HGCA

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THE VALUE OF HGCA-FUNDED PROJECTS TO ARABLE FARMS PART I : ENGLAND

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by

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This is Part I of the final report of a six month project which started in October 1998. The work was funded by a grant of £29,278 from HGCA (project 2065). Part II of this Project Report will cover analysis of a Scottish farm.

The Home-Grown Cereals Authority (HGCA) has provided funding for this project but has not conducted the research or written this report. While the authors have worked on the best information available to them, neither HGCA nor the authors shall in any event be liable for any loss, damage or injury howsoever suffered directly or indirectly in relation to the report or the research on which it is based.

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CONTENTS

1. SUMMARY

Since 1986 every tonne of grain sold from farms has been subject to an HGCA levy to contribute to research and development. Funds have been invested in a wide range of projects ranging from seed treatments to grain storage and processing.

This project sets out to look at what contribution technological advances arising from the research and development investment has made to the profitability of UK cereal production.

The assessment is based on actual results from a real farm, that of Manor Farm Morley in 1998. From this base has been subtracted the effect of four years of innovation in three key areas where HGCA has been particularly involved:

1 independent variety evaluation
2 dose response of fungicides
3 changes in sowing dates and seed rates

These effects have been measured, using a model developed by Silsoe Research Institute. This model not only measures the effect of changing agronomic practice on a farm's gross or net margin, but also assesses how changes in technology can affect crop rotations as well as labour and machinery costs.

In summary the results are :

	£ **Annual net margin/farm**	£ **Annual net margin/ha**	%
Base year 1998	165,576	452	-
Base year less four years of technological advance	153,551	419	-
Maximum potential benefits	12,025	33	7.8

In 1998, the Morley farm is estimated to sell approximately 1800 tonnes of cereal. This will be subject to an HGCA levy of £684, of which £468 is allocated to Research and Development. In the four year period considered by this report some £1,800 of HGCA levy has been collected specifically for research and development.

The effect of benefits from four years of HGCA-funded research would have generated extra profits of £12,025 in 1998.

2. INTRODUCTION

An HGCA levy, to conduct research and development in cereals, was introduced in 1986. In 1990 a similar levy was introduced to underpin oilseeds' research and development. In 1997/1998 £5.9 million was collected from, and invested on behalf of the cereals industry.

Technology uptake on Britain's farms occurs through a very diffuse mechanism. HGCA makes information generated from its research available through a wide variety of channels. Thus assessing just what benefit has been derived by UK agriculture from investment in levy-funded research and development is difficult to establish.

This project, led by the Morley Agricultural Consultants Ltd has sought to evaluate the benefits of just three of the many areas in which HGCA has been involved. It has sought to quantify the financial impact by taking data from two real farms – one in Norfolk, the other in the Borders. (Results from Manor Farm Morley only included in this report). Cropping, agronomic practice and output in 1998 were assessed in detail using the SRI whole farm model. Then, four years of technological advances from specific areas of technology-funded HGCA projects were removed. Thus, the effects of season, market prices, etc were removed, enabling a direct measure of the effects of different levels of technology in three key areas – independent variety evaluation, appropriate doses of fungicides and changes in sowing time together with seed rate only – to be measured.

This report has been undertaken with a full understanding of the many complex issues involved.

Modelling data from just two farms (Scottish farm report to be published shortly) has limitations. However, it is a valid and economic way to make the first-ever evaluation of the benefits UK cereal growers could derive from investing in research and development.

SRI was involved in adapting its model for this research. The economic and management techniques were scrutinised by Andersons, to independently ensure the measurements and measuring techniques stood up to the test of being practical and realistic.

3. THE SRI MODEL

The Whole Farm Land Use model has been developed to provide a sophisticated linear programme model that allows plans to be developed for farms which maximises long term profit in terms of cropping, labour and machinery.

The model database has been populated with actual farm information from the Morley farm; these include labour, number and horsepower of tractors, work rate of equipment, etc.

In the context of this report, it will put forward changes in optimum cropping mix taking account of differing potential yields, inputs to cereals and changes in labour profile due to changes in sowing or harvest date and produce a financial evaluation.

4. METHODOLOGY

Key data from the physical and financial records of the Morley farm for 1998 were entered into the SRI model. This established a base year from which comparisons could be made.

Cropping	Ha	Price/Tonne
Winter wheat	151.3	76
Winter barley	53.6	77
Spring barley	43.3	82
Sugar beet	75	29
Winter beans	5.2	72
Linseed	9.1	114
Rotational set-aside	29.2	

The model predicted a net margin of £165,576. This correlates well with the forecast actual net margin produced by Morley Farm of £167,858.

Having established the base year, the "clock was turned back" by four years in three key areas :

4.1 Varieties

Each year, plant breeders introduce varieties which raise yields as well as enhancing agronomic and quality factors. Independent variety evaluation enables farmers and their advisers to choose the best varieties to suit their rotation, agronomic practice, location and target markets.

Since government withdrew from near market research in 1990, HGCA has worked closely with NIAB to fund and develop consolidated Recommended Lists for the whole UK.

Work by J Ingram, J Macleod and M H McCall show the average percentage loss of yield between the best variety yields (the optimum) and that chosen without Recommended Lists.

Average percentage yield loss from best variety using two options	Winter wheat	Winter and Spring barley
Random selection	8.2%	8.1%
Recommended List	2.7%	4.4%
Difference	5.5%	3.7%

In addition, there have been variety improvements, but as this would have probably occurred regardless of HGCA-funding, it is ignored.

