



PROJECT REPORT No. 38

**QUALITY, MARKETING AND
RESEARCH IN THE UK OATS
CROP**

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HGCA PROJECT REPORT No. 38

QUALITY, MARKETING AND RESEARCH NEEDS IN THE UK OATS CROP

by

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Contents

	Page
SUMMARY	1
OBJECTIVES	2
RESEARCH METHODOLOGY	
- Literature Survey	3
- Discussions with Market Participants	3
- Questionnaires on Quality Parameters	5
A. Producers	6
B. Millers and Food Manufacturers	6
C. Animal Feed Compounders	7
D. Animal Feed Compounders for Horse Feed	7
RESULTS	
- Discussions with Market Participants	8
A. Producers	8
B. Merchants	9
C. Millers	9
- Literature Survey	11
Oats Quality for Human Consumption	11
Oats Quality for Animal Feed	12
Grading of Oats	14
Grading of Other Grains	17
- Analysis of Questionnaires on Quality Parameters	21
A. Producers	24
B. Animal Feed Compounders	27
C. Animal Feed Compounders for Horse Feeds	30
D. Millers and Food Manufacturers	33
CONCLUDING DISCUSSION	
- Key Issues in Oats Marketing	38
- Marketing Alternatives	40
- Classification Issues	41
Grading	42
Quality Communication	42
APPENDICES	
- I. Acknowledgements	48
- II. References Used	49
- III. The Economics of Product Quality	59

Quality, Marketing and Research Needs in the U.K. Oats Crop

SUMMARY

- * This review summarises information obtained from literature, discussions, and a market survey on quality measurement and communication in the UK oats market.
- * The total U.K. oats market is relatively small at only 500,000 tonnes. There are differences in the quality requirements of the following sectors of the market: producers; millers and food manufacturers; animal feed compounders; and animal feed compounders for horse feeds.
- * There is a relative lack of communication between the four sectors of the market.
- * Research recommendations by the four sectors are highlighted.
- * There is a need to develop a grading system which will enable the market to allocate the correct qualities of crop, at the correct prices, to the correct sector.
- * There is a need to develop an orderly marketing system, in which it is suggested HGCA could play a key role. Such a system should be relatively simple, cheap to administer, and effective.

OBJECTIVES

The objectives of this work were as follows:

- (a) To assess the different factors which influence the judgements (by intermediaries and end-users) of product quality in the U.K. oats crop.

- (b) To measure the relative importance of these factors to different categories of end-user, thereby offering guidelines to researchers regarding their priorities for research and development work.

- (c) To recommend possible improvements in the marketing of the crop, based on the quality requirements of different markets.

RESEARCH METHODOLOGY

Literature Survey

A literature review on oats and oat quality was carried out. Also information from the farming press, commercial sources, and extension services (especially in the United States), and government material, was assembled (see Appendix II).

This information was used to compile a questionnaire concerning oat quality parameters.

Discussions with Market Participants

Discussions were held with representatives of the following four categories involved in the U.K. oats market:-

Producers; Millers and Food Manufacturers; Animal Feed Compounders; Animal Feed Compounders for Horse Feeds.

The aims were:

- 1) to consider quality features of the oat crop and to draw up a list of key quality parameters¹ (Table 1).
- 2) to draw up a list of statements reflecting the potential attitudes in the different sectors of the oats market (Table 2), and to derive recommendations for research and development.

¹ Product quality is likely to be somewhat different for each consumer or user. The following definition is used in this study: '...that combination of attributes - real or perceived - which are held to be most important in the opinion of the user when judging overall product worth'.

Table 1. The Quality Parameters

VARIETY
GEOGRAPHIC ORIGIN
THOUSAND GRAIN WEIGHT
COLOUR
GENERAL APPEARANCE
GRAIN SIZE
MOISTURE CONTENT
PER CENT BROKEN GRAINS
PER CENT OTHER GRAINS
PER CENT DISEASE DAMAGED GRAINS
GROAT:HUSK RATIO
BETA GLUCAN CONTENT
PER CENT PROTEIN CONTENT
PER CENT OIL CONTENT
ENERGY CONTENT
EASE OF STORAGE
TASTE

