



PROJECT REPORT No. 7

**ECONOMIC ANALYSIS OF
STORED PRODUCT PEST
CONTROL STRATEGIES
(GPA 'GRAIN PEST ADVISER'
EXPERT SYSTEM)**

1989

FREE

REPORT ON A HOME GROWN CEREALS AUTHORITY FUNDED PROJECT TO DEVELOP A PROTOTYPE KNOWLEDGE BASED SYSTEM FOR STORED GRAIN PEST CONTROL

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INTRODUCTION

Agriculture in the UK is becoming more complex and more competitive. This applies equally to the post-harvest sector and to the production side of the industry. Specialist advice is vital if correct management decisions are to be made. However, with reduced support from government, such advice is becoming harder to find and often more expensive.

Against this background, the Home Grown Cereals Authority sponsored a project to investigate the development of a computer based expert system to help solve problems associated with pests in stored grain. The project was carried out jointly by the Silwood Centre for Pest Management (SCPM), Imperial College (London) at Silwood Park, Ascot, and the ADAS Central Science Laboratory at Slough. SCPM provided analytical and computer expertise while ADAS provided technical information on pests and their control. The project began in 1986 and was completed in 1988, when a prototype system had been constructed to satisfy the terms specified in the project.

DEVELOPMENT OF THE SYSTEM

Since no research in the area of post harvest pest expert systems had been carried out previously, the initial stage of the project concentrated on:

- * exploring the extent of problems likely to be faced by farmers and commercial store keepers; and
- * determining the range of software tools available to build a computer system.

It soon became apparent that storage problems are very complex, with many interactive factors involved. For example, a single infestation could involve up to 5,000 different combinations of conditions, many of which could affect the most appropriate solution. It also became apparent that large cost savings could be achieved by the industry if these technical considerations could be incorporated in the system, together with financial and marketing information and analysis.

The complexity of the decision problem excluded the use of simple expert system shells available at the beginning of the project. The approach adopted was to develop a specific program, using the specialist computer language PROLOG. This allowed a complex, interactive set of rules to be constructed, capable of accessing a built-in database. It also provided a means of interacting with the user of the system and selecting appropriate actions for dealing with the problem.

The rule base was constructed by carrying out extensive literature searches and by direct inputs from the experience of appropriate technical experts. As the system developed, it became clear that its functions could be extended to cover provision of basic storage advice, strategy advice, and financial analysis.

"GRAIN PEST ADVISER" - A PROTOTYPE SYSTEM

The final prototype computer program is called "Grain Pest Adviser" (GPA) and runs on a wide range of IBM compatible personal computers. It offers assistance with four aspects of store management.

Problem solving

Four main problem areas can be investigated: insects, mites, moisture content, and temperature. The user is questioned about the temperature and moisture content of the grain, the pest species found, the sampling methods used, the market and the intended time of sale. A diagnosis is given and suggestions made on the options that could solve the problem.

General information

GPA incorporates a facility that allows the user to browse through information screens appropriate to the questions being asked in the problem solving section. This information can also be accessed directly, through information menus on insect species, approved chemicals, safety, etc.

Strategy advice

This module in GPA provides information and advice on the management options available for planning future storage strategies.

Financial advice

A series of budgeting programs are available for evaluating and comparing the cost effectiveness of different management options, such as drying, admixing chemicals, cleaning and fumigation.

COMMERCIAL DEVELOPMENTS

GPA covers all types of pest problems found in UK grain, as well as offering advice on some of the other major problems associated with stored grain. The program is of specific interest to large scale cereal growers, managers of commercial grain stores, as well as consultants and advisers.

In view of the practical potential of GPA, work has continued since the end of the contract to develop a commercial expert system from the prototype. This subsequent work has concentrated on improving the ease of operation, with particular emphasis on eliminating the need for computer knowledge on the part of the user, and improving the screen presentation. This process is almost complete, and a commercial system will be available for sale before the end of 1989.

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