HGCA

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THE VALUE OF HGCA-FUNDED PROJECTS TO ARABLE FARMS

PART II : SCOTLAND

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by

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This is Part II 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 I of this Project Report covers analysis of an English farm.

CONTENTS

Summary

Since 1986 an HGCA levy has been raised on every tonne of grain sold from UK farms 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. Since 1991 a similar levy has been raised to support research and development on oilseeds.

This project examines contributions made to the profitability of UK cereal and oilseeds production through technological advances based on this research and development investment.

The assessment is based on results from Woodend Farm in 1998. Effects of four years of innovation in four key areas in which HGCA has been particularly involved (three on cereals, one on oilseeds) were subtracted from the base year data.

1 independent variety evaluation
2 dose response to fungicides
3 changes in sowing dates and seed rates
4 light leaf spot control in oilseed rape

Effects were 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 how changes in technology can affect crop rotations and labour and machinery costs.

In the summary the results are:

	Net margin/farm £	**Net margin/ha £**	**% difference**
Base year 1998	235,689	394	
Base year less four years of technological advance	223,426	374	5.5
Maximum potential benefits	12,263	20	

In 1998, Woodend Farm sold approximately 4,000 tonnes of cereals. HGCA levy paid on this was £1,520 (at 38p a tonne), of which £1,040 was spent on research and development. 399 tonnes of oilseed rape were sold and HGCA levy paid was £259 (at 65p a tonne), of which £231 was spent on research and development. Assuming similar yields were achieved each year, then the calculated levies paid during the four years of the study allocated to research and development would have been £5,084.

The effects of four years of HGCA-funded research would have been to generate extra profits of £12,263 in 1998

Introduction

An HGCA levy to conduct research and development on cereals was introduced in 1986. In 1990 a similar levy was introduced to underpin research and development on oilseeds. In 1997/1998, £5.6 million was raised from, and invested on behalf of, the 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 mechanisms. Thus, assessing the benefit derived by UK agriculture from investing in levy-funded research and development is difficult.

This project, led by the Morley Agricultural Consultants Ltd, sought to evaluate the benefits of just four of the many areas in which HGCA has been involved. It aimed to quantify the financial data from two farms – one in Norfolk, the other in the Borders (Results from Manor Farm, Morley are reported in Part I of this report).

Cropping, agronomic practice and output in 1998 were assessed in detail using the SRI whole farm model. Then, four years of benefits from areas of technology based on HGCA-funded R&D were assessed. Effects of season, market prices, etc were removed, enabling a direct assessment related to agronomic practices to be made. The four key areas were independent variety evaluation, appropriate doses of fungicides, changes in sowing time together with seed rate in cereals and light leaf spot control in oilseed rape.

Modelling from just two farms has limitations. However, it is a valid and economic way to evaluate the benefits UK cereal and oilseed growers could derive from investing in research and development.

SAC assisted in advising Woodend Farm and SRI adapted its model for this research. Agronomic and management techniques were scrutinised by Andersons to independently ensure measurements and techniques used were practical and realistic.

The SRI model

The Whole Farm Land Use model is a sophisticated linear programme model that allows plans to be developed for farms to maximise long-term profit in terms of cropping, labour and machinery.

Actual farm data from Woodend farm (and Manor farm, Morley), including labour, number and horsepower of tractors, equipment work rates etc were used in running the model.

The model suggested changes in optimum cropping mix taking account of differing potential yields, inputs of cereals and changes in labour profile due to changes in sowing or harvest date and produced a financial evaluation.

Methodology

Key data from the physical and financial records of the Woodend 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	196.3	76
Winter barley	95.2	77
Winter oats	96.7	78
Spring oats	102.5	78
Winter rape	47.2	120
Industrial rape on set-aside	59.8	

The model predicted a net margin of £235,689 for the whole farm.

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

1 **Varieties**

Each year plant breeders introduce varieties with higher yields as well as enhanced 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 the National Institute of Agricultural Botany to fund and develop a consolidated recommended list for the whole UK.

Work by Ingram, Macleod and McCall (1997) highlighted average percentage yield differences between the best varieties chosen using the recommended lists and those selected randomly.

	Winter wheat	Winter barley	Oilseed rape
Recommended list	2.7%	4.4%	6.5%
Random selection	8.2%	8.1%	11.3%
Difference	5.5%	3.7%	4.8%

NB Results for oilseed rape are based on only three years of trials.

In addition, there have been variety improvements. These would have probably occurred regardless of HGCA funding and are ignored.

2 Dose response of fungicides

Increased understanding of fungicide dose responses and variety resistance enables savings to be made in fungicide use.