Table 2. The Attitude Statements

THE OATS MARKET IS TOO SMALL TO OPERATE EFFICIENTLY
THE OATS MARKET IS CURRENTLY AT AN OPTIMAL SIZE
OATS ARE A TRADITIONAL PRODUCT
OATS HAVE A POSITIVE IMAGE
I AM NOT CONFIDENT ABOUT THE FUTURE OF THE OATS SECTOR
GENERIC PROMOTION OF OATS/OAT PRODUCTS WOULD BE BENEFICIAL
A GRADING SYSTEM FOR OATS WOULD HELP MY MARKETING/BUYING
THERE IS A SUFFICIENT CHOICE OF VARIETIES OF OATS
ORGANICALLY PRODUCED OATS ARE A USEFUL PART OF THE MARKET
THE NAKED (HUSKLESS) OAT COULD BE USEFUL FOR MY BUSINESS
PEOPLE LIKE THE TASTE OF OATS
PEOPLE APPRECIATE THE NUTRITIONAL BENEFITS OF OATS
THE PRICES PAID FOR OATS ACCURATELY REFLECT THEIR QUALITY
PRICE INFORMATION ABOUT OATS IS TOO LIMITED
THE PRICE OF OATS RAW MATERIAL IS ABOUT RIGHT
PRICES FLUCTUATE TOO MUCH
SELLING MY FINAL OATS PRODUCT IS DIFFICULT

Questionnaires on Quality Parameters

A questionnaire (in four versions) was devised in order to gain responses to the above issues. The first page of each questionnaire contained a covering letter, explaining the nature of the project. The second page (shown above as Table 1) contained the list of 17 quality parameters. The possible responses range from 'very relevant' to 'irrelevant' on a five-point scale.

On the third page respondents were asked to indicate their response to the 'attitude statements' (Table 2) on a six-point scale.

The final question (on all the questionnaires) asked respondents to indicate any areas in which they felt there was a special need for research work to be undertaken.

A different version of page 4 of the questionnaires was included for each of the four categories involved in the U.K. oats market; details are given below.

The questionnaires were mailed out during April and May 1991, and a reminder was sent if necessary.

A. Producers

Page four of the producer questionnaire contained questions regarding the areas and tonnages of oats produced, and their diversion to different outlets, plus questions relating to the factors motivating their buyers, and the relative advantages and disadvantages of feeding oats on the farm. Again, a question as to research priorities was included.

The sampling frame for the producer database proved to be a problem, as it was not possible to obtain nationwide coverage using either Ministry of Agriculture Fisheries and Food census data, or the Farm Business Survey. The sample, therefore, was picked with the assistance of four commercial organisations. Approximately 660 questionnaires were mailed out.

In the interpretation of the results from producers it is likely that the responses may show some biases, namely towards growers of seed oats, growers of naked oats, and Scottish growers.

B. Millers and Food Manufacturers

The final page of the form for millers and food manufacturers contained questions on the quantity and form of oats purchased, the broad product ranges, and the benefits and limitations of oats in their production and marketing activities.

The sample of millers and food manufacturers was obtained through the Food Trades Directory (1991), and the British Oat and Barley Millers Association. 101 questionnaires were sent out.

C. Animal Feed Compounders

Page four for this sector included questions on the tonnages of oats purchased (in 1990), the sorts of rations in which they were incorporated, and the animal species to be fed. Respondents were also asked to identify the reasons why farmers bought their products, and the benefits and limitations of incorporating oats in rations.

The sample of feed compounders was identified from a registered list of organisations using pharmaceuticals in animal feed products. 238 questionnaires were sent out.

D. Animal Feed Compounders for Horse Feeds

Page four of this questionnaire contained questions on the oats purchased: quantity; how bought; and what used for. There were also questions on the reasons why horse owners buy oat products, and on the limitations that the manufacturers experience in using oats as part of their feed formulations.

The database for this sector was sampled from a registered list of organisations using pharmaceuticals in animal feed products. 110 questionnaires were sent out.

RESULTS

A series of meetings with producers (including naked oat growers), merchants (handling grain for horses, other animals, and human consumption), and millers (also using oats in final consumer products) was held in February and March 1991. The report of these discussions follows:

Discussions with Market Participants

A. Producers

Oats may be produced both for sale and for use on the farm. The market dictates the quality requirements that the farmers should meet, and the price which they should be paid.

