (I), J.A.L. Dench (III and IV), J. Wright (IV), D.J. Ansell and J.A. Burns (V) and Miss W. Brooker (Bibliography)

Editor of report: A.K. Giles

Reproduction of report: Mrs. B. Fisher and Mr. F.G. England

R.H. Tuck

April 1972

SECTION I : AN INTRODUCTION - A.K. Giles

There are many farmers who have the natural resources and personal inclinations which point towards cereal production, but who, nevertheless are keenly aware of a need for mixed rotations. This need is engendered by a combination of husbandry and economic considerations some of which are clear cut but others, less so. In husbandry terms the need is seen usually in terms of the necessity to control cereal pests and diseases, to provide effective weed control and the need also to maintain soil structure. Something less than continuous corn is felt necessary if yields and returns are not to fall below an economic level. In addition the relative profitability of wheat in recent years, as compared with barley, has required an entry crop for the wheat which has further diluted rotations. On the more strictly economic side of the coin, the situation can easily be reached where, without alternatives to corn, the room for manoeuvre within the business tends to run out. So far as output is concerned, for instance, there is a limit beyond which further technical improvement can not be expected to go on being reflected in increased yields, whilst only in the special circumstances of world grain shortage have prices over the last decade moved off a relatively flat plateau. At the same time costs continue to rise as a result of inflation and because of the increasing sophistication of the physical inputs employed. Direct cost reduction (i.e. without intensification of output) is notoriously difficult to achieve and almost impossible to repeat. This is especially the case where, as in cereal growing, no particular input dominates the cost structure and therefore offers obvious scope for economy, and since intensification of output, of the type possible with livestock, is not possible with cereals all of this means that an economic impasse can sooner or later be reached. Recently published data from the Farm Management Survey[1] shows that despite the prosperity of the early and middle sixties profits on specialist cereal growing farms were little better in 1970/1 than they were fifteen years earlier. In real, as opposed to money terms, their position has now actually deteriorated.

It is because of these circumstances that farmers turn their attention to break crops and,ultimately,the only meaningful contribution

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1. Trends in Net Farm Income between 1954/5 and 1969/70. England and Wales M.A.F.F. July 1971.

of a particular break crop lies in its ability to relieve this situation; i.e. to slow up, halt, reverse or prevent a deterioration in profit. This contribution can be achieved in three main ways; first by making a technical contribution to the farm system (i.e. by adding to the control of such things as pests, diseases, weeds and soil structure) leading subsequently to reduced expenditure in these directions and/or to improved yields from subsequent crops, or even to a different combination of the crops themselves; secondly, by contributing to the better or easier organisation of the farm by improving for instance, the utilisation of existing investment in machinery and equipment; and thirdly by making a direct contribution to profits in the form of its own gross margin. This is not to suggest that a break crop may not also create fresh technical and organisational problems and make fresh demands on capital but simply that in the case of a successful break crop the balance of these things - over a number of years - will favour its introduction rather than not.

In making a choice in this matter the farmer will want not only to try to assess the balance of arguments for and against a particular break crop, but also the alternative courses of action that are open to him. Unless the economic base of the business can be expanded (e.g. by the acquisition of extra land or the development of a factory enterprise) then there are three basic courses of action:-

First, declining or reduced yields can be accepted without modification to cropping patterns and effort can be concentrated on those areas of the business where adjustment is possible. In the absence of a grazing livestock enterprise, this will inevitably mean either rigorous attention to cost reductions (remembering that a number of small reductions can add up to a large one - but remembering also that difficulty will be experienced in repeating the process), or the introduction or expansion of non land-using activities e.g. pigs and poultry. Sooner or later however, expansion will usually be halted, if only by a lack of capital.

A second alternative is to endeavour, with technical know-how to overcome declining yields. In the right soil conditions examples can be found, here and there, where years of continuous barley growing have produced consistently high yields. This reward has usually been achieved by meticulous attention to the timing of operations and to the effectiveness with which each job is done. Managerial attention is riveted to the pursuit

of excellence in producing cereals from the first stubble ploughing to the final marketing of the crop. Even for the few, however, who are capable of maintaining these levels of management, constant, if not diminishing returns must sooner or later be met and the limit to which rising costs can be offset by higher production from cereals alone will be reached.

A third alternative is to introduce grass leys into the rotation accompanied by livestock farming; dairying, cattle or sheep. For a wide range of technical and economic reasons many farmers do in fact prefer to combine cereal growing with grazing livestock. Where those livestock are dairy cows they not infrequently provide a corner stone of the farm economy as well as providing more favourable growing conditions for cereals. Traditionally beef cattle, dairy followers and sheep, with gross margins often down in the £15-£35 range, have been unable to match the contribution of dairy cows, from which gross margins, usually lie in the £45-£60 range.[1] It is nevertheless unusual for these more extensive livestock enterprises to make the heavy demands on fixed costs (e.g. labour, machinery, fixed equipment) that are made by dairy cows, and as development work in these enterprises becomes gradually reflected in more intensive commercial versions of them, then the gross margins that they offer (not to mention their other advantages) may rise. One recent and detailed account of an actual case study has demonstrated this possibility[2] and the opportunities which membership of the E.E.C. may offer could hasten this process.

For the farmer who has pursued and retained a mixed livestock/arable system of farming the labour, capital and managerial demands of livestock will already be familiar enough to him and for this reason they will be less of a barrier to him - mental or financial - than they are to the farmer who wishes to introduce (or re-introduce) them into his system. The financial problems, especially, of creating a livestock unit on a scale which is sufficient to provide a viable unit, may in many cases, be virtually prohibitive and it is for this kind of reason that farmers who cannot otherwise live with or combat falling cereal yields, often turn their attention to the cash break crop.

It is with these kinds of crops that this report is concerned - and in particular with those of them that are suitable to light land

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1. For detailed gross margins see Farm Management Pocket Book (Fourth Edition) by John Nix, School of Rural Economics & Related Studies Aug. 1971.

2. Grass as a Break Crop - A Case Study. H.W.T. Kerr. Farm Management Notes No.38. Department of Agricultural Economics, University of Nottingham 1968.

situations in Southern England. In a recent article J.L. Gould[1] conveniently categorised them into the following three main types:-

1. Intensive break crops of the vegetable and root crop kinds, with generally speaking, a high gross margin.
2. Medium Intensive break crops with gross margins that are generally comparable with cereals.
3. Low (or zero) output break crops such as fallows or ploughed - in green crops.

If cash break crops are, in fact, the chosen course of action for a particular farmer, then it may seem at first glance that the intensive high gross margin kinds have an obvious appeal. Ultimately, however, it is the relationship between the total gross margin from the farm system and the total fixed costs that the system attracts which, in profit terms at least, should govern decisions. And unfortunately there is often an inverse ratio between what a particular break crop can contribute to a system and the cost of getting it.

In assessing the net effect of a particular change, it is true, of course, that because of the marginal nature of most farm decisions the precise changes in fixed costs that may be associated with that change will always depend on a farmers' individual circumstances. The particular base situation from which the change is being contemplated will govern the subsequent changes that are necessary. To take a simple example an expansion in the acreage of an intensive arable crop may in one case demand a larger or an additional machine, whilst in another case the same change may not. This is one of the ways, of course, in which fixed costs are different in character from variable costs; the latter varying in a predictable way related directly to the scale of change being contemplated, whilst the former do not. In each particular situation therefore, the right questions must be asked and the right answers provided in the light of the existing stock of fixed resources.

More difficult to answer are the questions concerning the input/output coefficients that can reasonably be expected from new and generally untried enterprises, and quite apart from the physical responses, what level of gross revenue will accrue from commodities which do not enjoy some kind of guaranteed market. Nearly ten years ago Wragg[2] described a

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1. Break Crops - are they really necessary? by J.L. Gould. Farm Business. Vol.X No.7.
2. Note on the Economics of Crop Rotations with special reference to Continuous Cereal Production. S.R. Wragg N.A.A.S. Quarterly Review Vol.XIV No.58 Winter 1962.

simple model for examining in theory, the effect of product - product substitution within the context of crop rotations. He confessed at the time, that 'precise and adequately proven data for quantifying this model are not available' and in many respects the continual search for and the introduction of new viable and manageable break crops makes the situation little better today than it was when those words were written. Reporting, for instance in 1969 on a series of N.A.A.S. cereal growing seminars held in Hampshire, Baker[1] noted that the 'evaluation of crop rotations is especially difficult because of the lack of evidence as to the most likely yields under different growing sequences'.

It is because the real answers to questions like this can only be provided by controlled experiment, that R.G. Hughes, a crop husbandry specialist in the South Eastern region of A.D.A.S., has been invited to contribute Section II to this publication, summarising current technical knowledge in this field. The extent to which the behaviour of individual farmers reflects an awareness of this knowledge, and the extent also to which their behaviour may be influenced by other considerations is reflected in Section III where replies to a large scale postal enquiry are summarised.

In the real world, however, decisions have to be made whether or not reliable data are available and the best available 'guestimates' used. With this in mind, Section IV of this report summarises the results of a field enquiry on some of the farms that took part in the earlier postal survey. This kind of survey data cannot pretend to provide the technical range or the reliability of experimental data. To the extent, however, that it is based on actual observations it is probably superior to entirely hypothetical data and is offered here as a contribution to the fund of "best available data" that has to be employed in day-to-day partial budgeting. In his report on 'Oilseed Rape' J.A.L. Dench[2] has demonstrated in an interesting way how such information can be used in partial budgets to explore the kinds of cropping alternatives that offer themselves.

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1. Evaluation of Rotations. Eric Baker. N.A.A.S. Hampshire. Jan. 1969.
2. Oilseed Rape by J.A.L. Dench. Agricultural Enterprise Studies in England and Wales, Economic Report No.3. Department of Agricultural Economics and Management. University of Reading. Dec. 1970. 50p.

Finally in this Introduction, it is worth emphasising that in assessing and selecting the various alternatives that are open to him, a farmer should more than anything else, be quite clear in his mind what his long term strategy should be and which of the alternative tactics open to him is most likely to achieve his objectives. Some alternatives will depend on existing enterprises being done better and will call, therefore, for improved levels of management, which may not follow automatically just because the situation seems to call for them. Other courses of action will depend mainly on a change of system; on a different combination of activities which may or may not go beyond the range of existing activities.

Very often it has been demonstrated that modifications to existing systems - as opposed to improved results from an unchanged system - are more likely to guarantee results and this may be especially true where the modification leads to a simplification rather than to a complication of the farming system. Cereal growing farmers contemplating a change, are well advised, therefore, to consider seriously which of the two broad approaches - i.e. improvement of the existing system or a change in the system - are most appropriate to their particular talents and circumstances. Just now their considerations will clearly be complicated by the uncertain opportunities offered by the prospect of membership of the Common Market. It can be certain, however, that Common Market or not they will be increasingly concerned with the 'market' in its more conventional sense. Accordingly a consideration of the marketing of break crops provides the final section of this report. The report is accompanied by a separate bibliography.

SECTION II : A TECHNICAL APPRAISAL - R.G. Hughes. A.D.A.S.

The term "break-crop" generally refers to the growing of alternative crops to cereal in a cereal dominant rotation. The adoption of break cropping aims at rejuvenating the yield of subsequent cereal crops. Close cereal cropping is often vulnerable to the build-up of soil-borne disease and grass weeds which can drastically reduce yield of wheat and barley. Cereal monoculture is also associated with seasonal labour demands whilst the introduction of other crops could ease peak labour problems. The practice is often claimed to deplete soil organic matter leading to a deterioration of soil workability. The introduction of short duration alternative crops (break-crops), within a sequence of cereal crops, which can reduce some or all of these risks could therefore be considered technically desirable.

Individual break-crops may themselves offer economic financial returns but even where the resulting gross margins are low the benefit to subsequent cereal yields may fully justify the adoption of these break-crops within a rotation.

The benefits derived from break-crops in terms of improvement of subsequent cereal yield depend on:-

The choice of break-crop

The duration of break-cropping

The extent of build-up of cereal soil-borne diseases, pests and weeds at the point of introduction of break-cropping.

Technical skills and management-level available.

The Choice of Break-crop

The root systems of some arable break-crops such as peas and beans are very sensitive to compacted soil layers. Variability of soil within a field may also be a critical factor governing the evenness of ripening and this with direct combined crops such as peas or spring oil rape could aggravate the difficulty of harvesting resulting in yield loss and penalties for inferior quality of produce. Some break crops mature late so that harvesting could involve traversing land with heavy machinery when soil conditions are deteriorating. Late harvest could also preclude entry for winter sown cereals. On the other hand the introduction of break crops

could reduce the extent of cereal harvesting and thereby reduce cereal losses that accrue when combine strength is overburdened especially during a difficult cereal harvest period.

Few opportunities exist for substantially increasing organic matter levels in an arable cropping system on soils that already have a low level unless large quantities of animal manures are available. Short term leys of 6-18 months in length seldom produce significant increases in soil organic matter. The binding action of undecomposed roots subsequent to ploughing out a short ley, including herbage seed stands, can however bring about stabilisation of the soil aggregates near the surface and thus prevent surface slaking and provide a more suitable environment for subsequent crop establishment. This structural benefit from short leys is normally short lived and usually disappears within two years. Other break crops contribute little improvement of soil structure and in some instances the residues post-harvest can be a hindrance to cereal establishment unless fragmented and mixed well into soil.

A rapid increase in acreage of individual break-crops within a locality often leads to an increased pest problem, such as weevil in oil rape and pea midge. There is evidence also of disease problems being aggravated where the frequency of individual break-crops is increased within a rotation such as chocolate-spot in beans and club root in brassicae.

Grass breaks are not immune to problems. A two year herbage seed stand can become an excellent culture for couch to the detriment of subsequent cereal crops. Leys predominantly mown for conservation can also harbour annual grass weeds; e.g. rough stalked meadow grass, which are difficult to eradicate prior to subsequent winter cereal cropping. There is accumulating evidence of more intense and widespread pest problems in cereals grown after grass (e.g. frit-fly and moths) compared to their occurrence in cereals within an arable rotation.

On the other side of the balance sheet most break-crops are immune to "take-all" disease - oats, maize and Italian ryegrass being the least free of carry over of this disease - and also of straw and leaf disease which plague many cereal crops today. The growing of non-cereal break-crops can also aid destruction of straw fragments and green-bridge volunteer cereals carrying mildew, rust and straw diseases. Direct sowing of leys rather than under-sowing in cereals is a much more satisfactory approach where the carry over of cereal leaf diseases presents problems. Break-crops vary in the

opportunities for eradicating couch grass and other perennial weeds. Beans are notoriously poor since the crop is very open when couch growth is most active whilst oil rape can be an excellent smotherer of weed grasses especially if these have been weakened earlier by cultural or chemical control methods.

Grain maize, apart from its doubtful role as a carrier of cereal soil-borne disease, demands high inputs in terms of variable costs, harvesting and drying facilities together with a high degree of skills in management. It is a crop that thrives on deep fertile soils, but under marginal conditions economic yields are unlikely to be achieved with present day varieties.

Experimental evidence on the relative value of individual break-crops, as measured by subsequent cereal yield, is limited and sometimes confusing largely because there is little reliable data of the extent of soil borne disease or grass weed build-up prior to the introduction of the breaks. Benefits following break-crops at Bridgets E.H.F. are generally lower after oats than after beans but most break-crops have given higher responses in winter wheat compared to the introduction of wheat after long runs of barley. At Gleadthorpe E.H.F., on coarse sand, lengthening cereal runs invariably results in low yield whilst break-crops have boosted subsequent cereal yield but at the expense of low gross margins other than with cash-roots which themselves have serious effects on the labour/machinery structure. Three year leys at Gleadthorpe have benefited subsequent wheat yield by 3 to 6 extra cwt per acre compared to short term break-crops. At Rothamsted also 3 year leys have given superior results in subsequent cereals compared to short term arable or arable/one year ley combinations but differences between individual short term break-crops have been relatively small.

The Length of Break-cropping

Generally the introduction of a one-year break-crop after a long sequence of take-all and eyespot susceptible cereals will only ease the stress of disease in the cereal crop immediately following with subsequent deterioration in yield of subsequent cereals. In such a situation two year breaks are consistently more effective in achieving a reduction in levels of soil-borne diseases and pests. The duration of the improvement in yield will depend on the initial level of soil-borne disease at the point of introduction break-cropping, freedom from carriers of disease such as volunteer cereals or couch grass during break-cropping and weather conditions which govern the degree of flare-up of soil-borne disease annually.

A summary of rotation experiments at M.A.F.F. Husbandry Farms confirms the benefits of two-year breaks compared to single breaks although at some farms in some seasons differences were marginal. Where however single break-crops are introduced at short regular intervals, following an earlier longer break; e.g. 3 year ley, high yields of cereals can be maintained and in particular allow a frequent entry for wheat provided they are harvested early enough for satisfactory seedbed preparation. There are benefits therefore in concentrating short term break-crops on part of a farm rather than dissipating them thinly over a larger acreage. In the absence of livestock enterprises warranting longer leys the remainder of the farm could be subjected to continuous cereal relying on take-all decline to stabilise yield and even allow for wheat entry after a minimum of six consecutive barleys provided there is satisfactory soil structure, free drainage and absence of couch grass. The initial decline in yield in continuous cereal is greater in wheat than barley and usually much more rapid and drastic in wetter cooler areas compared to that on well bodied soils in the drier regions of the country. Recent experience at Boxworth E.H.F. suggests that "The limited choice of profitable combine harvested type break-crops available leaves the whole question of arable rotations wide open on the boulder clays where wheat yields in continuous cropping systems tend to stabilise at about 33 cwt per acre - but cereal monoculture although simple in concept is not simple or cheap to operate".

The Influence of Skills and Management

In a N.A.A.S. survey on "The Effect of Break-crops on Cereal Yield" conducted in Hants., Bucks. and Oxon. (1965-68) the ability of individual growers in handling the basic resources - soil, labour and machinery, etc. - together with their individual skills in crop management were clearly shown to have a much greater influence on cereal yield than cropping sequences. Modern varieties of cereals, well manured, are capable of "living with take-all and soil pests" provided they are not subjected to additional stresses such as soil pans, herbicide toxicity etc. The major factors currently influencing cereal yield are straw and leaf diseases, failures in crop establishment through erratic and deep drilling, the increasing menace of wild oats and other weed grasses and the losses that occur at harvest.

Reduction of the toll from these adverse factors can often outweigh the differences resulting from varying crop sequence. It is therefore the ability and skills of the grower, apart from weather, that are paramount in deciding the levels of yield and profitability from cereals today.