4.2 Dose Response of Fungicides

In the past four years there has been an increased understanding of fungicide dose responses and how to exploit variety resistance.

Work by D B Stevens, J A Turner and N D Paveley (funded partially by HGCA) showed that there is considerable scope to achieve both economy and rationalisation of fungicide use.

This policy is carried out on the Morley farm and without it more fungicide inputs would be used.

Looking back four years, an extra 0.25 l/ha Epiconazole would have been used on winter wheat and 0.15 l/ha Epiconazole on winter barley.

4.3 Sowing Dates and Seed Rate

Four years ago, an optimum sowing date for winter wheat was accepted to be 24 September (personal communication D B Stevens) at Morley Farm. Technology improvement has meant that earliest drilling dates of 10 September can be contemplated without yield penalty. These changes in sowing date and seed rate have been made to the model.

On going research by J Spink and J Foulkes funded by the HGCA has shown that much lower seed rates in winter wheat can be used. This enables earlier drilling without yield penalty.

By changing just these three variables, the SRI model was able to draw up the optimum cropping plan and financial synopsis for the less advanced farm of four years ago. As there is no change in the price of inputs or produce sales, the difference in net margin can be assumed to reflect the maximum potential benefit, which could be derived from the HGCA-funded advances.

5. RESULTS

5.1 Manor Farm Morley 1998 Harvest Year

Cropping	Ha	Gross Margin £/ha
Winter wheat	151.3	731
Winter barley	53.6	581
Spring barley	43.3	667
Sugar beet	75	1065
Winter bean	5.2	595
Linseed	9.1	581
Set-aside	29.2	284
	366.8	

	£/Total	£/ha
Total gross margin	267,066	728
Labour and Machinery Costs	101,490	277
Net margin	165,576	451

5.2 Manor Farm Morley 1998 less four years of technological advances

Cropping	Ha	Gross Margin £/ha
Winter wheat	145	683
Winter barley	34	553
Spring barley	74	633
Sugar beet	75	1065
Winter bean	0	-
Linseed	9.5	580
Set-aside	29.2	284
	366.8	

	£/Total	£/ha
Total gross margin	258,407	704
Labour and Machinery Costs	104,856	286
Net margin	153,551	419

5.3 Key Results

5.3.1 Technological change could improve gross margins by 3.4% (£24/ha)

5.3.2 Technological change could enable labour and machinery cost savings of 3.1% (£9/ha) to be made

5.3.3 Technology could enable greater winter cropping and less risk of exposure to spring cropping.

6. CONCLUSIONS

6.1 The maximum potential benefit from four year's of HGCA-funded research and development in three specific areas on Manor Farm, Morley is estimated to be £12,025.

6.2 During the same four years, some £1,800 of levy has been collected and invested in HGCA research and development from a total levy of £2,600 collected from Manor Farm.

Appendix i

The SRI Model

Whole Farm Model

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and

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The Whole Farm Land Use Model is a linear programming model designed to determine the optimal long-term profit, cropping, labour and machinery for an arable farm. The model is ideal for examining the effects of changes on the farm, such as price variations or the introduction of different machinery and techniques. The model also incorporates the gross margin risk and the environmental effects of the activities, such as nitrate leaching and herbicide use, and the optimum can be determined by a multiple objective optimisation where the factors are given weights by the user, or by imposing limits on any of the factors. An extension of the model optimises the activities on an arable and livestock farm.

A major feature of the model is the concept of rotational and timeliness penalties. Planting a crop late has consequences in terms of yield, cost and environmental effect. However, it is generally too expensive to plant all the crop at the right time. There is, therefore, an optimum level of timeliness penalties to incur, the level of which is different for different farms. The model outputs a recommended crop rotation and work schedule, giving the optimum time at which each operation should be carried out.

Similarly, rotational penalties, in terms of yield, cost and environmental effects, may be incurred when one crop is planted after another. For example, wheat after wheat relative to wheat after oilseed rape. These penalties are specified by the user, for all possible sequences. This information is then taken into account by the model when determining the optimum rotation.

Another important part of the model are the workable hours.

There are a different number of hours available for different types of operations. For example, there are less hours available for spraying than for cereal harvesting, and less for harvesting than there are for ploughing. The year is divided into periods, the model calculates the expected number of workable hours in each using a formula based on soil type and rainfall. The method considers ten years worth of workable hours, ranked in decreasing order and then picks the seventh in the list.

The model incorporates a comprehensive database including the majority of crops grown in the UK and associated price, husbandry and technical data. Although price and yield data are region specific (and in the database are for the region of East Anglia in the UK), much of the technical data is universal and does not need to be changed. The system allows the user to modify the base database to their own specific base database and then create further databases and models from this to study specific situations or farms.

Appendix ii

The Manor Farm, Morley

The Manor Farm, Morley comprises 366.8ha. The soil varies from sandy loam to sandy clay loam.

Labour - three full-time men (including Farm Manager).

Machinery
- Power Harrow Drill 4m
- Sugar Beet Drill 4m
- Six furrow plough
- Three tractors (100hp, 135hp, 112hp)
- Twin disc fertiliser sprayer
- 24m self-propelled sprayer
- Six-row sugar beet harvester
- Fifteen t/hr combine harvester

Appendix iii

Acknowledgements

J Spink	ADAS
D B Stevens	Morley Research Centre
A G Thurston	Morley Research Centre
J Ingram	NIAB
G Dodgson	The Chamberlain Partnership

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