Farmers were not in a good position (unlike for milling wheat or malting barley) to determine in advance the quality required by millers of oats. Although quality was assessed by visual inspection by merchants, the crop may still be rejected at the mill.

The level of screenings allowed in grain for milling and feed use may be a problem. One producer screened his crop down to milling quality, which was then rejected at the mill. The screenings therefore represented a net loss as they could have been included in the feed sample. If the farmer could more accurately determine the quality of his grain, then such problems would have been avoided.

There was a need for better communication of quality requirements in the market.

If millers (in particular) could define precisely their requirements, then the breeders could produce them. It was necessary to keep the crop completely separate from others being handled. Most producers aim for maximum yield (net of screenings), and fluctuating prices prove a major disincentive to grow. Most importantly, firm grower contracts were necessary.

The best market for naked oats, despite some problems, is as an animal feed, although some producers were prepared to experiment with other markets.

Many producers grow naked oats on contract to one of two companies which have major interests in the sector. This is generally a satisfactory arrangement.

Naked oats fitted in well with a mixed organic system of production, requiring relatively low inputs, and producing a product with very high nutritional levels.

B. Merchants

Two main uses of oats in rations were important: for horses - especially domestic horses and racehorses; and for other animals. The use of oats in rations for animals other than horses was limited by the availability of other products with similar properties at lower cost. Oat grain may break up when combined with other ingredients, and they may be dusty in storage and processing.

Farmers buy oat-based products particularly on the visual appeal, 'taste' and smell.

C. Millers

Because the oats market is small, it is of relatively little interest to plant breeders. Also, only small volumes of grain are traded.

Oat millers favour some stability in the market - the market at its present size and shape might give them the right combination of price and quality in most years, although the market should not contract any further.

Oats for human consumption are bought largely on bushel weight (49 kg/hl) and size (2mm screen). Hullability (measured using the spirit extraction test) and the ratio of groat to husk are also important, although they may not be specifically measured. Colour of the groat (a function of storage time and season) could also be considered.

Some of the crop may be contracted, and some may be bought through merchants on the 'open' market. The quality of the grain purchased depends to a certain extent on the year. Although feed crops are

of lower bushel weights, millers may be prepared to compromise in bad years, before resorting to imports.

Imports of cheap cereal substitutes may render oats unviable for feed compounders - thus making confidence in oats diminish, and the total market contract.

Yield improvements of oats are necessary in order to retain the interest of farmers. Research into on-farm storage (particularly given the new Food Act), and the production of a large bold grain are particularly important. There is a need to develop new varieties not necessarily reliant on chemicals and some companies are producing organic and conservation grade consumer products. It may also be possible to use naked oat varieties for human food use.

Literature Survey

Oats Quality for Human Consumption

Oats have beneficial dietary properties in terms of energy value, protein, and the cholesterol-lowering effects of the B-glucan component of oat brans and gums. An increased range of food products containing oats is necessary before a large increase in consumption may be expected, even though the trend in consumption is upward. A low groat to husk ratio, reduced enzyme content of the groat, and low levels of discolouration are important for human consumption.

The milling sector requires research into the parameters that affect the overall quality of the crop, especially in terms of grain size, grain discolouration, and contamination (often caused by lodging). Although oats do have a good lipid profile, a high lipid content may lead to rancidity problems. The naked oat is not highly regarded by the milling sector.

In general the milling sector requires the characteristics shown in Table 3, although specific quality parameters may vary with the season, the location of the crop, and the variety grown.

Table 3. Oat Quality Requirements for Human Food

PARAMETER	APPROXIMATE REQUIREMENTS
Bushel ² /Specific Weight	50 kg/hl minimum
Moisture Content	15% maximum, 12% minimum
Admixture	2% maximum
Screenings	2mm screen - maximum 5-6%
Skinned Grain	5% maximum
Cleanliness	from stones, mud etc.
Colour	White, white/yellow
Appearance	Plump, well-filled, regular size.
Hullability	Easy de-hulling - determined by spirit extraction test

Oats Quality for Animal Feed

Much recent research work has been concerned with the potential of naked oats for animal feeding, especially for pig-finisher diets, poultry and racehorses. For animals where conventional oats would have to be de-husked, the groat yield of huskless varieties is similar to that of the 'conventional' cultivars, and the nutrient profile of naked oats makes them a viable proposition.