SECTION III : BREAK-CROPPING PRACTICES; THE RESULTS OF A POSTAL SURVEY

- J.A.L. Dench

The data presented in this section was gathered by postal questionnaire, during May and June 1970, from farms on which the main enterprise is cereal production.[1] The object of the survey was to shed some light on the current use of break-crops in Central and Southern England, particularly on chalk or limestone based soils,[2] and the results of the survey are discussed in this section under the following main headings:-

CROPPING IN 1970

GRAZING LIVESTOCK AND GRASSLAND

THE REASONS FOR GROWING CROPS OTHER THAN WHEAT OR BARLEY

THE REASONS FOR CEASING TO GROW PARTICULAR BREAK-CROPS IN THE PREVIOUS FIVE YEARS

CHANGES PLANNED IN CROPPING AND THE REASONS

THE CROP ROTATION(S) FOLLOWED

CONCLUSION

The section has been arranged so that readers wishing to gain an outline of the results can follow the text on the left-hand pages without detailed reference to the tables on the right.

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1. Cropping: mostly cereals farms i.e. those on which more than 50% of the standard man-day requirement is for crops of which 50% or more is for cereals.

2. Much of the analysis has been subdivided between farms situated in parishes where the predominant soil type is of chalk or limestone origin and the farms in parishes where other soil types predominate (which comprise a wide variety of soils but are mainly medium and heavy loams and clays).

TABLE I

SAMPLE DISTRIBUTION AND RESPONSE TO POSTAL QUESTIONNAIRE*

County	Number of questionnaires sent out	Number of usable replies	Response %
Bedford	176	85	48
Berkshire	193	105	54
Buckinghamshire	205	89	43
Dorset	68	42	62
Gloucestershire	261	140	54
Hampshire and I.O.W.	300	155	52
Hertfordshire	257	114	44
Northamptonshire	394	174	44
Oxfordshire	278	133	48
West Sussex	88	37	42
Wiltshire	246	120	49
	2466	1194	48

TABLE II

NUMBER OF RESPONDENTS ANSWERING QUESTIONS IN THE POSTAL QUESTIONNAIRE*

Question		All Respondents		Respondents in parishes where chalk or limestone soils predominate		Respondents in parishes where other soil types predominate	
No.	Subject	Number	%	Number	%	Number	%
1.	Farm cropping 1970	1194	100	512	100	682	100
2.	Reasons for growing particular break-crops	1179	99	505	99	674	99
3.	Livestock and use of grassland	1176	98	500	98	676	99
4.	Break-crops discontinued in the previous 5 years	1004	84	425	83	579	85
5.	Proportion of the farm cropped with cereals over previous 5 years	1158	97	500	98	658	96
6.	Rotations	1006	84	434	85	572	84
7.	Cropping changes planned	1103	92	473	92	630	92
8.	Maximum cereal acreage	1154	97	495	97	659	97
9.	The changes likely in cereal yields and variable inputs	1171	98	505	99	666	98

* See Appendix to this section.

CROPPING IN 1970

One of the more striking first impressions from the survey is the relatively small proportion of total farm area which is devoted to non-cereal cash crops. From their replies, however, many farmers regard oats as a break from wheat or barley, so it has been included as a break-crop in most of the analysis tables which follow.

Rotational crops as a percentage of arable area

	All farms	Chalk or limestone	Other soils
	%	%	%
Non cereal cash crops including herbage seed	7.6	6.4	8.6
Rotational grass and fodder crops	12.9	14.0	11.9
Fallows and green manure	1.9	2.1	1.8
	22.4	22.5	22.3
Oats	5.4	5.1	5.8
Cereals* excluding oats	72.2	72.4	71.9
	100.0	100.0	100.0

* Virtually all wheat and barley; mixed corn and rye account for 0.1% of arable area.

Much of the slightly higher proportion of cash break-crops in the non-chalk group is accounted for by sugar-beet in Northants. and Hertfordshire and by the greater area devoted to potatoes and vegetable crops in these counties, Bedfordshire and West Sussex. Similarly, green manure crops grown on chalk-land farms in Dorset contribute to the slightly higher figures for this item in the chalk or limestone group.

TABLE III

CROPPING 1970, ACREAGES ON 1194 FARMS

	Acres	Per cent		
		All farms	Chalk L'stn	Other soils
Wheat	138555			
Barley	250673			
Wheat & Barley (not specified)	250	67.4	67.2	67.7
Oats	29207			
Mixed Corn	289			
Rye for Harvesting	296			
Maize	84			
Potatoes	4117			
Sugar-beet	2304	4.2	3.0	5.2
Field Beans	16310			
Oilseed Rape	2960			
Root Crops grown for seed	337			
Mustard for seed	382	1.5	2.1	1.0
Herbage seed crops	8801			
Other seed crops (Lucerne, oats & vetches, trefoil)	111			
Peas for processing	3286			
Peas for vining	72			
Beans for picking green or freezing	402	0.8	0.5	1.1
Brussels Sprouts	803			
Other vegetable crops	361			
Coriander	86			
Linseed	50	0.1	neg.	0.2
Miscellaneous cash crops (Lupins, canary grass, buckwheat)	21			
Other crops and not specified	531			
Green manure crops	880	1.7	1.8	1.6
Bare fallow	9689			
'Roots' for fodder (including rape, ryegrass and mustard)	6517			
Cereals for fodder (including rye and oat & vetch mixtures)	714	1.3	1.6	1.0
Lucerne	543			
Sainfoin, vetches and trefoil for fodder	93			
Leys of up to 3 years duration	45205	10.2	11.0	9.5
Leys of 3 years duration and longer	18284			
Permanent grass	62729	10.1	8.9	11.2
Orchards and non-rotational crops	25	3.0	4.4	1.6
Rough grazings	18515			
TOTAL	623482	100.3	100.5	100.1
Correction for double cropping	-1786	-0.3	-0.5	-0.1
TOTAL FARM AREA	621696	100.0	100.0	100.0

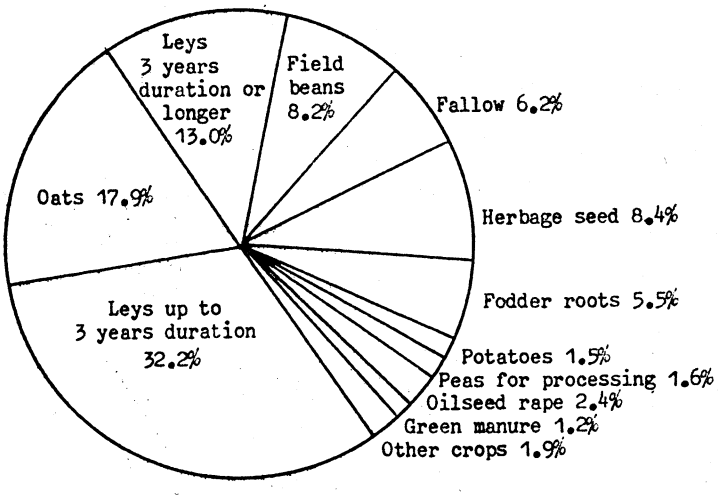
CROPPING 1970 (continued)

The limited number of different break-crops which account for much of the arable area not under cereals is another noticeable feature of the cropping data. A mere ten crops including oats, and regarding long and short leys as two different "crops", account for 95% of the total area of break-crops.

Cropping of Arable Area not under Wheat or Barley

Per-cent of break-crop area

Farms in parishes where chalk or limestone soils predominate.



Farms in parishes where other soil-types predominate.

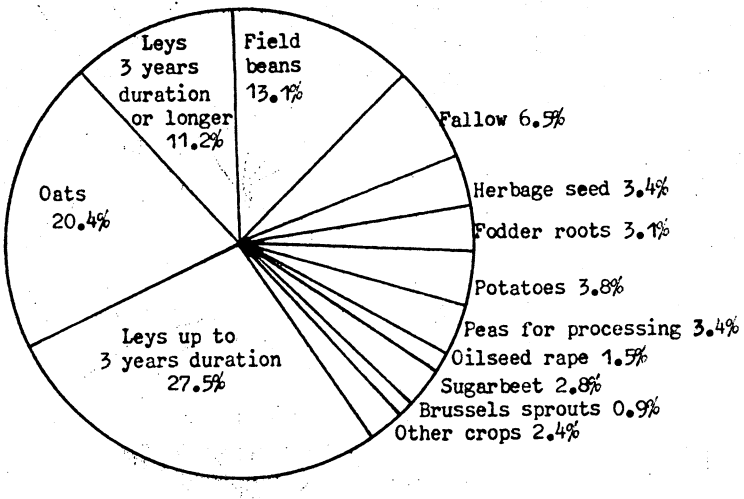


TABLE IV

THE GEOGRAPHICAL IMPORTANCE OF INDIVIDUAL BREAK-CROPS ON 1194 FARMS

Proportion of break-crop area devoted to each crop

	Whole sample	Counties in ascending order of the proportion of "other crops"										
		Wilts.	Bucks.	Berks.	Hants.	Oxon.	Glos.	West Sussex	Herts.	North Hants.	Dorset	Beds.
	%	%	%	%	%	%	%	%	%	%	%	%
Leys up to 3 years duration	29.8	37.2	20.7	30.2	23.8	35.0	39.4	24.9	25.2	24.2	33.3	28.1
Oats	19.2	21.5	34.1	12.4	12.1	20.6	15.4	23.5	20.2	25.4	21.6	18.1
Leys over 3 years duration	12.0	12.1	16.0	21.0	15.4	13.7	9.1	16.9	4.4	6.5	13.1	2.2
Field Beans	10.7	5.1	11.1	8.3	9.8	7.4	10.8	12.4	22.6	11.6	6.2	18.5
Fallow	6.4	5.3	8.5	8.8	4.5	5.4	8.4	2.3	7.6	6.6	3.4	7.1
Herbage Seed	5.8	8.4	2.0	3.0	16.8	4.1	3.2	0.5	2.2	3.9	2.3	1.8
Fodder Roots	4.3	4.8	2.0	3.9	5.7	4.6	4.9	5.6	1.4	3.2	7.3	2.9
Potatoes	2.7	1.1	0.7	1.8	1.7	2.3	2.1	4.4	3.9	6.5	1.4	4.4
Peas	2.2	0.9	0.9	3.2	2.8	0.8	1.2	2.4	4.0	2.3	0.0	5.1
Oilseed Rape	2.0	2.4	1.3	3.9	3.5	1.3	0.6	0.0	0.2	1.4	2.7	1.3
Other Crops	4.9	1.2	2.7	3.5*	3.9*	4.8*	4.9*	7.1*	8.3*	8.4*	8.7*	10.5*
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Includes:-

Veg. 1.0	Green Manure 1.1	Cereals for Fodder 1.1	Sprouts 1.4	Veg. 2.0	Sugar Beet 3.1	Sugar Beet 8.1	Green Manure 6.8	Mustard Seed 3.2
				Green Beans 1.2	Green Beans 2.2			Sprouts 2.9

GRAZING LIVESTOCK AND GRASSLAND

Although the survey was confined to predominantly cereal producing farms, the importance of grass and fodder crops in terms of their area is noteworthy. Of the 1176 farms, for which details of grassland utilisation were given, only 117 (10%) carried no grazing livestock at all and only 168 farmers regarded grass as a regular cash crop : 164 as hay and 4 as dried grass.

Whilst a detailed analysis of the position is beyond the scope of this study, grazing livestock form a very important part of the system on a majority of cereal farms. As might be expected, the proportion of farm area devoted to cereals and cash crops was highest on the farms without livestock and lowest on farms having a dairy herd. On farms having beef cattle or sheep, those with sheep devoted a slightly larger acreage to fodder crops and leys.

TABLE V

LIVESTOCK AND FARM CROPPING

	All farms answering question on livestock	Farms without grazing livestock	Farms with grazing livestock	Farms having: Dairy cows	Beef cattle	Sheep
			Number of farms			
Parishes where chalk or limestone soils predominate	500	51	449	53	248	143
Parishes where other soils predominate	676	66	610	53	391	212
Total sample	1176*	117	1059	106	639	355
			% of farm area			
Cereals	67.4	81.4	66.2	60.8	65.4	63.0
Other cash crops and fallows	7.8	14.0	7.6	6.7	6.5	6.3
Fodder crops	1.2	0.3	1.2	1.7	1.3	1.9
Leys	10.4	1.3	11.1	15.9	11.4	13.5
Permanent pasture and rough grazing	13.2	3.0	13.9	14.9	15.4	15.3
	100.0	100.0	100.0	100.0	100.0	100.0
Arable area	86.8	95.7	86.1	85.1	84.6	84.7
			% of arable area			
Cereals	77.6	85.1	76.9	71.4	77.3	74.4
Other cash crops	7.3	12.6	7.1	6.6	6.0	5.7

* 98% of total respondents.

THE REASONS FOR GROWING PARTICULAR BREAK-CROPS

Reasons given for growing each of the ten most widely occurring crops, other than wheat or barley, are summarised under eight headings in Table VI. The average response under each of these eight headings was:

	Percent of replies
To improve cereal yields	23
As a cash crop for the income it generates	15
Cereal disease and pest control	15
Weed control	11
To maintain or improve soil structure	11
To keep fertilizer costs down	6
As a short duration crop in place of a bare fallow	5
Other reasons	14
	100

As might be expected, the major reason for growing break-crops is to improve the yields of following cereals although two "crops", oats and fallow, were not rated very highly in this respect. Income generation by the crop itself came next in order of importance, and in this respect oats and beans did not measure up very well among the cash crops while leys and fodder crops came a long way behind. Obviously the other virtues of short leys outweigh their low profitability through livestock for the majority of cereal growers. Equal in importance, no doubt linked with cereal yield improvement, came control of cereal disease and pests. In this respect the leguminous crops - peas and beans - together with oilseed rape, were rated highest. Oilseed rape also came high in the popularity list for weed control, second only to bare fallow. Although the average replies do not indicate that maintenance of soil structure is a very important consideration when deciding on a break-crop, the supremacy of long leys in this respect is supported by the fact that this was the most frequent reason given for growing them.

TABLE VI

REASONS FOR GROWING THE TEN MOST WIDELY OCCURRING BREAK-CROPS

Crops in descending order of frequency of occurrence in the Survey

		Leys up to 3 years duration		Oats		Field Beans		Bare Fallow		Fodder Roots		Potatoes		Leys over 3 years duration		Herbage Seed		Peas for Processing		Oilseed Rape	
		Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils
Number of farms on which crop was grown in 1970	No.	282	359	227	384	110	234	135	205	135	127	65	131	72	92	85	64	27	56	29	15
Percent of farm area	%	7.8	6.8	4.4	5.0	2.0	3.2	1.5	1.6	1.3	0.8	0.4	0.9	3.2	2.7	2.0	0.8	0.4	0.7	0.6	0.4
Reasons		Replies per cent of number of farms growing[1]																			
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
To improve cereal yields		80	74	25	31	92	85	44	44	57	52	63	66	75	90	75	73	81	84	86	87
As a cash crop for the income generated		27	22	72	59	50	42	-	-	7	9	84	90	21	22	86	80	89	70	48	60
Cereal disease and pest control[2]		39	39	59	65	61	65	20	21	23	19	28	34	35	40	44	45	63	59	69	80
Weed control[2]		34	36	10	10	15	21	68	70	30	38	30	44	24	36	13	22	26	23	45	73
To maintain soil structure		51	62	1	4	18	23	25	19	27	18	13	19	60	71	48	58	19	14	10	40
To keep fertilizer costs down		27	26	1	3	26	32	11	5	22	15	11	16	29	28	15	19	26	21	13	7
A short duration crop in place of a fallow		21	26	3	5	10	11	-	-	39	48	5	5	0	8	4	8	0	11	34	13
Other reasons[2]		53	49	38	37	35	30	25	29	51	53	19	18	47	48	47	28	37	30	28	40

1. Percentages add to over 100 because crops are usually grown for several reasons.

2. See Table VII.

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Reasons given for growing each of the ten most widely occurring crops, other than wheat or barley, are summarised under eight headings in Table VI. The average response under each of these eight headings was:

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As a short duration crop in place of a bare fallow	5
Other reasons	14
	100

As might be expected, the major reason for growing break-crops is to improve the yields of following cereals although two "crops", oats and fallow, were not rated very highly in this respect. Income generation by the crop itself came next in order of importance, and in this respect oats and beans did not measure up very well among the cash crops while leys and fodder crops came a long way behind. Obviously the other virtues of short leys outweigh their low profitability through livestock for the majority of cereal growers. Equal in importance, no doubt linked with cereal yield improvement, came control of cereal disease and pests. In this respect the leguminous crops - peas and beans - together with oilseed rape, were rated highest. Oilseed rape also came high in the popularity list for weed control, second only to bare fallow. Although the average replies do not indicate that maintenance of soil structure is a very important consideration when deciding on a break-crop, the supremacy of long leys in this respect is supported by the fact that this was the most frequent reason given for growing them.

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REASONS FOR GROWING THE TEN MOST WIDELY OCCURRING BREAK-CROPS

Crops in descending order of frequency of occurrence in the Survey

		Leys up to 3 years duration		Oats		Field Beans		Bare Fallow		Fodder Roots		Potatoes		Leys over 3 years duration		Herbage Seed		Peas for Processing		Oilseed Rape	
		Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils
Number of farms on which crop was grown in 1970	No.	282	359	227	384	110	234	135	205	135	127	65	131	72	92	85	64	27	56	29	15
Percent of farm area	%	7.8	6.8	4.4	5.0	2.0	3.2	1.5	1.6	1.3	0.8	0.4	0.9	3.2	2.7	2.0	0.8	0.4	0.7	0.6	0.4
Reasons		Replies per cent of number of farms growing[1]																			
		%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
To improve cereal yields		80	74	25	31	92	85	44	44	57	52	63	66	75	90	75	73	81	84	86	87
As a cash crop for the income generated		27	22	72	59	50	42	-	-	7	9	84	90	21	22	86	80	89	70	48	60
Cereal disease and pest control[2]		39	39	59	65	61	65	20	21	23	19	28	34	35	40	44	45	63	59	69	80
Weed control[2]		34	36	10	10	15	21	68	70	30	38	30	44	24	36	13	22	26	23	45	73
To maintain soil structure		51	62	1	4	18	23	25	19	27	18	13	19	60	71	48	58	19	14	10	40
To keep fertilizer costs down		27	26	1	3	26	32	11	5	22	15	11	16	29	28	15	19	26	21	13	7
A short duration crop in place of a fallow		21	26	3	5	10	11	-	-	39	48	5	5	0	8	4	8	0	11	34	13
Other reasons[2]		53	49	38	37	35	30	25	29	51	53	19	18	47	48	47	28	37	30	28	40

1. Percentages add to over 100 because crops are usually grown for several reasons.

2. See Table VII.

THE REASONS FOR GROWING PARTICULAR BREAK-CROPS (continued)

Disease Control, Weed Control and Other Reasons

In their replies stating weed control, cereal disease control, or "other" as a reason for growing a particular break-crop, respondents were asked to give details of the disease, weed, or reason. These replies are summarised in Table VII for the ten most common break-crops.