Work by Stevens, Turner and Paveley (1997), funded partially by HGCA, showed considerable scope to achieve both economy and rationalisation of fungicide use.

This policy was carried out on the Woodend farm and resulted in savings in fungicide use.

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.

3 Sowing date and seed rate

Four years ago 24 September was accepted as an optimum sowing date for winter wheat (personal communication, D B Stevens). Wheat is now commonly sown on 10 September.

Ongoing HGCA-funded research led by Spink and Foulkes has shown that winter wheat seed can be sown at much lower rates, enabling earlier drilling without yield penalty.

These changes in sowing date and seed rate were made to the model.

4 Light leaf spot control in oilseed rape

Ongoing HGCA-funded work on varieties and fungicides (Green, Freer, Gladders and Sutherland) has shown benefits from appropriate fungicide use in oilseed rape varieties.

Good variety selection saved £10/ha, a figure that has been used in the model. In Scotland, responses in some years can be much greater and returns higher, but this has been ignored.

By changing four variables, the SRI model was able to draw up an optimum cropping plan for the less advanced farm of four years ago. The financial synopsis was produced on the basis of this plan. As there is no change in the price of inputs or produce sales, difference in net margin has been assumed to reflect the maximum potential benefit derived from HGCA-funded advances.

Results

1 Woodend Farm 1998 harvest year

Cropping	Ha	Gross margin (£/ha)
Winter wheat	196.3	801
Winter barley	95.2	641
Spring oats	102.5	714
Winter oats	96.7	657
Oilseed rape	47.2	546
Set-aside	59.8	519
	597.7	

	£/Total	£/ha
Total gross margin	411,884	689
Labour and machinery costs	176,195	295
Net margin	235,689	394

2 Woodend Farm 1998 less four years of technological advances

Cropping	Ha	Gross margin £/ha
Winter wheat	193.7	735
Winter barley	124.4	615
Spring oats	95.4	714
Winter oats	103.9	657
Oilseed rape	20.6	510
Set-aside	59.8	519
	597.7	

	Total (£)	£/ha
Total gross margin	396,771	664
Labour and machinery costs	173,345	290
Net margin	223,426	374

3 Key Results

3.1 Technological change improved gross margins by 3.8% (£25/ha).

3.2 Technological change increased labour and machinery costs by 1.6% (£5/ha).

3.3 Technological change enabled a greater proportion of oilseed rape crops with a greater rotational margin.

Conclusions

6.1 The maximum potential benefit from four year's of HGCA funded research and development in four specific areas on Woodend Farm was estimated to be £12,263.

6.2 During the same four years, some £5,084 of levy was collected and invested by HGCA in research and development from a total levy of £7,116 collected from Woodend Farm.

References

Prediction of seed rate in winter wheat
J Spink and J Foulkes *HGCA Project 1814*

The contribution of varieties to the optimization of cereal production in the UK
J Ingram, J Macleod and M H McCall *Aspects of Applied Biology 50, 1997*

Exploiting variety resistance to rationalise fungicide inputs – theory and practice
D B Stevens, J A Turner and N D Paveley *Aspects of Applied Biology 50, 1997*

Roles of varieties and fungicides in managing light leaf spot and canker in oilseed rape
M Green, B Freer, P Gladders and K Sutherland *HGCA Project 0528*

Appendix i)

The SRI Whole Farm Model

Mathematics and Decision Systems Group, Silsoe Research Institute,Wrest Park, Silsoe, Bedford, UK

and

Institute of Agricultural Engineering
University of Milan, Italy

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 formua 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 Woodend Farm

The Woodend farm comprises 597.7 ha. The soil is sandy clay loam.

Labour	–	three full-time men	
Machinery	-	1 x Class Lexlon 480 x 25 foot/header	1998
	-	1 x John Deere 8300	1998
	-	2 x JCB Fastrack 1135	1997
	-	1 x JCB TM2700 Forklift	1998
	-	1 x International 574	1978
	-	1 x Shortwheel base landrover	1992
	-	1 x Lemken 7-furrow variwidth plough	1998
	-	1 x Lemken Furrow press	1998
	-	1 x 4m Kuhn power harrow	1996
	-	1 x 4m Rotterra	1995
	-	2 x 4m Ley Accord Combi drill	1985 and 1997
	-	1 x 4.5 m Simba discs	1992
	-	1 x KRM disc Fertspreader	1996
	-	1 x Fertspreader	1990
	-	1 x 10.5 m Canbridge rollers	1991
	-	1 x 20 m CDA (Lely) sprayer	1985
	-	3 x AS master 12 tonne trailers	1981
	-	1 x 27 tonne per hour Carrier SFC drier	1992

Appendix iii)

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