Table 4. Oat Quality Requirements for Animal Feed

PARAMETER	NOTES
Bushel/Specific Weight	also plumpness, per cent hull
Crude Protein	perhaps ether extract (fat)
Fibre	as crude fibre
Lysine	
Digestible Energy	also total digestible nutrients

Note: The precise figures for these parameters depend upon the species being fed.

² approximately 40 lbs/bushel

Table 5. Comparative Nutritional Analysis of Oats, Barley and Wheat³
(all values are in g/kg Dry Matter, except energy values in MJ/kg DM)

	Wheat	Barley	Oats	Naked Oats
Ether Extract	19	13	43	90
Crude Protein	123	128	116	135
Crude Fibre	20	50	105	37
Neutral Detergent fibre	166	234	283	141
Acid Detergent fibre	32	30	147	51
Cellulose	29	54	105	36
Lignin	11	16	36	18
Starch	660	528	480	386
Lysine	3.4	4.5		5.0
Methionine and Cystine	4.3	5.2		6.2
Threonine	3.5	4.5		3.9
Tryptophan	1.6	1.8		1.5
Gross Energy	18.2	18.4	19.5	19.9
Metabolisable Energy (Cattle)	13.6	12.8	12.0	14.7
Digestible Energy (pigs)	14.7	13.0	12.2	16.0
Apparent Metabolisable Energy (Poultry)	15.0	14.2	13.3	16.5

As far as naked oats are concerned, in Canada millers are unlikely to adopt these varieties, and for feeding, while certain problems relating to groat hair and yield have to be overcome, in general a good naked oat would fulfil many of the protein and energy level needs of many classes of livestock. Naked oats are likely to be without the 'B-glucan problem' (for poultry feed) experienced in conventional varieties. Rancidity is a problem due to high levels of polyunsaturated fatty acids.

Quality requirements of conventional varieties differ according to the use of the feed (Table 4). Table

³ from Valentine (1990)

5 compares conventional and naked oats with other cereals.

For feeding to animals, fibre, density/plumpness, crude protein, lysine and energy levels are important. The miller of oats for human consumption may not take all of these into account.

Grading of Oats

The one useful source of information on oats grading used in this study was the Canadian Grains Commission. The current system is described below, although a number of changes were made in August 1991. The grading factors are shown in Table 6.

The grading system is both mechanical and subjective in nature. Several factors are determined on a mechanical basis by evaluating the percentage by weight of various admixtures and conditions. Some degree of subjectivity comes into play when actual samples are physically compared on a visual basis with standard samples prepared to reflect the minimum acceptable visual quality of specific grade levels.

The criteria on which grades are measured can be divided into three sub-groups. The first is density or test weight. The 'degree of soundness' is also assessed. This factor has a subjective and an objective portion. The subjective portion is an evaluation of sample maturity, and sample colour as it may be affected by superficial mildew or staining. The evaluation is performed by visually comparing the sample with a standard sample prepared to reflect the minimum visual quality for a specific grade. Also evaluated under the 'degree of soundness' section would be the concentration of factors such as green kernels, heated kernels, mouldy kernels, rotted kernels and dehulled kernels. Finally, levels of foreign material which include large seeds, wild oats and other grains are determined on a percentage by weight basis.

The grading system is primarily used by store managers and merchants as grain is received into the handling system, and is used as a basis for financial settlement between producers and grain companies. In the event that the producer and the manager disagree on the grade or dockage (foreign material) level, the Canadian Grain Commission's Grain Inspection Division will arbitrate the dispute.

The grading system in this case establishes the quality accountability placed on the terminal elevator (merchant/buyer) and may also facilitate financial accounting between grain companies. When the grain is exported from terminal elevators the grading system is once again applied. In this instance it forms the basis of settlement between exporter and buyer. It also serves to cancel the terminal elevator operator's quality accountability.

The new Canadian oat grading system will initiate several fundamental changes in our system. Greater emphasis will be placed on groat colour and less on the superficial discolouration assessed in the current system. foreign material specifications will be lowered to better reflect the quality of the product as it leaves the farm. These changes are expected to make the Canadian oat more appealing internationally with the hope of improved financial returns for Canadian producers.