The percentage replies in the table can be compared in two ways. First, on the basis of their actual values, e.g. of the farmers using a break for couch control 28% said they used a bare fallow for this compared with only 0 or 1% who used a field bean crop for the same purpose. Alternatively a comparison can be made in terms of the relationship between the percent replies to individual questions and the percent of farms growing the crop (shown at the top of Table VII). This will show whether a particularly large or small proportion of any crop is grown for a specified purpose, e.g. couch control. In order to help this comparison, red figures have been used for the entries which imply a small proportion of any crop and green for those which imply a large proportion.

Only the three cereal diseases, take-all, eyespot and cereal root eelworm, were cited frequently enough to enable an analysis to be made of the replies. This shows oats high in popularity for control of the first two diseases, followed by short leys and beans. Beans, peas and herbage seed crops are indicated as popular aids to reducing the level of cereal root eelworm infestation. Other diseases and pests mentioned in the replies include rhynchosporium, cereal leaf diseases in general, several mineral deficiencies, wheat bulb fly, (controlled by leys and fodder roots) leather jackets, wireworm and slugs.

Replies stating that particular crops aided weed control also indicated in many cases that this arose from the opportunities they provide to use particular sprays, e.g. simazine on beans, or to carry out more extensive cultivations before sowing, e.g. oilseed rape. Quite a number of weeds were mentioned in the replies, but only replies indicating couch, wild oats, and weed grasses were sufficiencly numerous to justify analysis. Other weeds mentioned include mayweed, corn marigold and field bindweed. It is perhaps a little surprising to find short leys rated so well for control of couch and wild oats but less unexpected is the indication that the next two most widespread break-crops, oats and beans, do not contribute much towards controlling these weeds, particularly couch.

An impression conveyed by the more scattered replies, citing less frequently mentioned diseases and weeds, is that control rests more on a change of crop providing an opportunity for a general clear up of cereal residues or for a changed sequence of cultivations, etc. than on the break-crop itself.

The fact that 'livestock feed' heads the list of other reasons again points to the important place of livestock even on the 'mostly' cereal farms in Southern England. The provision of a wheat entry comes a fairly close second in the list, particularly in chalk or limesotne localities, and it is interesting to note that oats are fairly well rated for this even though some way behind short leys and beans. Third in frequency of other reasons given - to spread labour demand or mechanisation costs - favours some of the less widespread crops - herbage seed, peas for processing and oilseed rape for example.

TABLE VII

DISEASE CONTROL, WEED CONTROL, AND "OTHER REASONS" FOR GROWING BREAK-CROPS

	Number of Replies		Crops in descending order of frequency of occurrence in the Survey																	
			Leys up to 3 yrs duration		Oats		Field Beans		Bare Fallow		Fodder Roots		Potatoes		Leys over 3 yrs duration		Herbage Seed		Peas for processing		Oilseed Rape	
	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils
Percent of farms in the Survey on which the crop was grown in 1970 %			55	53	44	56	21	34	26	30	26	19	13	19	14	14	17	9	5	8	5	2
			Percent of replies																			
Cereal Disease Control	No.	No.	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Take all	119	208	17	16	30	33	25	23	3	2	7	1	5	6	3	3	5	6	1	5	?	1
Eyespot	23	38	26	18	26	34	17	29	0	3	4	0	0	3	4	3	4	5	0	3	4	3
Cereal root eelworm	34	10	15	10	0	0	24	50	0	0	3	0	0	0	6	0	24	0	3	30	12	0
Weed Control																						
Couch	121	187	28	28	3	2	0	1	28	27	17	15	7	12	3	2	1	3	3	1	4	3
Wild oats	101	198	35	23	4	1	8	16	12	4	7	5	3	12	11	10	5	4	2	3	3	4
Other grass weeds*	26	56	12	18	15	11	4	20	23	16	15	2	0	7	0	2	4	4	4	4	4	7
Other Reasons for growing a particular break-crop																						
For livestock feed	157	223	34	35	9	19	1	5	0	0	23	19	0	0	11	13	4	2	0	0	0	0
As a wheat entry	129	130	27	31	11	23	15	20	9	2	5	4	4	5	4	5	12	2	4	2	3	1
To spread labour demand and machinery costs	72	98	21	17	4	6	17	22	4	1	3	1	6	10	3	2	15	5	6	13	3	3
As a break from wheat and barley	44	61	27	25	27	31	20	21	2	2	7	3	2	2	5	7	5	5	2	0	0	0
Because the crop allows a bastard fallow	36	61	36	39	0	2	0	0	0	5	14	2	6	3	3	2	0	2	0	5	3	5
To obtain the beneficial effects of livestock residues	52	29	50	38	0	0	0	0	0	0	25	44	0	0	19	17	4	3	0	0	0	0

Other Reasons which were less frequently stated in descending order of frequency (28 to 12 replies)

To improve soil fertility or humous content	(Short leys, long leys, herbage seed, green manure, fodder roots and potatoes)
Land improvement or reclamation	(Mainly bare fallow, also leys and oats)
Non agricultural reasons including shooting, etc.	(Mainly fodder roots, also miscellaneous cash crops, mustard for seed and bare fallow)
To provide a two year break	(Mainly herbage seed)
To provide a variety break in cereal seed production	(Leys only)

* Includes Creeping Bent, Blackgrass and Meadow Grasses.

REASONS FOR CEASING TO GROW A PARTICULAR BREAK-CROP

The reasons why particular crops have been discontinued sheds some interesting light on their shortcomings as break-crops. When grouped under seven main headings the replies were in the following proportions:

Reason	Percent of replies
Economic	41
Technical or rotational difficulties	22
Low or variable yield	16
Labour, Machinery or Capital demands	14
Weed problems	12
Disease or pest problems	10
Other	16
	131*

* More than one reason was given in many replies.

Economic reasons head the list and by far the most numerous of these was simply that the crop produced a poor return. Beans, which come third in the frequency league table of crops grown in 1970 also heads the unpopularity list for some very good reasons; low returns linked with poor or unreliable yield being the major factor as well as technical difficulties in harvesting and drying the crop. Oilseed rape, although a long way behind beans in frequency of occurrence comes second due mainly to low return linked to low yield, in spite of being rated fairly highly as a break-crop in other respects (Table V). Recent increases in the price for rapeseed may result in a reversal of the trend to abandon this crop. Herbage seed is also high in the list of crops discontinued, mainly for economic reasons, although it is highly rated by those still growing the crop (Table V). This is probably a reflection of the specialised nature of seed production which demands considerable expertise if it is to be lucrative. Similar comments can also be applied to peas for processing but additionally there have been marketing difficulties due to some degree of over-supply of this crop. Fodder roots are the fourth most widely reduced crop, the main reason given being changes in livestock policy for the farm.

TABLE VIII

REASONS FOR DISCONTINUING TO GROW PARTICULAR BREAK CROPS

(All crops which ten or more farmers stated they had ceased growing)

	Leys up to 3 years		Oats		Field Beans		Fodder Roots		Potatoes		Leys over 3 years		Herbage Seed		Peas for Processing		Oilseed Rape		Sugarbeet		Sprouts		Mustard for Seed		Linseed	
	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils
Number growing in 1970 No.	282	359	227	384	110	234	136	127	65	131	72	92	85	64	27	56	29	15	6	36	4	19	2	4	1	0
Number discontinuing in the last 5 years No.	22	40	5	12	77	116	32	32	9	33	5	6	29	33	3	13	49	54	2	19	1	12	11	13	5	5
Number discontinued as a % of number growing in 1970 %	8	11	2	3	57	50	24	25	14	25	7	7	34	52	11	23	169	360	33	53	-	-	-	-	-	-
Reasons	**Number of replies[1]**																									
Economic[2]	8	13	2	4	23	51	7	10	2	9	-	3	15	10	-	5	36	32	2	13	-	1	6	8	2	1
Technical or Rotational[3]	3	6	2	4	22	40	3	6	-	4	-	1	6	2	1	1	9	9	-	1	-	-	3	3	3	2
Low or variable yields	1	3	-	1	25	39	1	-	-	4	-	-	6	6	1	2	7	4	-	2	-	-	2	1	-	1
Labour, Machinery or Capital demands[4]	2	3	-	-	2	3	6	3	7	24	-	1	5	4	-	1	2	4	3	8	1	8	1	-	-	-
Weed problems[5]	1	3	1	-	25	28	-	-	-	-	-	-	4	8	-	-	5	5	-	-	-	1	-	-	2	1
Pest or disease problems[6]	1	-	1	3	5	12	1	-	-	-	-	-	5	4	1	5	7	11	-	-	-	2	1	1	1	1
Other[7]	3	14	-	4	5	10	16	18	2	7	4	2	1	1	-	2	3	4	-	1	-	1	1	-	-	-

1. Replies may add to more than the number discontinuing if some respondents gave more than one reason, conversely they may not add to this number if some did not give a reason.

Replies given under the main headings were, in order of frequency:

2. Poor or variable return
   Difficulties in marketing
   High cost of growing
   Unable to obtain a contract

3. Late harvest - difficult to clear in time for following crop
   Difficulties in harvesting and drying
   Little benefit as a break-crop
   No longer required as a break-crop
   Difficult to grow successfully

4. Clash in labour demand with other crops
   Cost of mechanisation

5. Existing weed problems worsened by the crop
   Difficult to control weeds in the break-crop

6. Pigeon and other bird damage
   Disease of the break-crop
   Pest damage to the break-crop

7. A change in livestock policy
   Unsuitable soil
   Simplification of the farm system
   Unsatisfactory or no longer required as a fodder crop
   The weather this season

PLANNED CROPPING CHANGES

The changes proposed in cropping, and the reasons given for them, provide a further insight into the attributes looked for in a break-crop. And it is interesting that leys were the most frequently mentioned break-crop to be increased while beans again head the list of reductions. Whilst nearly all changes are ultimately for economic reasons, i.e. to increase farm profitability, it is never-the-less significant that rotational reasons outnumber direct economic ones - replacement by a more profitable crop - for increasing or introducing several types of break-crop. A frequently given rotational reason was that the break-crop introduced will provide a wheat entry, a change which is, of course, closely linked to the relative gross margins of wheat and barley.

A number of the replies giving details of cropping changes also indicated the acreage involved. From these the following percentage changes have been estimated for the whole sample of 1194 farms:

Crops in descending order of total acreage involved	Percent change in 1970 acreage	
	+	-
Barley		3.8
Wheat	4.3	
(All cereals including wheat and barley		1.9)
Leys up to 3 years duration	11.3	
Leys of 3 years duration or longer	18.9	
Oats	6.4	
Field Beans		5.1
Potatoes	15.5	
Peas for processing	18.0	
Herbage seed	6.5	
Fodder roots	4.6	
Oilseed rape	2.3	
Bare fallow		0.6

The general trend implied is an increase in the total area devoted to break-crops and a reduction of about 2% in the area of cereals combined with a swing of about 4% out of barley and into wheat. Obviously many cereal growers consider it will be financially worth while to reduce their cereal acreage and grow more break-crops, even though they give a lower return, in order to have a greater proportion of wheat in the rotation.

Tables I to IV in the Appendix to this section* give an analysis of past and planned changes in cereal acreages, together with the reasons for the latter. Appendix I Table V sets out farmers' views on the likely changes in cereal yields and the level of variable inputs in three different circumstances. Given the changes summarised above it appears that, on balance, increased yields with unchanged or reduced inputs are anticipated. However, quite a number of farmers planning changes expected unchanged yields and inputs, presumably because the changes planned are intended to combat falling yields or rising levels of input under the existing system. Against this it is rather surprising to find a larger number of respondents indicate unchanged yields and inputs in reply to the question "what will happen to yields and inputs if you grow the maximum acreage of cereals that can be maintained on your holding for an indefinite period?" (Appendix I Table V). This maximum cereal acreage appears to be about 70% of the farm acreage on average (Appendix I Table I) Thus it seems that while a number of cereal growers are feeling they must reduce the acreage they grow, many others could expand their cereal acreage, if they chose, without bringing about a fall in gross margin per acre.

* Appendix I pages 79 to 82.

TABLE IX

CHANGES PLANNED IN BREAK-CROPPING AND THE REASONS FOR THEM

	Leys up to 3 years		Oats		Field Beans		Bare Fallow		Fodder Roots		Potatoes		Leys over 3 years		Herbage Seed		Peas for Processing		Oilseed Rape	
	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils	Chalk L'stn	Other soils
Number planning to increase or introduce	58	77	16	23	8	12	4	9	3	2	7	15	19	34	12	8	5	7	-	7
Number planning to reduce or discontinue	9	12	2	4	13	19	3	5	-	-	1	2	1	6	-	-	-	-	2	1
Reasons for Increasing	Number of replies[1]																			
Economic - to increase returns[2]	25		21		4		-		-		10		10		7		4		1	
Rotational[3]	60		18		14		4		3		10		20		3		3		5	
Weed and disease control	14		5		-		8		-		2		7		1		1		1	
Farm system and management[4]	60		3		1		-		3		1		22		1		1		-	
Other	6		-		-		-		-		1		1		-		2		-	
Reasons for reducing	Number of replies[1]																			
Economic - to increase returns[2]	9		2		23		4		-		1		2		-		-		3	
Rotational reasons or weed control	4		-		7		-		-		-		-		-		-		-	
Farm system[4]	7		2		2		1		-		2		2		-		-		-	
Other	3		1		3		2		-		-		1		-		-		-	

1. Replies may add to more than the number planning a change as some respondents gave more than one reason, conversely they may not add to this number if some did not give a reason.

Replies given under the main headings were, in order of frequency:

2. Nearly all replies indicated the change was to a crop which it was hoped would give a better return.

3. To obtain a wheat entry.
To increase the proportion of break-crops in the rotation.
To maintain or improve cereal yields.
To obtain the benefits of livestock residues.

4. Increasing or introducing a livestock enterprise (increases), a change of livestock policy (reductions).
To ease or level out labour demands.
To simplify the farming system.

ROTATIONS

The rotations reported in the Survey varied so widely that they defy any neat form of classification. They ranged in length from an alternation between two different crops to cropping sequences extending over more than ten years. It is probably more than ever true to say that most farmers alternate their crops according to broad rotational principles rather than adhering to any rigid sequence of cropping and, to the extent that this may be so, the rotations on which this analysis is based are likely to represent farmers' "good intentions" rather than set policy. However, a comparison between the mean (average) proportion of cereals in the rotations reported (Table X) and the proportion of cereals shown on page 22 reveals that policy and practice are not widely different.

Table X sets out some general features of the rotations reported, giving both the model (most frequently occurring value) as well as the mean (arithmetic average) value. These features present a picture of the model rotation as five years in length, four years under cereals (one wheat and three barley) followed by a break-crop. The greater mean values in each case reflect the fact that there is a fairly large spread of rotations which are longer than five years with a correspondingly greater number of years devoted to cereals and break-crops. With the exception of those rotations incorporating a ley or a herbage seed stand of three or more years however, many of these longer rotations are really a repetition of shorter cropping sequences incorporating a different break-crop and possibly a slightly changed choice of cereals in two consecutive sequences.

Soil type has little apparent influence on the features described in Table X. The average length of uninterrupted cereal runs is slightly longer on chalk and limestone soils as a result of slightly lengthened runs of barley. Wheat runs are slightly shorter on average on these soils i.e. fewer second or third wheat crops are grown after a break.

TABLE X

ROTATIONS; LENGTHS OF CROP SEQUENCES AND OTHER FEATURES

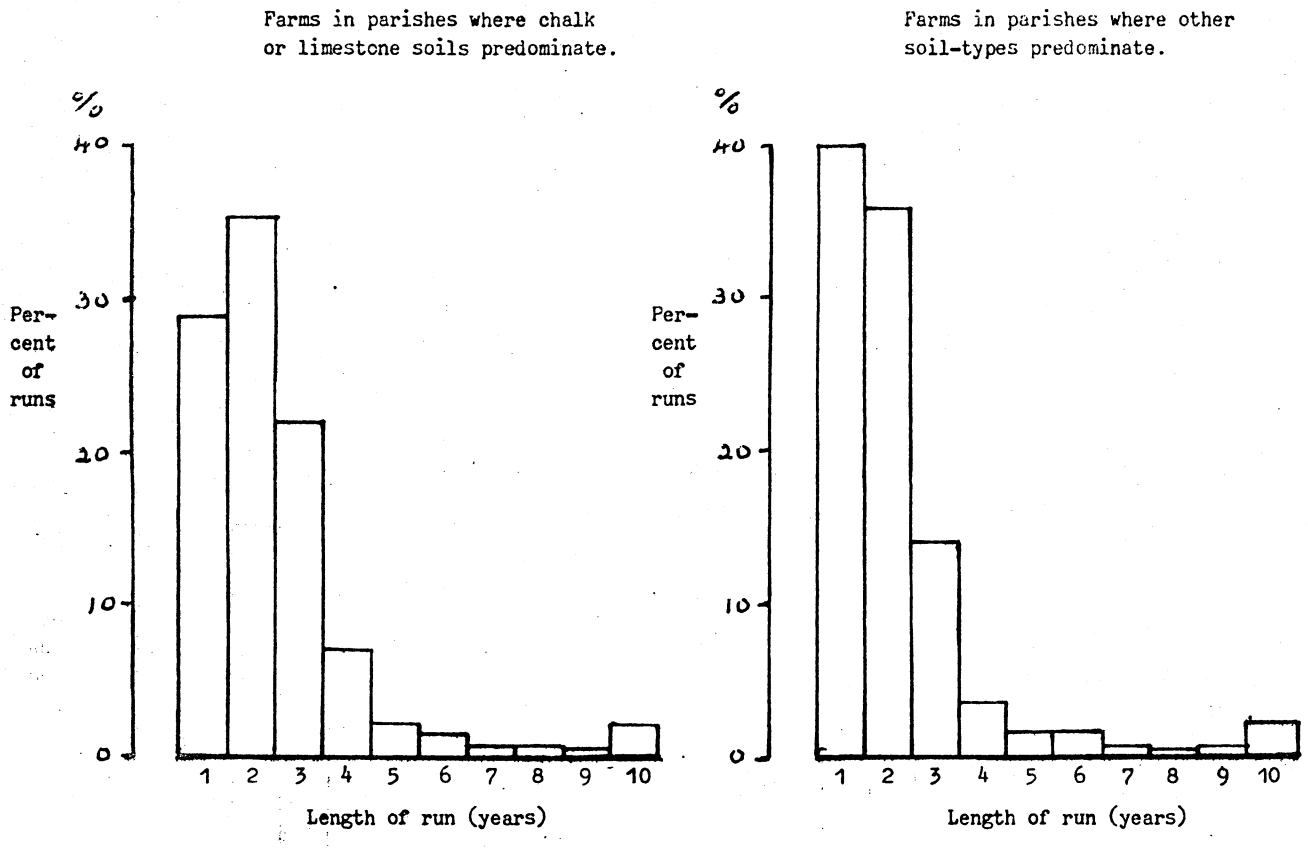
	Farms in parishes where chalk or limestone soils predominate		Farms in parishes where other soil-types predominate	
Rotations reported				
	Number	%	Number	%
Mixed cropping rotations	417	92.5	592	91.4
Continuous barley cropping	11	2.4	14	2.2
Continuous wheat cropping	1	0.2	1	0.1
Other continuous cereal cropping (wheat, barley and oats combinations)	22	4.9	41	6.3
Total number of rotations described[1]	451	100.0	648	100.0
Farms having no set rotation	98	-	102	-
Proportion of cereals in the rotation				
	Mode (most common)	Mean (average)	Mode (most common)	Mean (average)
	Number of years in ten			
All cereals	8	7.4	8	7.4
Barley	3	3.9	3	3.9
Length of crop sequences				
	Number of years			
Length of rotation	5	5.6	5	5.9
Uninterrupted cereals	4	4.1	3	3.9
Uninterrupted barley	2	2.5	1	2.2
Uninterrupted wheat	1	1.5	1	1.6
Breaks excluding oats	1	1.7	1	1.6
Breaks excluding leys	1	1.3	1	1.2
Duration of all leys	2	2.0	1	2.0

1. Two or more rotations were described for a number of farms, particularly those having areas of different soil-type or separate blocks of land.

ROTATIONS (continued)

Perhaps the most striking feature presented by Table X is the short model and mean length of uninterrupted barley runs.

Lengths of uninterrupted barley runs



Note: Ten years represents continuous cropping.

These results serve to emphasise that long sequences of cereal cropping are much less widespread than may be thought and that the present practice is to intersperse relatively short sequences of cereal crops with equally short, usually one-year but sometimes two-year, breaks.

Table XI sets out the place in the rotation of the most frequently grown break-crops. They are listed in descending order of the frequency with which they are grown so that any deviation from this gradation in the percentage figures serves to emphasise a more than proportional use of the crop either to follow barley or to precede wheat. The crops most frequently preceding wheat are leys and beans, also herbage seed crops on chalk and limestone soils, while leys and oats are the crops which very often follow barley.

TABLE XI

ROTATIONS: CROPS FOLLOWING BARLEY AND CROPS PRECEDING WHEAT

Crops (In order of frequency with which they occur on 1194 farms)	Crops following barley (Other than barley itself)		Crops preceding wheat (Other than wheat itself)	
	Chalk or limestone	Other soils	Chalk or limestone	Other soils
	%	%	%	%
Barley	-	-	7.0	3.9
Wheat	6.3	4.3	-	-
Leys up to 3 years duration	40.1	33.5	42.6	34.0
Oats	16.9	23.1	9.3	14.5
Field beans	7.4	11.2	12.8	15.3
Bare fallow	2.4	3.3	2.3	3.3
Fodder roots	3.4	2.7	1.5	1.3
Potatoes	2.6	4.3	2.3	5.9
Leys of 3 years duration or longer	9.5	12.5	11.7	15.6
Herbage seed	7.1	1.8	6.1	1.8
Peas for processing	0.8	1.0	1.5	1.3
Oilseed rape	1.1	0.6	1.2	1.7
Other crops	2.4	1.7	1.7	1.4
	100.0	100.0	100.0	100.0

CONCLUSION

It is perhaps not at all surprising that there is no ideal break-crop for farms in the area covered by this survey. If such a paragon existed it could well become the principal crop grown! The findings presented in this section do however emphasise the limited choice of crops available as well as the small number which are used to any extent. The more unusual crops among those listed in Table III are mostly confined to particular circumstances of farm situation or soil type, market outlet, management experience or aptitude, etc., and with the possible exception of maize and oilseed rape, developments in plant breeding or the technology of growing appear unlikely to lead to any widespread increase in the near future. For many crops market factors are a major limitation, an aspect which is discussed in Section V.

Many of the technical points made in Section II on choice of break-crop, and duration of break-cropping, appear from these results to be applied in practice. One exception is the view expressed on the value of short leys in weed - especially couch - and cereal disease control. Leys appear to be held in higher popular esteem for this than the results of technical investigation suggest. Also, the widespread view that oats provide a break runs a little counter to the technological view of its limited value in this role.

In spite of the well publicised benefits of a two year break, the high proportion of single year breaks seems to indicate either that many cereal growers have yet to be convinced or that they are not prepared to increase the proportion of break-crops they grow in order to permit this. On the other side, the short average length of uninterrupted barley or cereal runs indicates an appreciation of the benefits to be gained from a high frequency in growing short term break-crops.

SECTION IV : MANAGEMENT DATA - J.A.L. Dench and J. Wright.

This section presents, in reference form, the economic and technical features of a selection of break-crops. It has been restricted to the fairly small range of crops which can be regarded as suitable for barley growing areas in Southern England and for which reasonable marketing opportunities exist. Potatoes and sugar beet have therefore been excluded as also have the more obscure crops grown on a very limited scale or for strictly limited markets.

Basic data for the section has been gathered from a variety of sources including:-

Field Beans and Oilseed Rape: surveys of the 1968 and 1969 crops by the Universities of Nottingham, Reading and Cambridge.

Grain Maize: surveys of the 1970 and 1971 crops by Wye College (University of London).

Dried Peas, Herbage Seed and Sugar Beet grown for seed: a survey of the 1970 crops by the University of Reading.

Vining Peas, Carrots and Brussels Sprouts: surveys of the 1970 crops by the Universities of Cambridge, Nottingham, Leeds and Bristol.

In each case the output and input figures have been revised where necessary to allow for recent price changes.

The information on each crop is presented in a uniform manner which it is hoped will help those wishing to assess the relative merits of different break-crops and to budget the effects of growing them. Attention is drawn to the following explanatory notes:

1. Output, Variable Costs and Gross Margin. Where possible both average and premium results have been shown. The premium results are based on the best 25% of crops in terms of yield and serve as targets of performance under reasonably good conditions and management. A single set of variable input figures is given for seed, fertilizers and sprays however, because premium yields are not usually attributable to differences in these costs.

2. Capital Requirements. An attempt has been made to indicate the likely capital investment in additional machinery and equipment, or in modifications to the normal corn growing equipment, that may be necessary in order to grow each crop.

The actual figure can vary widely from farm to farm depending on the type and range of equipment already available and on the acreage of crop grown. Whereas a small acreage may be handled successfully with somewhat makeshift adaptations costing very little, a larger acreage may necessitate greater outlay on specialist equipment.

Average capital figures and a range is shown wherever sufficient information is available. These indicate the average and range on farms where modifications or additional machines are necessary. It should be emphasised that these capital requirements could be higher than shown for acreages in excess of 80 to 100.

In addition to fixed capital investment an investment of working capital is required in order to grow any crop. This will be directly proportional to the acreage grown; it may be more or less than that required to grow an alternative crop, and usually it is not all required for a full year but builds up to a peak just before the crop is sold. The total variable costs shown in this Section can be taken as an indication of the peak working capital requirement per acre. Where a contractor's services or casual labour is employed the cost of these must be added to the total of variable costs.

3. Location. The notes on location are intended simply as an indication of the main areas and soil types where each crop is grown. They do not necessarily imply that particular crops are unsuited to other locations, unless this is specifically stated.

FIELD BEANS - SPRING

Compiled from data supplied by W.S. Senior of Nottingham University

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average	Premium
Yield	cwt per acre	21.0	25.0
Price	£ per ton	32.00	32.00
		£ per acre	
Gross Output		33.60	40.00
Variable Costs:			
Seed		4.20	
Fertilizers		4.00	
Spray materials:	herbicide	2.70	
	aphicide	1.10	
Sundry		0.60	
		12.60*	
Gross Margin		21.00	27.40

Output. Average price is slightly higher than for winter beans due to higher protein content. There is a limited high-price market for small tick beans as pigeon feed.

Inputs:

Seed: 1½ to 2 cwt per acre @ £2.50 per cwt.

Fertilizer: Southern England 0.45.45 total N.P.K. as 2 to 2½ cwt of compound, about 2 out of 3 crops also receive 20 units N in the compound (£4.00 per acre). Over 50% of crops in E. England receive no fertilizer, the remainder usually 0.45.45. N.P.K. (£2.90 per acre). A few crops mostly in E. England receive dressings of F.Y.M.

Sprays - herbicide: 1½ to 2 lbs simazine

- aphicide: Malathion spray which frequently involves aerial application. Alternatively phorate granules (£2 per acre) can be applied more cheaply.

Sundries: Hire of beehives, sacks, etc.

Contract - specialised operations:

Apply aphicides - aerial spray £1.60

- phorate granules £1.00

- non specialised operations:

Drilling £1.50 to £2.00 per acre

Combining £5.00 to £6.00 per acre

* Some crops are grown successfully without fertilizers or without sprays in which case variable costs are correspondingly lower.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Month	Man Hours per acre	Tractor Hours per acre	Operations
October	1.0	1.0	Complete stubble cultivations
November	0.4	0.4	Plough
December	-	-	
January	-	-	
February	0.2	0.2	Cultivate twice
			Drill seed and ferts.(Late Feb. & March)
March	1.8	1.5	Harrow
			Roll
April	0.5	0.4	Spray herbicide
May	-	-	
June	0.2	0.2	Spray aphicide
July	-	-	
August	0.2	0.2	Combine and cart (90% Sept.)
September			Dry
(Harvest)	1.6	0.9	Chop or disc straw
(Prepare for drilling)	0.3	0.3	Cultivate stubbles
September to sale	0.7	-	Barn work
	6.9	5.1	

Machinery and Equipment

Normal cereal growing equipment is usually adequate without modification. Wear and tear on corn drills may be slightly increased by the greater depth of drilling but an alternative method - used for 20% to 25% of crops - is to broadcast or shallow drill the seed and then plough or disc harrow it in. Wear and tear on combines, dryers and grain elevators can be considerably increased especially under wet harvest conditions when moving parts may become clogged with soft beans and trash.

Additional Capital

(i) Modifications to corn growing machinery. Very little necessary. Agitators are occasionally needed in drill seedboxes (£5 to £10) and difficulty is experienced in getting an adequate depth of planting with some drills.

(ii) Specialised machinery and equipment. None normally required.

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3. GENERAL COMMENTS

Suitability

The crop is easily incorporated into cereal growing systems as it has very similar machinery and labour requirements, and helps to spread the harvesting period. It shares with winter beans a reputation for considerable year to year, and farm to farm, variability in yield although perhaps to a less extreme degree than winter beans.

Location

Fairly widely distributed throughout England, spring beans are suited to medium and heavy soils which have a high lime status.

Normal place and value in rotation

After oats or barley as an entry for winter wheat. The residual nitrogen value of the crop may enable some savings in fertilizer for the following crop and there is strong evidence that yields from following wheat crops are improved.

Difficulties of growing

Spring beans are particularly susceptible to blackfly infestation and, although the aphicides available are reasonably effective, late attacks frequently necessitate aerial spraying (which is costly) if considerable mechanical crop damage is to be avoided.

Scarcity of pollinating insects can be a limiting factor on yield and, if beans are grown in large blocks, it is advisable to import colonies of bees during the flowering period.

Unless sprayed with simazine, the crop can allow a build up of weed infestation particularly couch.

Beans are not easily handled by auger type equipment and drying can prove difficult and slow in wet seasons.

FIELD BEANS - WINTER

Compiled from data supplied by W.S. Senior of Nottingham University

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average	Premium
Yield	cwt per acre	23.0	30.0
Price	£ per ton	31.00	31.00
		£ per acre	
Gross Output		35.70	46.50
Variable Costs:			
Seed		3.90	
Fertilizer		2.90	
Spray materials:	herbicide	2.70	
	aphicide	-	
Sundry		0.50	
		10.00*	
Gross Margin		25.70	36.50

Output. The average price is slightly lower than for spring beans due to a lower protein content.

Inputs:

Seed: 1½ to 2 cwt per acre @ £2.50 per cwt

Fertilizer: about 1 in 3 crops, mostly in E. England, receive no fertilizer, the others 0.45.45. total N.P.K. as 2 to 2½ cwt of compound. A very few crops also receive small amounts of nitrogen, about 20 units, and 1 in 10 crops receive dressings of F.Y.M.

Sprays - herbicide: 1½ to 2 lbs simazine in Autumn

- aphicide: rarely necessary

Sundries: Bird scaring materials, hire of bees, etc.

Contract: no specialised operations, others as farm circumstances require:
Drilling £1.50 to £2.00 per acre
Combining £5.00 to £6.00 per acre

* Some crops are grown successfully without fertilizer or without sprays and therefore with correspondingly lower variable costs, in a few cases amounting to the cost of seed only.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Month	Man Hours per acre	Tractor Hours	Operations
October	1.5	1.2	Cultivate or Disc and drag harrow Drill seed and fertilisers(Oct)
November	0.5	0.4	Spray herbicide
December to July	-	-	
August	0.2	0.2	Combine and cart (90% Sept)
September (Harvest)	1.6	0.9	Dry Chop or disc straw
(Prepare for planting)	1.3	1.3	Cultivate stubbles Plough
September to sale	0.7	-	Barn work
	5.8	4.0	

Machinery and Equipment

Normal cereal growing equipment is usually adequate without modification. Wear and tear on corn drills may be slightly increased by the greater depth of drilling but an alternative method - used for 20% to 25% of crops - is to broadcast or shallow drill the seed and then plough or disc harrow it in. Wear and tear on combines, dryers and grain elevators can be considerably increased especially under wet harvest conditions when moving parts may become clogged with soft beans and trash.

Additional Capital

(i) Modifications to corn growing machinery. Very little necessary. Agitators are occasionally needed in drill seedboxes (£5 to £10) and difficulty is experienced in getting an adequate depth of planting with some drills.

(ii) Specialised machinery and equipment. None normally required.

---

3. GENERAL COMMENTS

Suitability

A break-crop which is suited to heavy land and can be handled with normal cereal growing equipment. Fitting easily into cereal cropping systems without making additional demands on labour supply or skills, it extends the harvesting period, and the labour required for autumn planting can be quite low. An extreme variability in yield from year to year and between farms is the crop's chief drawback.

Location

Traditionally on heavy loam and clay soils throughout Southern and Eastern England.

Normal place and value in rotation

After oats or barley as an entry for wheat. The residual nitrogen value of the crop may enable some savings in fertilizer for the following crop and there is strong evidence that yields from following wheat crops are improved. It is sometimes difficult to clear in time to plant winter wheat.

Difficulties of growing

The main reasons for the uncertain yield of winter beans are susceptibility to winter damage by frost and birds, and to chocolate spot disease, any of which can considerably reduce yields. Scarcity of pollinating insects can also be a limiting factor on yield and if beans are grown in large blocks, it is advisable to import colonies of bees during the flowering period.

Unless sprayed with simazine, the crop can allow a build up of weed infestation particularly couch. In the event of a crop failure, however, land sprayed with simazine cannot be replanted with other crops for seven months i.e. until about mid May.

Beans are not easily handled by auger type equipment and drying can prove difficult and slow in wet seasons.

OILSEED RAPE - SPRING

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average	Premium
Yield	cwt per acre	14.5	17.5
Oil content	%	38.0	39.0
Price	£ per ton	46.00	47.00
		£ per acre	
Gross Output		33.40	41.00
Variable Costs:			
Seed		1.70	
Fertilizers		9.10	
Spray materials:	herbicide	-	
	pesticide	1.00	
Sundry		0.20	
		12.00	
Gross Margin		21.40	29.00

Output is based on a contract price of £47.50 per ton at 40% oil content subject to an addition or deduction of 1½% in the price for every 1% oil above or below 40%.

Inputs:

Seed: 6½ lbs per acre @ £0.16 to £0.30 per pound.
Fertilizer: 140.50.55 total N.P.K. as 3 cwt. of compound at sowing plus 3½ cwt. of nitrogen top dressing when the crop is growing.
Sprays - herbicide: not widely used but spring rape provides a good opportunity for spraying to control wild oat and couch infestations which have built up under successive corn crops.
- pesticide: malathion, D.D.T. or B.H.C. to control pollen beetle.
Sundries: bird scaring materials (cartridges, carbide, etc.), hessian for ventilated bins and on floor drying, sacks for storage, etc.
Contract: no specialised operations except drying in rare instances where the farm dryer cannot be easily modified to handle small seeds. Cost is similar to cereals depending on moisture extracted.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Month	Man Hours per acre	Tractor Hours per acre	Operations
October (Harvest)	1.2	0.5	End of harvest (see below)
(Prep. for planting)	0.2	0.2	Cultivate Stubbles Start ploughing
November to February	0.8	0.7	Plough
March	0.6	0.6	Complete ploughing Cultivate twice Heavy harrow or spring-tine cult. Drill seed and ferts. (15% March 15th-31st 85% April) Light harrow
April	1.3	1.2	Roll
May	0.3	0.3	Top dress fertilizer
June	0.2	0.2	Spray
July	-	-	
August	-	-	
September (Harvest)	0.7	0.2	Combine, mainly September Chop or rake and burn straw (Sept & Oct) Dry seed (Sept & Oct)
(Prep. for planting)	0.1	0.1	Cultivate stubbles
September to sale	0.3	-	Barn work
	5.7	4.0	

Machinery and Equipment

Much the same requirements as barley growing. The wear and tear on drills is possibly less than for barley but it can be significantly heavier on combines particularly under difficult weather conditions when the combine mechanism may become very dirty.

Additional Capital

(i) Modifications to corn growing machinery. On many cereal growing farms the existing equipment is adequate to handle rape with only minor adjustments. On about 10% of farms, however, some cost may be incurred in modifying drills, combines and dryers to cope with the small seed.

	Average	Range
Drills	£15	£5 to £50
Combines	£25	£5 to £60
Dryers	£45	£15 to £80

Modifications usually involve fitting restrictors, small seed boxes, etc. to drills and additional sieves or modifications to the air flow mechanisms of combines. Drying equipment rarely requires much modification but where necessary this usually involves fitting false floors to ventilated bin systems and additional screens to cleaners.