Table 6. Grading Factors for Oats in Canada

GRADING FACTOR	NOTES
VARIETY	Not taken into account unless hull-less
FOREIGN MATERIAL	Other cereals, large seeds, mudballs, ergot, stones.
FIREBURNT	Samples with more than 0.25% fireburnt kernels are downgraded
GREEN	
HEATED	Groat appears brown or orange in colour (5% allowed before full downgrading)
HEATED ODOUR	Subjective
SUPERFICIALLY MILDEWED	Considered in soundness
MILDEWED KERNELS	8.0% before full downgrading
ROTTED KERNELS	5.0% before full downgrading
ODOUR	
FROST	
HULLESS OATS	Graded 'dehulled' or 'hulless'. Conventional grade number still applies
COLOURED VARIETIES	Still eligible for full range of grades

When the grading factors in Table 6 are applied using 'Canada Western'⁴ as an example, the detailed grade determinants given in Table 7 are produced.

Table 7. OATS (Canada Western) - Primary Grade Determinants

(Oats containing more than 95% of hulless varieties shall have the word 'hulless' added to and made part of the grade name)

	No.1 Canada Western	No.2 Canada Western	No.3 Canada Western	No.4 Canada Western	Final name if rejected
Min.Test Weight kg/hl	52.0	52.0	47.0	41.0	Sample C.W. Account Light Weight
Variety	Reference	Ref	Ref	Ref	
Soundness	Damage-free	Frost	Frost, Stain	Other	
Large Seeds	0.2%	1.0%	1.0%	1.0%	a/c admixture
Wild Oats	2.0%	2.0%	4.0%	8.0%	a/c mixed grain
Other Grains	4.0%	6.0%	12.0%	20.0%	a/c mixed grain
Sprouted	Nil	2.0%	15.0%	unlimit	No. 4 C.W.
Green	3.0%	10.0%	20.0%	unlimit	No. 4 C.W.
Mildewed	0.01%	0.1%	3.0%	8.0%	a/c mildewed
Rotted	Nil	0.05%	0.5%	2.0%	a/c rotted
Heated	Nil	0.3%	3.0%	5.0%	a/c heated
Fireburnt	Nil	Nil	Nil	0.25%	a/c fireburnt
Stones	1K ⁵	2K	5K	5K	sample 'salvage'
Ergot	Nil	0.05%	0.05%	0.10%	a/c ergot
Sclerotinia	Nil	0.05%	0.05%	0.10%	a/c admixture
Dehulled	8.0%	13.0%	unlimit	unlimit	No.3 C.W.

Tables 6 and 7 illustrate the fairly close (and well-laid down) definitions of oat quality in the different grades. There are currently no general recommendations in Canada for beta-glucan or lipase activity. Protein levels are suggested at a 13% target minimum on a dry weight basis, with oil at a maximum of 10%.

⁴ 'Canada Eastern' also exists, with slightly different tolerance levels.

⁵ Kernels or kernel sized pieces in 500 grammes

The recommendations for naked oats are based on a benchmark standard which is the target cultivar Terra. Quality in naked oats is then determined as equal or superior to Terra in Colour, Plumpness, Kernel Weight, Test Weight, Hulled (%), Protein and Oil. Levels of B-glucan (which is beneficial to humans) should be kept relatively lower for animals.

In the United States oats are rapidly becoming a speciality feed for horses, and the human food market is beginning to grow. There is some price support (in the form of loans) to producers. Oats import levels have increased recently. The U.S. government (through the Federal Grain Inspection Service) operates an oats grading system, so that 'price can be differentiated between grades to stimulate the production of the desired qualities'.

There are five basic grades (with special grades to emphasise special qualities) based on:

- Test Weight per bushel
- Sound Oats (%)
- Heat Damaged Kernels (%)
- Foreign Material
- Wild Oats

Special categories (depending on the reason) are assigned as follows:

BLEACHED, BRIGHT, ERGOTY, EXTRA-HEAVY(>40lbs/bushel), HEAVY (between 38 and 40 lbs/bushel), GARLICKY, SMUTTY (>2% smut covered), THIN (>20%), WEEVILY.