(ii) Specialised machinery and equipment.

Harvesting: The majority of spring rapeseed is combined direct from the standing crop. Cutting with a windrower and combining later from the windrows may however show worthwhile benefits in seed yield and quality, particularly in seasons when the harvesting weather is difficult. See Winter Rape page 49 for the capital costs involved.

Bird scaring: Carbide "bangers" £25 each, one for 20 to 30 acres of crop when required.

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3. GENERAL COMMENTS

Suitability

In technical and managerial respects an almost ideal break-crop for barley growing systems. It fits easily into the cropping system and labour supply of cereal farms and can usually be grown using existing equipment. Spring rape also helps to extend the harvesting period.

Location

On the lighter soils in Central Southern England, particularly in Berkshire, Hampshire and Wiltshire.

Normal place and value in rotation

A one year break providing an entry for wheat or as part of a two year break from cereals. Improves the health and yield of following cereal crops. Provides a good opportunity to use pre and post-sowing sprays for control of couch and wild oats. April sowing allows time for cleaning cultivations in Spring.

Difficulties of growing

The majority of growers encounter no serious difficulties.

Pigeon damage to the growing plants is widespread and is usually controlled by carbide or gas "bangers" or by shooting.

Setting and operating combines and dryers can give some difficulty until experience has been gained with the crop.

The precise stage at which the crop should be combined requires experience and accurate judgement, and there is a high risk of seed loss through shedding if cutting is mistimed or the weather is bad.

OILSEED RAPE - WINTER

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average	Premium
Yield	cwt per acre	18.0	22.0
Oil content	%	41.5	42.0
Price	£ per ton	48.50	49.00
		£ per acre	
Gross Output		43.70	53.90
Variable costs:			
Seed		1.70	
Fertilizers		9.50	
Spray materials:	herbicides	1.50	
	pesticides	-	
Sundry		0.50	
		13.20	
Gross Margin		30.50	40.70

Output is based on a contract price of £47.50 per ton at 40% oil subject to an addition or deduction of 1½% in the price for every 1% oil above or below 40%.

Inputs:

Seed: 6½ lbs per acre @ £0.16 to £0.30 per pound.

Fertilizer: 170.40.40 total N.P.K. (premium yield 200 N) as 2 cwt. of a low N compound in Autumn plus 5 cwt. of nitrogen top dressing in Spring.

Sprays - herbicide: 3½ lbs. per acre of dalapon in Autumn to control couch where present.

- pesticide: very little necessary but if a substantial acreage is grown regularly the incidence of seed weevil may increase and spraying become necessary at about £1.00 per acre per application for materials.

Sundries: bird scaring materials (cartridges, carbide etc.), hessian for ventilated bins and on-floor dryers, sacks for storage, etc.

Contract: mainly specialised operations where suitable equipment is not available on the farm.
Windrowing £2.00 per acre
Pick-up combining £5.50 per acre
Aerial spraying, occasionally required to control late attacks by seed weevil, £1.60 per acre plus materials.
Drying, in rare instances where farm dryers cannot easily be modified to handle small seeds. Cost similar to cereals depending on moisture extracted.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Month	Man Hours per acre	Tractor Hours per acre	Operations
October to December	0.2	0.2	Spray herbicide
January	-	-	
February	-	-	
March to May	0.4	0.3	Top dress twice (usually March and April)
June	-	-	
July (Harvest)	0.8	0.4	Windrow (15th-31st July) Combine (50% July 15th-31st 50% Aug 1st -15th)
August (Harvest)	1.4	0.6	Chop or rake and burn straw Dry seed
(Planting)	0.8	0.8	Disc or spring harrow twice Drill seed and basal ferts. (30% August 60% Sept.) Harrow
September	0.9	0.9	Roll
September to sale	0.3	0.1	Barn work
	4.8	3.3	

Machinery and Equipment

Much the same requirements as barley growing. The wear and tear on drills is possibly less than for barley but it can be significantly heavier on combines particularly under difficult weather conditions when the combine mechanisms may become very dirty.

Additional Capital

(i) Modifications to corn growing machinery. On many cereal growing farms the existing equipment is adequate to handle rape with only minor adjustments. On about 10% of farms, however, some cost may be incurred in modifying drills, combines and dryers to cope with the small seed.

	Average	Range
Drills	£15	£5 to £50
Combines	£25	£5 to £60
Dryers	£45	£15 to £80

Modifications usually involve fitting restrictors , small seed boxes,etc., to drills and additional sieves or modifications to the air flow mechanisms of combines. Drying equipment rarely requires much modification but where necessary this usually involves fitting false floors to ventilated bin systems and additional screens to cleaners.

(ii) Specialised machinery and equipment.

Harvesting: Although the standing crop is frequently combined direct many growers prefer to cut and windrow first in order to overcome threshing difficulties created by the large bulk of haulm and uneven ripening of the pods. Windrowing also allows greater flexibility in the actual date of combining.

Capital requirements:

Windrowers: new £300, range £200 to £350, secondhand £70, range £50 to £100.
Combine pick-up attachments: new £200, range £100 to £280, secondhand £30, range £10 to £50.

Capital requirements for winter rape can thus be about £500 more than for spring rape.

Bird scaring: Carbide 'bangers' £25 each, one per 20 to 30 acres of crop when required.

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3. GENERAL COMMENTS

Suitability

An alternative to cash roots or field scale vegetables which does not complicate a simple cereal cropping system, provided the lower gross margin is acceptable. The crop does not make additional demands on labour supply or skills and spreads the harvesting period.

Location

Although mainly grown in the South East Midlands on medium or heavy soils, the crop is now gaining popularity in Southern England where it was originally feared that pigeon damage might be a serious problem.

Normal place and value in rotation.

A one year break, frequently after winter barley, providing an entry for wheat, or as part of a two year break from cereals. Beneficial effects on health and yield of following cereal crops. Good perennial weed control from smothering effects, especially if the rape is sprayed with dalapon in Autumn.

Difficulties of growing

Control of pigeon damage to the over-wintering plants. The plants will, however, recover from quite severe attacks provided the main shoot is not damaged. Carbide or gas 'bangers' is the means of control most frequently reported effective.

Seed-bed preparation and sowing may clash with cereal harvest but this can be avoided by keeping seed-bed preparations to a minimum even to the extent of disc drilling direct into the stubbles of the preceding crop.

Setting and operating combines and dryers can give some difficulty until experience has been gained with the crop.

The precise stage at which the crop should be combined requires experience and accurate judgement, and there is a high risk of seed loss through shedding if cutting is mistimed or the weather is bad.

GRAIN MAIZE

Compiled from data supplied by J.D. Sykes of Wye College, University of London.

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average	Premium
Yield	cwt per acre	35.0	48.0
Price	£ per ton	30.00	31.00
		£ per acre	
Gross Output		52.50	74.40
Variable Costs:			
Seed		4.60	
Fertilizer		8.50	
Spray materials:	herbicide	2.30	
	pesticide	-	
Sundry		0.40	
		15.80	
Gross Margin (without contract)		36.70	58.60
Contract:	drilling	2.00	
	combining	7.00	
	haulage to dryer	1.00-1.40	
	drying	9.00-13.00	
		19.00-23.40	
Gross Margin (contract drill, harvest and dry)		17.70	35.20

Output Sale prices for the 1971 crop have been well below £30 per ton but this figure is a reasonable expectancy especially if U.K. production continues to increase and local buyers become used to taking the crop.

Inputs:

Seed: 26 to 28 lbs per acre at 17p dressed for wireworm. Seed prices vary widely.

Fertilizer: 110.60.60 total N.P.K. as 5 to 6 cwt. of compound. There appears to be little response to nitrogen in excess of 100 units, heavier applications may also delay ripening. The crop can utilize quite substantial dressings of F.Y.M. or slurry with a consequent reduction in fertilizer.

Sprays - herbicide: atrazine 2 to 3 lbs. per acre.

- pesticide: phorate granules may be required as a preventative against frit fly in some years, materials £3, application £1 per acre.

Sundries: bird scaring materials - nylon thread strung on bamboo canes in 40 yd. squares.

Contract: drilling, harvesting and drying by contractors is at present the most usual system of growing. When the crop is farm dried (the next most usual system) the variable costs for contract are reduced by from £10 to £14.40 per acre but fuel costs are increased by £2 to £3, and labour, depreciation, etc. are also higher.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Month	Man Hours per acre	Tractor Hours	Operations
October to February	1.1	1.1	Cultivate stubbles Plough
March	0.6	0.6	Disc harrow or cultivate Heavy harrow Roll Apply fertilizer
April	1.7	1.7	Drill (20th April to 7th May)
May	1.0	0.8	Spray (mid May)
June	0.4	-	Bird scaring (mid May on)
July	-	-	
October (Harvest)	0.9	0.9	Combine (contract; mid Oct to mid Nov) Haul grain
November (Harvest)	0.6	0.6	Burn, chop or disc stover
	6.3	5.7	(contract harvesting and drying)
Mid Oct. to mid Nov. (Drying)	1.8	-	
	8.1	5.7	(contract harvesting and farm drying)

Machinery and Equipment

In addition to normal cultivation machinery a precision drill and specialised harvesting equipment is necessary. Continuous driers are suitable providing the rate of harvesting is controlled to match the throughput, which is about one third of the usual rate. There appears to be little additional wear and tear on combines and dryers except when simple harvesting attachments are used for passing the whole plants through the combine.

Additional Capital

(i) Modifications to corn growing equipment. Negligible, farm dryers possibly £50.

(ii) Specialised machinery and equipment.

Precision drill £200 to £250	
Harvesting - 50 acres or less	
Reel and divider attachment for passing whole plants through a standard combine	£200 to £300
2-row cob pickers loading to trailers for threshing later,	£600 to £750
Harvesting - 150 to 200 acres	
4-row picker attachments for a standard combine	£1,500 to £2,500
Complete maize harvesters	£6,000 to £8,000
Storage for feeding on the farm: Propionic acid applicators	£200

Depreciation and interest charges are thus likely to be about £2.50 per acre for specialised machinery which, however, lends itself to group ownership.

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3. GENERAL COMMENTS

Suitability

Grain maize has a potential for high gross margins under favourable conditions and variable costs may be reduced if present attempts to develop improved growing techniques are successful. There are no serious weed problems if the crop is sprayed with atrazine. Labour requirements for sowing and harvest avoid the normal cereal growing peaks. Stover (trash) disposal presents no great difficulty and, if collected, it has a useful feeding value. For livestock feed the whole cobs chopped, have a value equal to barley at a much higher yield.

Location

Grain maize can at present be grown below 400 ft. altitude south of a line from Bristol to Norwich but new hybrid varieties may in future extend this area. The crop requires a fertile, reasonably clean site with preferably a sheltered southern aspect. A well drained soil of good depth is desirable.

Normal place and value in rotation

Usually after cereals, generally barley, and followed by barley, wheat or a second crop of maize. It is regarded as an alternative cash crop to barley (Kent) or an alternative to beans (Suffolk). Lateness of harvesting frequently prevents planting winter wheat afterwards, especially in wet seasons. Continuous maize growing for 7 to 8 years at a time appears a possibility but atrazine residues may give trouble in following crops if it is used two or more years in succession. Eelworm might also become a problem under continuous cropping.

Difficulties of growing

To be successful the crop requires a high standard of husbandry. Drilling is a particularly critical operation requiring precise timing (as soon as soil temperature reaches 10°C at the end of April) combined with careful drill operation to ensure correct depth (1½ to 2 inches) and optimum plant population (38-40,000 per acre).

Prevention of bird damage is also important; nylon thread has proved effective and cheap.

Harvesting and drying probably present the biggest difficulties, and grain losses as high as 15 to 20% of the potential yield have been recorded - a reflection of the importance of combine performance and operation and of getting a well grown upright crop.

Under favourable conditions harvesting rates may be two acres an hour, representing 6 tons of grain at 38% moisture. Few farm dryers have a capacity to match this particularly as the grain must be dried slowly to avoid splitting or discoloration and the high moisture content necessitates two or three passes through the dryer. Haulage costs of transporting wet grain may be appreciable where off-farm drying is involved. Where the crop is retained for feeding, treating at least part of the wet grain with propionic acid can help to overcome this bottleneck and avoid the cost of contract drying. The cost of treatment is higher than farm drying, however, due to the high moisture content.

DRIED PEAS (Marrowfat for processing)

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average	Premium
Yield	cwt per acre	17.6	27.5
Price	£ per ton	45.00	53.00
		£ per acre	
Gross Output		39.60	72.90
Variable Costs:			
Seed		10.50	
Fertilizer		2.50	
Spray materials:	herbicide	2.80	
	pesticide	2.50	
	desiccant	-	
Sundry		0.20	
		18.50	
Gross Margin		21.10	54.40

Output is based on a contract price of £53 per ton at 3-4% "waste and stain". Price is usually reduced by between £1.00 and £1.20 per 1% of waste and stain. Some contracts offer a bonus of £10 a ton for peas of good colour with low waste and stain. Samples with high waste and stain may go for stockfeed at £30 per ton.

Inputs:

Seed: 1½ to 2 cwt per acre @ £5.20 to £6.00 per cwt.
Fertilizer: 1½ to 2 cwt per acre of 0.20.20. compound. Some crops receive no fertilizer.
Sprays - herbicide: pre-emergence, 2lbs per acre of prometryne.
- pesticide: as required to control weevils (£1.00), also aphids (£1.50 per acre).
- desiccants: diquat (£2.60 per acre) was used extensively on the 1969 and 1970 crops to minimise shedding when direct combining, but the use of desiccants has since been discouraged on crops grown under contract with processors.

Sundries: mainly bird scaring materials
Contract: windrowing £3.00 per acre
combining, pick up or direct, £6.00 per acre

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements*:

Month	Man Hours per acre	Tractor Hours per acre	Operations
October	0.5	0.5	Complete stubble cultivations
November	0.3	0.3	Plough
December	0.1	0.1	
January	-	-	
February	0.1	0.1	Cultivate twice
March	1.3	1.3	Harrow
			Drill seed and fertilizer
			(78% March)
			(17% April)
			(5% May)
			Light harrow and roll
April	0.5	0.5	Spray pre-emergence herbicide
May	1.0	0.1	Scare pigeons
June	0.1	0.1	Spray pesticide
July	0.9	0.5	Spray desiccant if permitted
			Combine and cart
			(mid July to mid August)
August	1.0	1.0	Dry
September			
(Prep. for drilling)	0.3	0.3	Cultivate stubbles
	6.1	4.1	

* Direct combined crop (the most usual practice in S. England). Windrowed crops up to 1 man and tractor hour more per acre. Drying on 4-poles 10 to 12 man hours and 2 to 3 tractor hours more per acre in July and August.

Machinery and Equipment

Normal cereal growing equipment is usually adequate but may require some modification. Owing to the prostrate nature of the crop, direct combining can considerably increase combine wear and tear especially on the cutter bar and header due to picking up earth and stones. Drying when required is usually by blowing with cold low humidity air.

Additional Capital

(i) Modifications to corn growing machinery

Corn Drills - seed box agitators	£15 to £30
Combines - crop lifters	£30 to £75

Grain handling equipment - may require modification because chain and flight elevators and auger conveyors can cause considerable damage to the peas. Bucket elevators and rubber conveyors are recommended.

(ii) Specialised machinery and equipment. The majority of growers in the south combine the crop direct although some prefer to cut and windrow first to assist even ripening and reduce staining, also to reduce drying requirements.

Pea cutter/windrower (tractor mounted)	new £650; secondhand £300
Pick-up reel for combine	£250 to £300

Cutting, turning and drying on 4-poles before threshing with a combine has been considered the surest way of obtaining good quality; equipment required in addition to a windrower:

4-poles, 16 @ £1.00 = £16 per acre (life, say 6 years)

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3. GENERAL COMMENTS

Suitability

A break-crop producing a high gross margin if satisfactory quality can be achieved. Over-supply in 1970 and 1971 has, however, resulted in a reduction in prices and in the tonnage contracted as well as a tightening of quality standards by the processors. Organisationally the crop fits cereal growing systems well as it has a low labour requirement and is harvested before the main cereal acreage. Considerable expertise and attention to detail is necessary if a good sample is to be obtained but even then the crop is a risky one as quality depends very much on good weather at harvest time.

Location

Until 1968 mostly grown on the drier eastern side of England from Yorkshire to Kent. Since then there has been an expansion into central southern areas but very few contracts are offered west of a line through Southampton. Medium and lighter calcareous soils suit the crop well but it is highly susceptible to adverse effects of soil compaction and pan formation.

Normal place and value in rotation

A good entry crop for winter wheat which allows time for thorough autumn cultivation after it is harvested and affords a good disease and fertility break if kept weed free.

Difficulties of growing

Early spring drilling in good seed-bed conditions are important success factors with the crop.

Pigeon attacks in the seedling and growing stage can cause serious losses, and control measures such as carbide or gas bangers, shooting or nylon thread are usually essential.

Of the possible harvesting methods, combining the crop direct (at 35% moisture) involves the highest risk of loss and poor quality, and requires considerable operating skill to get the prostrate plants without excessive combine wear and tear.

Cutting the crop and drying in windrows or on 4-poles are more laborious methods but usually give better samples. Recent developments in vining the crop at 40% to 45% moisture and drying with low humidity air are claimed to achieve high quality with greater certainty, but great care is needed in handling and drying.

HERBAGE SEED

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

Variety / Strain	Italian Ryegrass S.22		Perennial Ryegrass S.23		S.24		S.321	
	Average	Premium	Average	Premium	Average	Premium	Average	Premium
Yield - cwt per acre	7.3	10.6	6.0	8.3	8.1	10.0	8.8	11.0
Price p per lb.	7.2		10.2		6.3		5.3	
	£ per acre		£ per acre		£ per acre		£ per acre	
Output	58.9	85.5	68.5	94.8	57.2	70.6	52.2	65.3
Variable Costs:								
Seed	3.7		2.8		2.4		2.0	
Fertilizer	7.6		7.4		6.5		6.7	
Sprays	-		-		-		-	
Sundries	3.5 - 4.9		3.2 - 4.2		3.7 - 4.6		4.0 - 4.9	
	14.8 - 16.2		13.4 - 14.4		12.6 - 13.5		12.7 - 13.6	
Gross Margin	44.1	69.3	55.1	80.4	44.6	57.1	39.5	51.7

Variety / Strain	Timothy S.352		Meadow Fescue S.215		Cocksfoot S.143		Red Clover S.151	
	Average	Premium	Average	Premium	Average	Premium	Average	Premium
Yield - cwt. per acre	3.0	3.9	4.6	6.5	3.1	3.9	3.0	4.8
Price p per lb	13.8		9.5		11.5		15.8	
	£ per acre		£ per acre		£ per acre		£ per acre	
Output	46.4	60.3	48.9	69.2	39.9	50.2	53.1	84.9
Variable Costs:								
Seed	1.1		2.2		1.9		3.6	
Fertilizer	6.5		6.9		7.7		2.7	
Sprays	-		-		-		2.5(desiccant)	
Sundries	1.9 - 2.3		2.5 - 3.4		1.8 - 2.2		1.9 - 2.8	
	9.5 - 9.9		11.6 - 12.5		11.4 - 11.8		10.7 - 11.6	
Gross Margin	36.9	50.4	37.3	56.7	28.5	38.4	42.4	73.3

Output. Seed prices are 1969 to 1971 averages. Prices can fluctuate considerably from year to year and those recommended for certified seed grown under contract are not decided until after harvest. From 1972 however, merchants will be able to offer contracts under which the price is fixed at an earlier date. Most merchants pay 60% of the estimated value of the crop by January and the balance later. The output figures above represent seed sales only, and do not include any allowance for the value of grazing, silage or straw. Straw, which is of relatively low feeding value, may be worth £7 to £15 per acre depending on variety; I.R.G. produces the highest output per acre, timothy straw has little value.

Inputs

Seed: Costs have been calculated on an annual basis over the life of the crop:

Variety	Seed rate narrow drilled or broadcast	Cost	Life of crop for seed production
	lbs. per acre	p per lb.	years
Italian ryegrass	12 - 15	30	1
Perennial ryegrass	10 - 12	30 - 35	2
Timothy	6 - 8	55 - 60	4 +
Meadow fescue	10 - 15	40	2 - 3
Cocksfoot	4 - 6	45 - 50	2 - 3
Red clover	10 - 12	35	1

Inputs (continued)

Fertilizer: Costs vary widely within varieties as well as between them. Red clover is usually grown without any nitrogenous fertilizer, hence the lower cost. Undersown crops normally receive slag or a balanced compound fertilizer after removal of the cover crop. In the spring most crops receive either one or two dressings of nitrogen fertilizer depending on use; if grazed in spring one dressing in February/March and a second when shut up for seed. A satisfactory lime status in the soil is important for all herbage seed crops.

Sprays: herbicide use is generally restricted to a small number of crops which are direct drilled (£1.00 per acre).
A desiccant is frequently necessary for clover crops when these are direct combined (£2.50 to £3.00 per acre).

Sundries: is the minimum figure for levies, crop inspection fees and handling charges. The latter is 30p per cwt. on all seed cleaned to certification standard on the farm but which still requires work to be done by the merchant such as testing, weighing, labelling, sealing, etc. Charges for cleaning and handling seed not up to this standard vary with the initial purity up to about 1.2p per lb for grasses and 0.7p per lb for clover, i.e. up to £14 per acre for a $10\frac{1}{2}$ cwt. crop of "uncleaned" seed.

Contract: specialised operations when suitable equipment is not available on the farm.

Mowing with a windrower	£2.00 to £2.50 per acre
Combining	£5.00 to £8.00 per acre
Drying	rates depend on moisture removed

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2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Establishment

(a) Direct seeding during August and September: Plough, cultivate, drill seed and fertilizer, harrow and roll; 3.4 man hours and 3.1 tractor hours per acre.

(b) Undersowing to a cereal in early spring: Broadcasting seed plus one extra harrowing; 0.5 man and tractor hours per acre.

Growing and harvesting (combining direct)

Month	Man Hours per acre	Tractor Hours per acre	Operations
September	0.3	0.2	Broadcast fertilizer (Undersown crops and second or later years of direct crops)
October - January	-	-	
February	0.1	0.1	Roll
March	0.5	0.4	Top dress with fertilizer
April	-	-	
May	0.3	0.2	Top dress with fertilizer
June	-	-	
July and August	2.0	1.2	Combine seed (see table below of harvesting periods)
August to sale	2.0	-	Barn work
	5.2	2.1	

Note: Approximately 25% of herbage seed acreage is cut and windrowed before combining; 0.5 to 0.8 man and tractor hours per acre in July. Timothy crops frequently require combining twice to get satisfactory seed recovery.

Variety		Approximate harvesting period
Italian ryegrass		Mid July
Perennial ryegrass:	S.23	Late July - early August
	S.24	Early July
	S.321	Mid July
Timothy:	S.48	Late August
	S.352	Mid August
Meadow fescue		Early July
Cocksfoot		Early July
Red clover		Late September

HERBAGE SEED (continued)

Machinery and Equipment

Modern cereal growing machinery can be obtained which will also handle herbage seeds. The cutting mechanism of combines must be in good order for direct combining and the wear and tear on this can be considerably heavier than for cereal harvesting. On-floor drying was found to be the most usual method.

Additional Capital

(i) Modifications to combines and dryers are sometimes necessary:

Combines.	Finger and knife modifications	£60 to £150
	Additional screens, sieves, etc.	£30 to £100
Dryers and cleaners		£30 to £200

(ii) Specialised equipment:

Windrowers	£200 to £350
Pick-up reels for combines	£250 to £350

Thus additional capital requirements need not be heavy although on farms where large acreages are grown regularly the capital investment in drying, cleaning and storage facilities can be very substantial.

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3. GENERAL COMMENTS

Suitability

Although herbage seed production can be incorporated easily with cereal growing it is essentially a crop which must occupy a central place in the farm system. A high degree of technical skill is required, which can only be gained through experience, and seed purity requires strict attention to crop isolation and weed control on the farm as a whole. On the other hand labour demands are fairly low and most varieties help to spread the harvesting period. Also the animal feed by-products - grazing, silage and hay or straw - can be very useful on livestock farms.

Location

The main herbage seed producing areas are in the southern and eastern counties where there is a greater likelihood of dry sunny weather during the harvesting period.

Normal place and value in the rotation

Frequently after barley and followed by wheat. Red clover is frequently harvested too late for winter wheat to be drilled afterwards. The longer stands - cocksfoot, meadow fescue and particularly timothy - benefit soil structure and help to reduce cereal diseases and arable weeds, but the shorter stands of ryegrass have much less value in these respects and can result in an increase in couch infestation.

Difficulties of growing

The harvesting period for any variety is short if heavy seed losses are to be avoided and it is therefore advisable to have a fairly high combine capacity in relation to the acreage to be harvested. Judgement of the correct stage at which to harvest is particularly critical as also is skill in setting and operating the combines. The actual harvesting operation tends to be slower than for cereals, particularly with timothy which frequently requires combining twice. The time when timothy must be harvested may clash with cereal harvest and the harvesting of red clover may coincide with autumn drilling.

Undoubtedly the farm system is complicated by the many details which require attention if herbage seed production is to be successful. The reward can make this trouble worthwhile however for those prepared to persevere and gain the required experience.

Much helpful information on technical matters is contained in leaflets published by the National Institute of Agricultural Botany. Growers can also obtain considerable help on both technical and marketing aspects from the Seed Growers' Association for their area.

SUGAR BEET GROWN FOR SEED (an example gathered from a relatively small number of farms)

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average
Yield	cwt per acre	19.8
Price	£ per cwt.	5.91
		£ per acre
Gross Output		117.00
Variable Costs:		
Seed		-
Fertilizer		10.50
Spray		3.30
Sundry		0.10
		13.90
Gross Margin		103.10

Inputs:

Seed: Supplied by the British Sugar Corporation free of charge.
Fertilizer: Compound in the seedbed plus top dressing in the spring.
Sprays: Mainly pesticide to control aphids.
Contract: Drilling - £1.50 to £2.00 per acre.
Swathing £4.00 per acre.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Similar to herbage seed production. Crop is drilled in the late summer after a summer fallow or winter barley.

Additional Capital

Prior to combining, the crop is usually windrowed.

Windrowers	£300 to £350
Pick-up reel	£200

3. GENERAL COMMENTS

The crop is grown on contract to the seed companies which handle sugar beet seed and there are approved zones for sugar beet seed production. The market for the crop is thus limited both by size and location.

As with most root crops, the crop allows effective weed control and has a beneficial effect on soil structure and fertility. The crop is usually harvested in August or September and thus provides an entry for winter wheat.

OTHER SEED CROPS

These include mustard, trefoil, kale, rape, coriander, etc. but they are of limited importance since the market is restricted and the crops are usually grown on contract.

Inputs in terms of variable costs and labour are usually low but yields are very variable and occasionally disappointing.

These crops normally provide effective control of weeds and cereal pests and diseases and give a good wheat entry.

FIELD-SCALE VEGETABLES

Acknowledgements are due to W.L. Hinton, Cambridge University, who gave considerable help on these crops.

Developments in mechanical harvesting and in chemical control of weeds and crop diseases, have stimulated a considerable expansion in field-scale vegetable production on general arable farms during the last decade. This has gone hand in hand with an increase in the proportion of vegetables which are pre-packaged, frozen, dried or canned - outlets which demand the uniform crops from field-scale production. Until recently much of the acreage devoted to vegetables on a field scale has been confined to areas adjacent to the traditional vegetable districts, but arable farmers in other areas have not failed to see the financial and other advantages of these crops. For cereal growers in Southern England vegetable crops clearly offer scope for increasing the revenue from their farms if suitable outlets can be found. Unfortunately, after fairly rapid expansion in the 1960's, the 'convenience vegetable' market, though still growing, has become more subject to the effects of over-supply; new contracts with processors have been difficult to get recently and the quality standards required can be very exacting.

Vegetable crops generally involve higher costs and higher risks of loss, as well as higher potential profit, than cereals. The extent of these higher risks, costs and profits will depend on the extent to which the farmer participates in growing the crop. Farmer participation ranges from letting land which has been ploughed (at £17 to £20 per acre), or worked down, through varying degrees of involvement with a specialist grower or merchant in growing and marketing the crop. The lower degrees of participation - frequent in brussels sprout and carrot growing - obviously involve less risk as well as lower returns. Growers can increase their marketing strength or reduce the capital they have to find by forming groups or syndicates for sharing machinery, labour, grading and packing facilities and marketing arrangements. In a recent survey of vining pea producers, Cambridge University found that 70% were members of some form of group.

As an indication of the performance which can be expected from vegetable crops grown on a field scale, examples are given for three crops on the folowing pages. Greater detail can be found in the following publications by W.L. Hinton, Cambridge University:

The Economics of Carrot Production and Marketing in Britain
The Economics of Pea Production and Marketing in Britain (to be published shortly)
The Economics of Brussels Sprout Production and Marketing in Britain (in preparation)

VINING PEAS

Compiled from data supplied by W.L. Hinton of Cambridge University.

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average	Premium
Yield	cwt per acre	35.0	48.0
Price (grower vining and delivering)	£ per ton	47.00	47.00
		£ per acre	
Gross Output		85.25	112.80
Variable Costs:			
Seed		12.30	
Fertilizer		3.00	
Spray materials:	herbicide	2.80	
	pesticide	1.00	
Sundry		0.90	
		20.00	
Gross Margin (without contract)		65.25	92.80
Contract:			
Harvesting		20.00 - 27.00	
Haulage		3.50 - 4.80	
		23.50 - 31.80	
Gross Margin (contract harvest and haul)		41.75	61.00

Output. The price per ton is an example for peas for canning delivered unchilled. Contracts are complex and actual payments are related to tenderometer readings; for freezing the price is higher but yield lower.

Inputs:

Seed: 2 cwt per acre @ £6.00 to £6.50
Fertilizer: 0.40.40. total N.P.K. as 2 cwt of compound, some crops receive no fertilizer.
Sprays - herbicide: pre-emergence at 2 lbs per acre
- pesticide: malathion 1½ to 1¾ pints per acre, for thrips, weevil and aphis. Two applications may be required.

Sundries: Bird scaring materials, levies, etc.
Contract - Spraying: low volume £0.80 per application.
- Harvesting: costs vary widely from between £3.00 and £10.00 for group operating costs to £20.00 to £30.00 when operations are carried out by the processor.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements: (Successional sowing to provide a longer vining season results in a range of dates for any operation).

Time of Year	Man Hours per acre	Tractor Hours per acre	Operations
November to April	0.8	0.8	Stubble cultivation
November to January	1.3	1.3	Plough
February to April	0.6	0.6	Seed bed cultivation
March to May	0.3	0.2	Fertilizer application
March to May	0.6	0.5	Drilling (1 man)
March to June	0.3	0.3	Post drilling cultivation
March to May	0.3	0.3	Spraying
June to July	10.1	7.2	Harvesting
	14.3	11.2	

Machinery and Equipment

Normal cereal growing equipment plus a mobile viner, £6,500 to £9,000, which is usually group owned.

3. GENERAL COMMENTS - see page 62.

BRUSSELS SPROUTS - Compiled from data supplied by W.L. Hinton of Cambridge University.

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN
(Crop grown and harvested by the farmer)

		Average	Premium
Yield	tons per acre	3.6	5.5
Price	£ per ton	40.00	40.00
		£ per acre	
Gross Output		144.00	220.00
Variable Costs:			
Seed/Plants		6.00	
Fertilizer		16.00	
Spray materials:	herbicide	-	
	pesticide	9.00	
Packing materials		10.00 - 15.00	
Sundry		0.80	
		41.80 - 46.80	
Gross Margin (without casual or contract)		102.20	173.20
Casual labour, Contract and Haulage:*			
Casual labour		44.60 - 47.30	
Contract work		3.70 - 4.70	
Haulage		3.40 - 7.90	
		51.70 - 59.90	
Gross Margin (average casual and contract)*		50.50	113.30

Output: The net price through a wholesale market has been assumed. Production for freezing and pre-packaging will result in a higher price but lower yield.

Inputs:

Seed/Plants: 1½ to 2 lb. seed direct drilled or 5,000 plants per acre at £1.25 per 1,000.
Fertilizer: 160.80.80. total N.P.K. as 8 cwt of compound plus 80 to 100 units nitrogen as a top dressing.
Sprays - herbicide: post-emergence spray may be used on the seed bed or direct drilled crop (£2.50 to £3.50 per acre)
- pesticide: organo-phosphorous granules to control cabbage root fly and aphids £5.00. Sprays to control at later stage £4.00.
Packing materials: 20 lb. nets @ 2½p each.
Sundries: pigeon scaring materials by carbide bangers, shooting, etc.

*Casual labour, contract and haulage: varies widely depending on the proportion of planting and harvesting work, etc. which is carried out by regular farm labour. The figures shown are "all farms averages" and do not represent the full costs for a particular system.
Casual labour costs per acre. Machine planting £6: singling £10 to £12; hand picking £50 to £60; machine harvesting (topping and deleafing)£14; crops for freezing, cutting stems and loading £20.
Contract operations per acre: drilling £2.50 to £3.00; planting £6.00 to £6.50; tractor hoeing £2.00 to £2.50
Haulage: £15 to £20 per acre depending on yield and distance.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Time of Year	Man Hours per acre	Tractor Hours	Operations
November to April	1.7	1.7	Ploughing
March to June	1.2	0.7	Fertilizer application
April to June	1.9	1.9	Pre-planting cultivation
April to May	(1.0)	(0.9)	Direct drilling
March to June	2.2	0.5	Plant raising
May to July	(9.7)	-	Hand planting
May to July	10.6	2.6	Machine planting
July to August	1.0	1.0	Spraying
July to August	8.9	-	Hand hoeing
July to August	2.1	1.8	Tractor hoeing
	29.6	10.2	
September to March	57.0	4.8	Harvesting
September to March	(61.3)	(18.4)	Single harvesting
	86.6	15.0	

Figures in parenthesis represent alternative systems.

Machinery and Equipment: Little conventional cereal growing machinery other than cultivation equipment can be used and capital investment may be quite high. Some typical items are: Precision drill £200 to £350; Planter £300 to £400; Inter-row cultivator £250 to £300; Mobile stripping units for mechanical harvesting £2,000 to £2,500. These machines, also packing equipment and buildings may be eligible for a 35% grant under the Horticultural Improvement Scheme.

3. GENERAL COMMENTS - see page 62

CARROTS - Compiled from data supplied by W.L. Hinton of Cambridge University.

1. OUTPUT, VARIABLE COSTS AND GROSS MARGIN

		Average
Yield	tons per acre	13.0
Price	£ per ton	15.00
		£ per acre
Gross Output		195.00
Variable Costs:		
Seed		3.60
Fertilizer		11.50
Spray materials:	herbicide	4.00
	pesticide	3.50
Packing materials	for half the crop	10.00
		32.60
Gross Margin (without casual and contract)		162.40
Casual Labour, Contract and Haulage:*		
Casual and piecework labour		15.90
Contract		5.20
Haulage		6.90
		28.00
Gross Margin (average casual and contract)*		134.40

Output:

Many growers sell both through market and to processers, £15.00 per ton is an average. Market sales £17.40 per ton; sales to merchants and processers £13.20per ton. Yield and price vary widely with the type of outlet.

Inputs:

Seed: 3 to 4 lbs per acre @ £1.00 per lb.

Fertilizer: 65.65.100 total N.P.K. as 5 cwt compound, plus up to 5 cwt. kanit depending on potash level of the soil. Cost can vary from nil after a crop having a high residual value e.g. early potatoes, to £17.00 or more on light sands showing trace element deficiencies.

Sprays - herbicide: pre- or post-emergence e.g. linuron

- pesticide: pharon granules to control aphids and carrot root fly. Can range from £1.00 per acre for a single aphicide spray.

Packing Materials: 56 lb. nets @ 3.75p each

* Casual, Contract and Haulage: Varies widely depending on the proportion of harvesting, grading, etc. carried out by farm labour. The figures shown are an "all farms averages" and do not represent the full costs for a particular system.
Casual Labour: grading £2.50 per ton.
Contract charges: drilling £2.00 to £2.50 per acre; tractor hoeing £2.00 per acre; harvesting £3.50 to £4.00 per ton.
Haulage: £1.00 to £2.50 per ton depending on distance.

2. DEMAND ON FIXED RESOURCES

Labour and Tractor Requirements:

Time of Year	Man Hours per acre	Tractor Hours	Operations
September to December	0.9	0.9	Stubble cultivation
November to March	1.3	1.3	Plough
February to April	2.2	2.2	Seed bed cultivations
February to May	0.7	0.7	Fertilizer application
April to May	1.0	1.0	Drilling
April to August	1.0	1.0	Spraying
May to July	1.9	1.0	Tractor hoeing
September to May	32.4	10.0	Harvesting
September to May	37.8	-	Washing and grading
	79.2	18.1	

Machinery and Equipment

The additional equipment required can vary widely depending on the acreage and whether the farmer or a merchant harvests the crop. Small acreages can be harvested using a potato hoover (£350 to £500). Typical specialised items are: Precision drill £200 to £350. Inter-row cultivator £250 to £300. Carrot lifters and harvesters £750 to £1,500. Washer and grader up to £5,000 (plus building). These machines, also packing equipment and buildings may be eligible for a 35% grant under the Horticultural Improvement Scheme.