Grading of Other Grains

In Canada, the wheat grade system is highly developed. There follows a brief review of the 1985 report of the Canada Grains Council (Grain Grading Committee):

Research should be intensified to identify the relative importance of the factors presently used in grading as indicators of value, and current efforts to develop technology to measure the end

use value of wheat throughout the handling system should be expanded. Grade structures of individual classes of wheat should be kept under constant review.

Moisture content should be discontinued as a grading factor, and be replaced by a system of graduated discounts relating to moisture.

The number of grades should be reduced (from 20 in 1985).

Feeding trials should be carried out to determine the feeding value of the grain.

Four factors (Test Weight, Protein Content, Alpha Amylase Activity and Foreign Material) are taken into account for wheat.

This document was the only one reviewed which took into account details of the prices paid for the different grades.

The North Dakota Agricultural Experiment Station produced two reports in 1989, relating to the grading of wheat in France and Australia.

In France, the E.E.C. intervention price is influential in determining final producer price levels (see Table 8). Prices are set for three levels of quality - Quality, Bread and Feed, with premia and discounts applied for Moisture, Test Weight, Extraneous Matter, Broken Kernels, Sprouted Kernels and other miscellaneous impurities.

Table 8 . Price Adjustments in the Paris Contract for Feed and Milling Wheat⁶

FACTOR	DISCOUNT RATE (per cent)	UNIT	MAXIMUM DEVIATION BEFORE ARBITRAGE
Test Weight - Feed - Milling	1.0	1 kg/hl	3 kg
	1.0	1 kg/hl	2 kg
Moisture	1.0	first %	2%
	1.5	second %	
Broken	0.25	per point	3%
Sprouted	0.50	per point	3%
Impurities	1.0	per point 1 - 2.0%	4%
	2.0	per point 2 - 4.0%	
Hagberg ⁷	0.001	per second	15 secs
Protein ⁸	0	0.0 - 0.29%	50%
	1.2	0.30	
	1.6	0.40	
	2.0	0.50	
Zeleny ⁹	0	1	6%
	0	2	
	1.2	3	
	1.6	4	
	2.0	5	
Variety ^{10, 11} Specified ¹²	0	0-2 grains of 50	5
	0.5	3 grains of 50	
	1.0	4 grains of 50	
	1.5	5 grains of 50	

⁶ Unless indicated otherwise price adjustments are the same for feed and milling wheat

⁷ Applies to milling wheat only

⁸ Applies to milling wheat only

⁹ Applies to milling wheat only

¹⁰ Applies to milling wheat only

¹¹ Based on sample of 50 grains and using electrophoresis

¹² Varieties in contracts are either specified, or excluded

Excluded	0 0.5	0-2 grains of 50 3 grains of 50	3
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In Australia, seven classes of wheat are identified (on 'hardness') with further segregation on protein level. The Australian Wheat Board provides detailed information on the percentage of crop received, by product class.

Analysis of Questionnaires on Quality Parameters

Returned questionnaires were dated, and the information from each one was entered onto a single Lotus 123 computer spreadsheet. Codes were entered for the respective categories, and all questionnaires were part of the same database. The data were then checked for consistency and accuracy, before analysis.

The initial analysis consisted of various summing and averaging techniques within Lotus 123.

Averages to the various factual and attitude questions, and to the indicative ('demographic') data from page four of the questionnaires were calculated, and some sub-analyses of smaller groupings (mainly according to category of user) were also undertaken.

Two forms of analysis were carried out, using the cluster and factor analysis algorithms of the SAS (Statistical Analysis System) package. The aims were, firstly, to identify groups of respondents (for example, by region or size), whose responses to all the questions were similar, and secondly, to identify variables (attitude statements or quality factors) to which the mass of respondents answered in a similar way, thus trying to isolate groups of variables and give them some overall identity.

A small scale price analysis was carried out on a limited data set provided by the HGCA. The objective of this work was to illustrate the movement of prices for crops of milling and feed quality standards with time. Various statistical analyses (time series analysis and co-integration tests) were performed.

The rates of response to the questionnaires shown in Table 9 may be indicative of the interest in the crop amongst those who use it.