3. GENERAL COMMENTS - see page 62.

3. GENERAL COMMENTS - VINING PEAS, BRUSSELS SPROUTS AND CARROTS

Suitability

Of the three crops, vining peas probably involve the least modification in a cereal growing system. Brussels sprouts and carrots involve more drastic changes in the farm organisation and capital structure if it is to be geared to handle the harvesting operations, as opposed to harvesting by the buyer. Production of any of these crops should only be considered if it is intended to make them a fairly permanent feature of the farm system; they are not crops which amateur producers are likely to grow successfully.

Location

Marketing outlets, particularly proximity to processing plants, have largely dictated the distribution of field-scale vegetable production. This has meant that it is still mostly centred on the traditional areas; peas on medium and light soils in East Anglia, Lincolnshire and Yorkshire; sprouts on medium to heavy soils in the Eastern and East Midland counties and in the Evesham area; carrots on the sandy and fen soils of East Anglia, Lincolnshire and Yorkshire. There is no reason however, why production should not become more widespread where soil type and depth is suitable.

Place and Value in the Rotation

All vegetable crops provide a good species break from cereals and are therefore beneficial in reducing the incidence of cereal disease and weeds associated with cereal growing. These crops should not however, be considered as a remedy for dirty land. They also have beneficial residual effects on soil structure and fertility, although winter harvesting of sprouts and carrots may damage the structure of some soils.

Vining peas and early carrots are ideal precursors for winter wheat but sprouts and maincrop carrots are harvested too late for a winter cereal to follow them.

Difficulties in Growing

These are mainly associated with the higher managerial and labour skills required and the increased complexities which can result in the farm organisation.

In spite of increasing mechanisation, the availability of casual labour having the requisite skills is still an important factor for many sprout and carrot producers.

Returns are highly dependent on quality, and considerable attention to detail is necessary to ensure that a high proportion of the crop meets the specifications required by the market or the processors.

Marketing is another vital factor in achieving satisfactory returns, and any cereal grower contemplating field-scale vegetable production cannot be too strongly advised to make sure he has a satisfactory outlet before embarking on production of these crops.

SECTION V : MARKETING AND PROSPECTS - D.J. Ansell and J. Burns

The previous sections of this report have been principally concerned with the production characteristics of the range of crops encountered in the Survey, and with more general technical issues which will govern their use on farms. A discussion of the economy of these crops on arable farms would however be incomplete if reference were not made to the wider business environment in which the production process takes place. This chapter has two principal objectives:-

1. To describe the marketing arrangements likely to be encountered by the prospective producer.
2. To assess the probable trend in market price as determined by the likely principal changes in supply and demand, and not purely in a national context.

The preceding chapters have indicated that few break-crops are capable of producing Gross Margins of such an order that close inspection of the marketing situation is not demanded, and indeed if costs continue to rise at a higher rate than market price, the quest for the best markets becomes increasingly important.

In addition agriculture is now entering as great a period of uncertainty as it has encountered since the 1947 Agricultural Act, and although the general prospect may look favourable, the need for adjustment and perceptiveness in recognising new possibilities will be crucial. If needed, a further justification for discussing the marketing of these crops is that little has previously been said on the subject. This is not surprising when account is taken of their proportionate contribution to the gross value of agricultural output - which seems unlikely to exceed 2%. Furthermore, whilst farmers are now familiar with the basic structure of cereals and livestock markets, they are likely to be less familiar with the requirements and procedures of some of the more rarely encountered arable crops described in this text.

The array of crops which are considered in this report are sufficiently diverse to make it impracticable to discuss their marketing requirements jointly or to generalise about economic prospects.

The approach used is then to examine individually the main crops encountered in the Survey.

HERBAGE SEEDS

The term 'herbage seed production' lacks precision in that there are some 30 varieties of herbage seeds and clovers, which are different in many important respects. They differ not only with respect to production characteristics - yield, date of harvest, fertilizer requirements, but also in their requirements for marketing. Thus, date of harvest is likely to vary, prices vary, and so do marketing outlets. However, in most other respects they can be conveniently regarded as being an individual enterprise.

The marketing arrangements for herbage seeds provides an interesting example of the problem of price instability in the agriculture sector. An unpredictable level of annual production, associated particularly with large yield variations and an inelastic demand, provide the requirements for such instability. A variety of institutions and procedures have however been developed in order to regulate production and in order to protect the interests of the herbage seed producer and others in the trade. The most important aspect of these arrangements has been a price-fixing arrangement undertaken by the Aberystwyth Seeds Committee following bargaining between representatives of growers and merchants. This committee met after the harvest was completed and on the basis of its knowledge as to the level of the past year's production, the level of stocks and international aspects, fixed a price for each Aberystwyth Seed variety. Thus, it will be noted, producers did not know the level of market price which would apply to their crop until after the crop was harvested. This has been cited as a disadvantage of the marketing system, but still of course left the producer in no worse a position than the producer of any other crop on the free market. This particular system is in any case no longer operative. It was made clear to the Aberystwyth Seeds Committee that the system of central regulation of seed grower's prices made its activities open to objection by the Registrar of Restrictive Trade Agreements. Thus a new system has been developed, and will come into operation as from the 1972 crop. Prices will be announced by the National Seeds Development Organisation Ltd. (the commercial arm of the Government Plant Breeding Stations) following recommendations from a new British Herbage Seeds Committee. This committee, consisting of eight representatives of the Growers and Traders, and six members of N.S.D.O., will still sit annually and fix prices for seed after the

harvest has been completed, but growers now have the alternative of arranging a contract with a specified price with their seedsmen or merchant at the time at which the contract is initially negotiated. It is hoped that the involvement of N.S.D.O., the wider membership of the price fixing committee, and the option of contracting prices in advance, will remove any possibility of objection to the system by the Registrar.

Certified seed is grown entirely on a standard contract which was developed by agreement between seed growers, firms in the seed trade and the Aberystwyth Seeds Committee of the N.I.A.B. The contract specifies the conditions under which the crop should be grown, the inspections that should be made, and deductions from the price which should be made for cleaning and drying.

In 1968 a report was submitted to Parliament on Herbage Seed Supplies,[1] which made a series of recommendations which can be summarised as follows:-

1. The wider use of improved varieties of herbage seed would bring about a significant increase in home food production at negligible cost.
2. A need for increased stability in the industry, and desirability of keeping returns in line with those from cereals production.
3. Farmers' choice should not be restricted to home-grown seed. Imported seed of equal merit must remain available.
4. Licensing of seed processors and importers was desirable.
5. Formation of a Herbage Seeds Authority.

The recommendations of the Report were not found acceptable to the Government and have thus remained unadopted. The main effect would have been to bring a substantial amount of extra regulation into the marketing system and a greater degree of price stability. (The extent of price instability in the past is indicated by Appendix II on page 84.)

The advantages of hind-sight suggest that the Donaldson Committee were perhaps over influenced by the prevailing conditions of the time - certainly the Herbage Seeds Industry had reached a low ebb, but by 1971 a substantial recovery had taken place. Thus although the inspected acreage of most of the important herbage seeds had fallen consistently during the period 1964-1968 it has since risen again. The following figures give some indication

1. Report of the Committee on Herbage Seed Supplies. Cmnd. 3748 Sept.1968. (Chairman: Lord Donaldson)

of the reversal in trend for ryegrass.

Acreages of Ryegrass inspected in selected years

Perennial Ryegrass S23	Acreage of seed inspected
1964	7,316
1968	3,220
1971	6,350
Italian Ryegrass	
1964	7,206
1968	3,806
1971	4,200

It is doubtful anyway whether any price stability can be achieved for a product where yield variations can be marked without introducing an unacceptable degree of rigidity into the market. Certainly the Donaldson Committee recommendation of parity of return between cereals and herbage seeds seems to lack economic foundation, and could have led to serious imbalances between supply and demand. The results of the survey of herbage seed producers suggested that Gross Margins are in any case comparable with returns from cereal production.

Neither is it the case that farmers as a whole were unhappy with the previous price fixing arrangement, and one can indeed see logic in a system which left the determination of price until a stage in the system when most of the important variables were known. With the alternative this year and subsequently, of making a fixed price contract with merchants at the time at which the crop is sown, farmers' choice will be widened. It seems likely at this stage that more growers than merchants will be expressing a preference for a fixed price contract. There has been a shift in the risk-bearing function and if merchants are confronted with growers demanding fixed price contracts they will clearly need to discount the risks, and this may well lead to a situation where growers' returns are lower than they were before. The choice facing the grower will be between accepting the security of a fixed price contract or taking a chance on the post harvest situation. Crucially important in determining the way in which post harvest

prices behave will be the proportion of the total production for which prices are fixed in advance. It will be the small 'free' market which will have to bear all the stresses of yield fluctuations and the smaller that market the greater will be the variation in price.

The future level of herbage seed production is particularly uncertain with the prospect of the Common Agricultural Policy soon to be relevant for U.K. growers of herbage seed. There will be a requirement for only certified seed to be used, which will probably increase the demand for Aberystwyth varieties, although these will now be competing directly with European varieties (some protection is offered at present through a 10% ad valorem tax). Imports of seed from other countries e.g. Canada, will however presumably be reduced. At the moment it seems unlikely that intervention prices will be fixed for herbage seeds but it is probable that a direct subsidy will be paid on production. The transitional period for the industry will commence in January 1973 and should be completed by 1st January 1976.

The Common Market is only one of the factors which will affect the profitability of the industry, although the implications of that event extend further than mere speculation as to the nature of direct arrangements and support systems. The higher price of cereals might, for example, persuade herbage seed producers to increase their cereal acreage, and a movement out of herbage seed production would inevitably have an effect on prices. Or will there be a change in the acreage of temporary grass grown, and an increase in the grass break on arable farms in response to an improvement in the relative profitability of meat produced from grass. Such thoughts are speculatory, but will provide the overall environment in which the herbage seed producer operates.

The other major factor in recent years has been competition from foreign producers which has tended to grow in importance - but E.E.C. entry will modify both the directions and volumes of such competition. An indication of the demand for grass seed can be obtained by examining changes in the grass (particularly temporary grass) acreage in the country. Appendix II shows how the temporary and permanent grass acreage has changed as a proportion of total crops and grass in the counties that were surveyed in the south of England. The overall feature is of a fall in the grass acreage, particularly marked since 1965; this clearly has been the main cause of the relative depression of the herbage seeds

industry, although one could not assume that the figures for the south of England represented a national trend. Western and northern areas have shown greater stability in this respect. For the U.K. as a whole the following figures give an indication of changes in the acreage of grass:-

Grass acreage in U.K. in 1,000 acres

	Temporary grass	Permanent grass	Total Crops & Grass (including rough grazed)
1955	6,138	13,532	47,978
1962	6,948	12,556	48,779
1968	5,873	12,195	47,973
1970	5,700	12,217	46,542
1971	5,718	12,172	46,530

A rough indication of the relationship between expansion in the grass acreage and associated increase in demand for herbage seeds might be that an acre of herbage seeds will, on average, provide sufficient seed for about 30 acres of grassland under typical application rates. Taking into account the large proportion of permanent grass and relatively long leys in the temporary grass acreage, clearly the demand for herbage seed cannot be expected to be buoyant. In addition, yield increases can be expected to occur, not simply through the development of new varieties but also associated with improvements in harvesting, drying and storage techniques.

For the individual farmer however, choosing a break-crop, the main concern will be whether he can obtain a contract, and whether he has sufficient skill to grow the crop successfully. Capital can rarely be the constraint in this enterprise. If the contract can be arranged, and a reasonable yield obtained, herbage seeds seem likely to remain a sensible choice of cereal break-crop.

FIELD BEANS

Field beans are an unusual crop in this country in that their principal outlet is the export market. Rather more than 50% of the crop has been exported in recent years mainly to the E.E.C. countries. The main factor differentiating the compounding sector in the E.E.C. countries and the U.K. is the very much higher price of cereals in Europe, and as has been pointed out, the movement of prices for beans in the U.K. depends principally upon cereal prices in the E.E.C. Consumption by feed manufacturers at home has been limited by a number of factors, but the principal one appears to be that beans are only capable of supplying a small fraction of companies' requirements (Hebblethwaite[1] estimates 1·2% of total possible supply of feedstuffs and 2·4% of possible protein supply), and their use may entail too much trouble in relation to their importance. Not only is the total supply small but it is also variable, again leaving compounders in uncertainty in their forward planning of purchases. The other disadvantage of grinding beans for incorporation into feed rations is that there are some technical difficulties, particularly rancidity if beans are not dried sufficiently, and the fact that the flour does not flow very freely and is thus difficult to handle.

The other outlets are for pigeon feed, which cannot be expected to grow substantially, and feeding on the farm, which may increase in importance if the cereal element of animal rations becomes more expensive. It is indeed the change in the price of wheat, barley and oats, both to manufacturers and farmers which will be the key to the movement of prices of field beans, and E.E.C. membership would mean some substitution of beans for cereal ingredients. In addition a larger acreage grown would remove some of the objections based on the small total supply - this is clearly an enterprise where external economies of scale exist.

For the individual farmer few problems exist in marketing the crop. There has been a trend in the last few years for an increase in the proportion of the total acreage which is contracted, but there is nothing to prevent spot transactions taking place. Contracts are usually linked with a specific market outlet e.g. production for seed, or for export or pigeon feed. The usual type of advantages can be cited in connection with the use of contracts; the greater degree of security for the grower, and in some cases a premium in return for certain requirements concerning moisture and quality.

1. Marketing and Use of Field Beans. P.D. Hebblethwaite. Agriculture Vol.78 No.1. January 1971.

VEGETABLE CROPS

The production of vegetables on a farm scale has attracted growing interest in recent years, associated particularly with the need to incorporate higher value crops into farm systems which were being threatened by a tendency for costs to increase rather quicker than product prices. In addition the market outlook seemed to be attractive, bearing in mind the rather higher income elasticities associated with many vegetable products. These values are still however mainly less than one so there is a tendency for retail vegetable prices to advance at a rather slower rate than retail prices generally.

The change in tastes in favour of convenience foods has been well documented, seems likely to continue and will depress the growth in demand of fresh vegetables. Certainly the fastest growth sector of the vegetable market has been frozen vegetables in the last decade. This has not only been at the expense of fresh vegetables, but also at the cost of many canned products. Additionally, if the evidence of the U.S.A. is relevant there is much more scope for a swing to frozen foods. At the moment the U.K. per capita consumption of frozen food is about one-fifth that of the U.S.A. and less than one half that of Sweden. On the other hand the U.K. already consumes substantially more frozen food than most of the E.E.C. countries; France, West Germany, Italy and Belgium stand well below the U.K. in this respect. It is not therefore possible to predict that as real incomes rise there will be a steady and inevitable swing towards frozen vegetables, particularly if one considers the wider European market in which U.K. producers will be operating. There are more variables to be considered and this makes accurate prediction difficult.

The evidence of the 1960's does however point the way in which the economic climate has changed. Production of quick frozen vegetables in the U.K. rose in terms of volume by over 100,000 tons during that time - an increase of 300%. During the same period canned vegetable production rose by less than 150%.

The sector as a whole is likely to grow slowly, as a result of population increase and higher incomes, probably more slowly than the rate at which yields will increase - this was certainly true of the last decade. The growth of demand in frozen vegetables will be higher but mainly at the expense of other types of vegetable products.

The international aspects are also of course important. The U.K. currently imports a substantial volume of dried and frozen peas, a small amount of carrots (mainly out of season) and about one tenth of the annual requirement of broccoli and cauliflower. Clearly however, such international flows are of limited interest with the prospects of E.E.C. membership close. The likely pattern of events after 1973 is lifficult to discern, and cannot be adequately discussed here. What does seem true however, is that the chief threat to profitable vegetable production in this country comes not from foreign suppliers, but from an increasing level of home production.

The implication for the prospective U.K. grower seems therefore to be reasonably clear. Growing vegetables implies operating in an environment in which government protection is scant. The absence of any body which can control the acreage sown means that 'band wagon' effects are likely to occur, resulting in severe overproduction in some years and catastrophic falls in prices e.g. brussels sprouts 1970/71 and onions this year.

Production, without the assurance of a contract would seem in most cases to be risky, and is indeed impossible in the production of most vegetables for freezing as the crop has to be speedily cut, partly processed in the field and rapidly transported to the freezing plant. Processers clearly need to be in a position to manage the sequence of harvesting of the contracted acreage. Thus an increase in the importance of frozen products implies a growth in the use of contracts. The grower of fresh vegetables or dried peas has of course, a wider if not more attractive choice in that he can produce for the traditional wholesale markets and in absolute terms these still handle the bulk of the U.K. production of vegetables and fruits. Participation in these activities however, will usually involve a greater amount of participation by the grower in decisions as to when to sell, where to sell, and how to sell. The organisation of transport will normally be the responsibility of the grower, and substantial other marketing and packaging charges may be involved. The general point with respect to the production of vegetable crops for the free market is that this is a more difficult operation to successfully manage than producing the wide range of other products which are protected by marketing boards, or guaranteed prices.

The main problem encountered by the farmers interviewed in the Survey had been their inability to negotiate a quota with a processer, or a reduction in their existing quota due to the build-up of stocks of processed vegetables during the previous year. One of the causes of this was the

increase in the brussels sprout acreage in 1970-71 which led to a sharp fall in prices and some movement of consumers back towards the fresh product.

The conclusion would appear to be that prospective growers of vegetable crops must expect difficulty in moving into the sector and many skills to learn in production and marketing once he gets there - this is not a profitable exercise for the amateur.

MAIZE

The production of maize for grain seems one area where the prospects for growth seem promising. There are climatic factors which limit the zones in which maize can be grown, but within these areas there does seem scope for expansion. The primary determinant will clearly be whether consistently high yields can be obtained so that the crop can compete with the large amount of maize imported annually (400-500,000 tons). The price for the 1971 harvest was disappointing compared with the previous year but opinion in the trade supports the view that a price of £30 per ton might reasonably be expected in the foreseeable future.

The requirement for specialised machinery for planting and harvesting does make this a particularly suitable crop for group action by farmers, and most maize production has developed in this manner. Often such groups have an agreement with a merchant or group of merchants for the disposal of their collective harvesting. Most agricultural merchants are prepared to handle maize and are accustomed to so doing, particularly those who have a compounding activity. There is unlikely to be any difficulty for the farmer who decides to embark on production and marketing on his own, except the high capital costs per acre.

The successful development of maize production will, however, test the ability of the syndicate movement in the U.K. to provide opportunities for commercial exploitation of a crop which would probably not otherwise be possible.

OILSEED RAPE

The greatest factor limiting the expansion of oilseed rape production has been not an absence of markets but the low return associated with poor yields. The price of rapeseed for crushing is largely determined by the imports of other vegetable oils. In 1970 the U.K. used 692,000 tons of vegetable oils of which only 32,000 originated from rapeseed. (Soya bean and palm oil are most important quantitatively in the U.K. market). The U.K. grows an insignificant proportion of the total world supply of rapeseed, production here was about 8,000 tons in 1970-71 and world production estimated at 6,400,000 tons. Total U.K. imports in 1969 were 77,000 tons of rapeseed, the largest suppliers being Sweden, Poland and East Germany, in that order. If reasonable yields can be obtained clearly there is room for expansion in the home acreage.

Price will be determined not only by world supplies of rapeseed but also by the availability of other oil seeds - particularly groundnuts, soya beans and sunflower seeds. Vegetable oils have however tended to be relatively scarce in the last few years and the outlook does look encouraging for producers. Prices in western Europe generally were substantially higher in 1970 than they were in any recent previous year.

The usual procedure for growing the crop is to obtain a contract - usually at a fixed price - from one of the relatively few organisations which handle rape. One organisation in the south of England is, in fact responsible for the marketing of a large proportion of the crop, although a few other firms do act as agents for the seed crushing plants. Certainly the prospective grower would be unwise to grow the crop without having approached the appropriate marketing bodies and neither could he expect his local merchant to be able or willing to handle the crop for him. There seems no reason however, why anybody should have difficulty in obtaining a contract, and the rise in world prices in the last few years has made the product more profitable.

CONCLUSIONS

Farmers growing the range of break-crops encountered in the Survey will be doing so without the protection of guaranteed prices or assured markets. Some of the crops being grown have a limited market and tendencies for over supply and falling prices already exist. For almost all the crops the farmer will need to make arrangements with a merchant or processer before the crop is actually sown.

For the above reasons it is clear that farmers should give greater attention to marketing than they typically do at present. There is a danger in concluding from an inspection of average gross margins (which by definition refer to the past) that a particular crop in the future will necessarily provide a profitable cash return. These dangers are particularly marked where substantial capital outlay is required. Nevertheless it is as true in marketing as it is of production that the better farmers will successfully operate in an environment which the less skilled find inhospitable. If the premise is accepted that growth in supply is likely to be greater than growth in demand for most food products, then the returns to be gained from acquisition of selling skills will be high.

APPENDICES

APPENDIX I

(APPENDIX TO SECTION III)

CONFIDENTIAL CODE NO.

UNIVERSITY OF READING, DEPARTMENT OF AGRICULTURAL ECONOMICS

CEREAL BREAK CROP STUDY QUESTIONNAIRE

1. Cropping Please list the crops you are growing in 1970, and the acreage of each, making sure that each different crop (including different varieties of herbage seed, crops for ploughing in, bare fallow etc.) is shown separately.

Crop	Acres	PLEASE USE THIS SPACE IF THE ROOM PROVIDED OPPOSITE IS INADEQUATE.
Winter Wheat		
Spring Wheat		
Barley		
Oats		
Permanent grass (grassland not under rotation)		
Rough grazings etc.		
Total		

2. With the exception of wheat and barley we would like to know your reasons for growing all the crops and temporary grass you have listed. To help you to answer this question EIGHT reasons are suggested below. Would you please note under each, the crops (excluding wheat and barley) that you grow to meet these needs. It is expected that you may want to note the same crop under several of these headings because it serves more than one purpose.

(a) As a cash crop primarily for the income it generates in its own right.

(b) To obtain better control of persistent weeds. If control of a particular weed is associated with a particular crop please indicate in the following way: Maize (wild oats).

(c) As a short duration crop on land that would otherwise be bare fallowed.

(d) To check or control the incidence of cereal pests or diseases. If control of a particular pest or disease is associated with a particular crop please indicate in the following way: Linseed (take all).

(e) To maintain soil structure e.g. cultivations would be more costly or difficult without them.

(f) Because fertilizer costs would be higher without these crops.

(g) The yields from succeeding cereal crops are improved.

(h) Other reasons. Please note the reasons as well as the crops.

N.B. PLEASE CHECK YOU HAVE NOT OMITTED ANY CROPS FROM YOUR ANSWERS.

3. What livestock do you keep or how else do you utilise your grassland?
(e.g. a herd of 60 dairy cows rearing own replacements, surplus calves fattened for beef, sale of surplus hay).

4. What break-crops, if any, have you grown in the last five years and have now stopped growing?

Crop	Reason for discontinuing

5. Without troubling to refer in detail to past records, can you please tell us approximately:

Year	Total area farmed (acres)	Total area in wheat and barley (acres)
1965		
1966		
1967		
1968		
1969		

6. If you practice a definite crop rotation please give the sequence of crops e.g. 3 year ley, wheat, barley, barley.

Rotation	Predominant soil type

7. Are you planning any changes in the cereal acreage for future years?

Changes planned if any (Please include an indication of acreages if possible)	Your reasons

8. What is the maximum cereal acreage that you think can be maintained on your present holding for an indefinite period?

..... acres

9. Please place a tick(✓) in the appropriate box in each line of tables (A) and (B) below to indicate what you think will happen in each of the following three circumstances:-

(A) will your yields

	Increase	Decrease	Remain Unchanged	Don't Know
(i) If your present cereal acreage is maintained?				
(ii) If any planned acreage you may have indicated in 0.7 is grown?				
(iii) If any maximum acreage you may have indicated in Q.8. is grown?				

(B) Assuming no price change will the quantity of the materials you use (e.g. seed, fertilizer, spray):

Increase	Decrease	Remain Unchanged	Don't Know

APPENDIX TABLE I

Changes in farm size and in acreage of wheat and barley (Question 5)

Harvest	Number of farms providing information	Total acreage of farms	Total acres of wheat and barley	Average farm size	Acreage wheat & barley per farm	Wheat & barley as % of farm area
				acres	acres	%
1965	1002	483150	299225	482	299	62
1966	1043	513394	327641	492	314	64
1967	1085	540832	349996	498	323	65
1968	1118	571183	368718	511	330	65
1969	1145	600214	383655	524	335	64
1970	1194	621696	389478	521	326	63

Cereal acreage grown in 1970

Soil type			Total acres of all cereals		Acreage of all cereals per farm	All cereals as % of farm area
Chalk or L'stn	512	299644	201290	585	393	67
Other soils	682	322052	217994	472	320	68
All farms	1194	621696	419284	521	351	67

Maximum acreage of cereals that respondents believe they can maintain for an indefinite period (Ques. 8)

Chalk or L'stn	495	293754	203338	593	411	69
Other soils	659	313920	219991	476	334	70
All farms	1154	607674	423329	527	367	70

APPENDIX TABLE II

Farmers stating that they planned to REDUCE a cereal crop (Question 7)

(a) Number by soil type and cereal crop

	Barley	Wheat	Oats	Cereals (type not specified)
Chalk or limestone parishes	78	5	2	39
Other soils	93	4	4	78
	171	9	6	117
Uncertain but may reduce a cereal (all soil types)	6	-	-	8
	177	9	6	125

(b) Reasons given for the changes planned - % of number of farmers in (a)

	Barley			Wheat			Oats			Cereals (type not specified)		
	All farms	Chalk or L'stn	Other soils	All farms	Chalk or L'stn	Other soils	All farms	Chalk or L'stn	Other soils	All farms	Chalk or L'stn	Other soils
	%	%	%	%	%	%	%	%	%	%	%	%
No reason given	11	10	12	44	20	75	17	-	25	2	2	1
Low return/substituting with a crop giving a better return	45	48	42	22	20	25	33	-	50	12	14	11
To allow a break-crop giving a wheat entry	19	25	13	-	-	-	-	-	-	2	-	4
To allow a break-crop for weed control	6	5	6	22	40	-	-	-	-	9	5	11
To increase a livestock enterprise	16	23	10	-	-	-	17	50	-	36	40	34
To increase the proportion of break-crops/improve soil "fertility"/improve cereal yields	11	10	11	-	-	-	-	-	-	33	40	29
To ease/level out, labour or management demands	3	4	3	11	20	-	17	-	25	5	2	6
To control cereal disease or pests	4	3	5	-	-	-	17	50	-	6	10	5
To allow a break-crop to improve soil structure	1	-	1	-	-	-	-	-	-	6	2	8
Because of a reduction in the acreage farmed	-	-	-	-	-	-	-	-	-	5	5	5
Other reasons	3	5	1	-	-	-	-	-	-	6	2	7

Note The per-cent replies may add to more than 100% because many farmers gave several reasons.

APPENDIX TABLE III

Farmers stating that they planned to INCREASE a cereal crop (Question 7)

(a) Number by soil type and cereal crop

	Barley	Wheat	Oats	Cereals (type not specified)
Chalk or limestone parishes	8	37	16	20
Other soils	9	47	23	27
	17	84	39	47
Uncertain but may increase a cereal (all soil types)	-	2	-	1
	17	86	39	48

(b) Reasons given for the changes planned - % of number of farmers in (a)

	Barley			Wheat			Oats			Cereals (type not specified)		
	All farms	Chalk or L'stn	Other soils	All farms	Chalk or L'stn	Other soils	All farms	Chalk or L'stn	Other soils	All farms	Chalk or L'stn	Other soils
	%	%	%	%	%	%	%	%	%	%	%	%
No reason given	24	13	33	17	16	19	15	6	22	31	29	33
To increase returns (more profitable than crop replaced)	29	25	33	71	71	71	51	63	43	44	57	33
As an entry for wheat	-	-	-	-	-	-	21	25	17	-	-	-
To allow weed control	6	13	-	5	5	4	5	6	4	-	-	-
A charge linked with changes in livestock enterprises	-	-	-	3	3	2	3	6	-	10	10	11
To ease/level out, labour or management demands	18	13	22	1	-	2	5	-	9	2	-	4
Because of an increase in acreage farmed	18	25	11	1	3	-	-	-	-	8	14	4
To control cereal disease or pests	-	-	-	-	-	-	8	-	13	-	-	-
On land reclaimed from waste/ rough grazing/woods	6	13	-	-	-	-	-	-	-	8	-	15
Other reasons	-	-	-	2	3	2	10	6	13	2	-	4

Note The per-cent replies may add to more than 100% because many farmers gave several reasons.

APPENDIX TABLE IV

Acreage changes planned in cereal crops (Ques. 7)

	Barley	Wheat	Oats	Cereals (type not specified)	Total
Reductions					
Number	87	4	2	59	-
Total acres	5482	124	68	3385	9059
Acres per farm	63	31	34	57	-
Increases					
Number	9	43	16	34	-
Total acres	693	2943	854	1830	6320
Acres per farm	77	68	53	54	-
Total acreage change	-4789	+2819	+786	-1555	-2739

A number of the replies specified an acreage by which it was planned to increase or decrease a cereal crop. Although some farmers were planning a switch from one cereal to another, or to increase or decrease more than one type of cereal and have therefore been counted under more than one heading, Table VII gives an indication of the swing in acreages planned.

APPENDIX TABLE V

Respondents' views on likely changes in cereal yields and variable costs* in three different circumstances (Number of replies)

(a) If their present cereal acreage is maintained

Yields \ Costs	Not answered	Increase	Decrease	Remain unchanged	Don't know	Total
Not answered	32	3	1	3	1	40
Increase	4	114	24	200	3	345
Decrease	5	45	7	42	2	101
Remain unchanged	11	105	19	491	17	643
Don't know	3	15	4	25	18	65
Total	55	282	55	761	41	1194

(b) If the planned cropping changes indicated in Question 7 are made

Yields \ Costs	Not answered	Increase	Decrease	Remain unchanged	Don't know	Total
Not answered	62	2	2	0	2	68
Increase	8	96	81	104	12	301
Decrease	0	2	4	3	1	10
Remain unchanged	2	21	8	51	1	83
Don't know	2	4	2	6	15	29
Total	74	125	97	164	31	491**

(c) If the maximum cereal indicated in Question 8 is grown

Yields \ Costs	Not answered	Increase	Decrease	Remain unchanged	Don't know	Total
Not answered	226	6	0	10	1	243
Increase	6	93	38	95	9	241
Decrease	3	70	9	20	2	104
Remain unchanged	20	105	16	324	12	477
Don't know	11	21	1	25	31	89
Total	266	295	64	474	55	1154***

Note Some respondents who stated that yields would remain unchanged or increase, if an increased or a maximum acreage of cereals is grown, indicated new improved varieties or cultivation methods as the reason. Some of the replies also indicated the same reasons for a decrease in variable costs in these circumstances.

* This question was asked presuming there would be no change in the prices of inputs.

** Number answering Question 7 who planned changes and gave details.

*** Number answering Question 8.

APPENDIX II

GROWERS' PRICES FOR GRASSES AS AGREED BY THE ABERYSTWYTH SEEDS COMMITTEE OF THE N.I.A.B. 1957-1971 *

Grasses		1957 s. d.	1958 s. d.	1959 s. d.	1960 s. d.	1961 s. d.	1962 s. d.	1963 s. d.	1964 s. d.	1965 s. d.	1966 s. d.	1967 s. d.	1968 s. d.	1969 s. d.	1970 s. d.	1971 p.
Perennial Ryegrass	S.23	1 9	2 6	1 11	2 6	2 0	2 3	2 1	1 7½	1 8	1 7½	2 3	2 7	2 3	2 1	9 (1/9)
	S.24	11	1 7	1 4	1 9	1 2	1 6	1 0	10	1 5	1 5	1 5	1 5	1 3	1 3	7 (1/4)
	S.101	1 6	2 0	1 8	2 2	1 8	2 0	1 9	1 3	1 5	1 5	1 9	2 0	2 0	2 0	10 (2/-)
	S.321								1 3	1 5	1 2	1 4	1 5	1 3	1 0	5 (1/1)
Italian Ryegrass	S.22	1 0	1 11	1 6	2 2	1 1	1 7	1 6	11	1 6	1 3	1 1	1 5	1 6	1 7	6 (1/3)
Cocksfoot	S.26	1 8	2 1¾	1 8½	1 7	1 3	1 7	2 2	1 9	1 9	1 8	1 8	1 8	1 9	2 1	11 (2/2)
	S.37	1 8	2 1¾	1 8½	1 6	1 3	1 7	2 1	1 7	1 7	1 6	1 6	1 7	1 8	2 0	10 (2/0½)
	S.143	1 8¾	2 1¾	1 8½	1 8	1 3¾	1 8	2 3	2 0	2 0	1 11	1 10	1 11	2 2	2 4	12 (2/4½)
	S.345								1 8	1 9	1 3	1 2	1 5	1 8	1 10	10 (1/11½)
Timothy	S.48	4 0	4 3	3 8	4 0	3 9	4 0	3 11	4 0	4 0	3 10	3 10	4 3	4 4	4 4	22 (4/4)
	S.50	6 0	6 3	5 6	5 3	4 3	4 8	6 0	6 0	6 3	6 3	6 3	6 3	6 3	6 3	32 (6/4)
	S.51	2 8	3 0	2 7	2 7	2 3	2 10	3 3	3 3	3 6	3 6	3 2	3 5	3 6	3 6	16 (3/3)
	S.352									3 9	3 0	2 4	2 6	2 8	2 9	14 (2/9)
Meadow Fescue	S.53	3 6	4 0	3 6	4 0	3 3	2 6	2 6	2 9	3 0	3 0	3 0	3 0	3 0	3 0	16 (3/1½)
	S.215	1 8	2 6	2 6	2 6	2 0	1 6	1 6	2 2	2 9	2 3	1 9	1 3	1 5	2 1	11 (2/2)
Red Fescue	S.59	3 6	4 0	3 6	3 0	2 3	2 3	3 3	3 3	4 0	4 0	4 6	4 6	4 6	4 0	21 (4/2)
Tall Fescue	S.170	2 0	2 6	2 6	2 6	1 9	2 3	3 0	2 9	2 6	2 6	2 0	2 4	2 6	2 6	11 (2/3)

* Net price per lb. to grower.

APPENDIX III

TEMPORARY GRASS AND PERMANENT GRASS AS A % OF TOTAL CROPS AND GRASS

		1955	1957	1959	1961	1963	1965	1967	1969
Bedfordshire	T. Grass	11	10	10	11	10	7	6	6
	P. Grass	27	26	26	25	24	21	20	18
Cambridgeshire	T. Grass	8	8	8	8	7	5	3	2
	P. Grass	12	12	13	12	11	10	10	9
Hertfordshire	T. Grass	17	19	18	18	17	14	11	11
	P. Grass	27	27	27	27	25	24	23	22
Huntingdonshire & Peterborough	T. Grass	10	10	11	11	10	7	5	4
	P. Grass	22	21	21	20	18	15	13	13
Berkshire	T. Grass	21	22	23	24	24	20	17	17
	P. Grass	15	16	18	18	17	14	13	13
Buckinghamshire	T. Grass	15	16	18	18	17	14	13	13
	P. Grass	52	53	52	52	50	47	46	45
Hampshire	T. Grass	24	25	26	28	26	22	19	20
	P. Grass	28	27	27	27	26	26	25	25
Oxfordshire	T. Grass	20	20	21	21	20	16	15	15
	P. Grass	40	40	38	38	36	33	31	31
Sussex West	T. Grass	21	23	24	25	25	22	20	20
	P. Grass	36	35	35	36	34	33	32	31
Northamptonshire	T. Grass	17	18	18	18	17	14	11	12
	P. Grass	47	46	45	44	42	39	36	34
Dorset	T. Grass	20	21	23	25	25	23	23	24
	P. Grass	57	56	53	51	49	46	46	45
Gloucestershire	T. Grass	20	20	21	22	21	18	15	15
	P. Grass	52	51	50	49	48	47	46	46

APPENDIX IV

TOTAL ACREAGE AND PRODUCTION OF HERBAGE SEEDS IN 1970

	Estimated Acreage Producing British Certified and Variety Approved Seed	Estimated Production of British Certified and Variety Approved Seed	Total of 1970 Herbage Seed Crops Cut for Seed	Total Estimated Production
	Acres	cwts.	Acres	cwts.
Ryegrass	29,075	195,500	31,232	210,987
Cocksfoot	3,414	11,989	3,449	13,156
Timothy	3,625	7,640	3,757	8,740
Fescues	7,111	4,938	1,643	6,925
Clovers	3,053	6,765	12,266	31,443
Total	40,178	226,832	52,247	243,251

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