Table 9. Response Rate

CATEGORY	Number sent	Total number of replies	Number of useful replies	Per cent of total replies	Per cent useful replies
PRODUCERS	660	214	209	32	32
FEED COMPS.	238	164	96	69	40
HORSE FEED	110	54	38	49	35
MILLERS/MANUF.	101	63	40	62	40
TOTAL	1109	495	383	42	35

Table 10 gives a breakdown of the four categories into which producer respondents fall, although there may be some limited overlap between them.

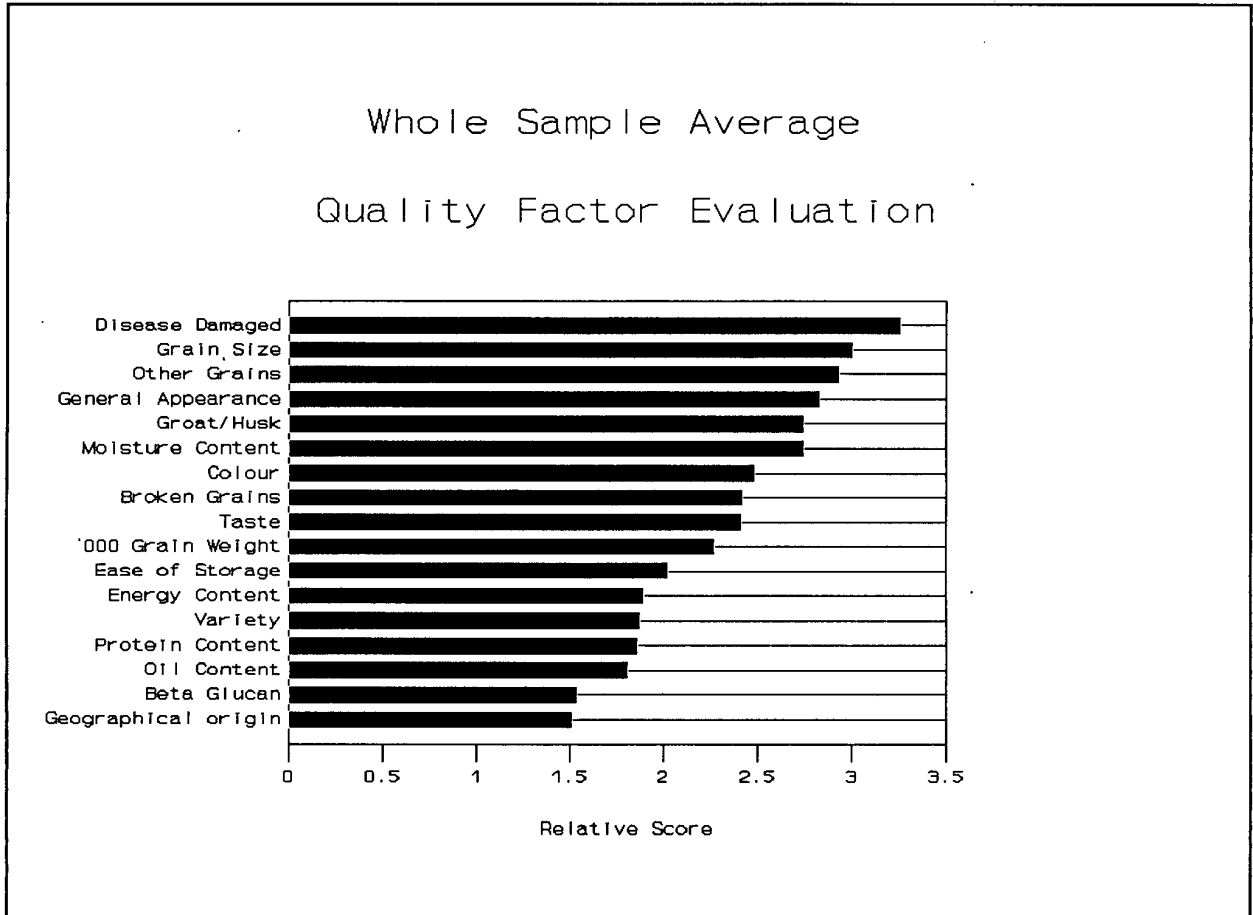
Table 10. Producer Breakdown

PRODUCER CATEGORY	Number received
Mainly Scottish Growers	82
Mainly S.E. England Growers	14
Mainly Seed Growers	40
Mainly Growers of Naked Oats	78
TOTAL	214

Quality Parameters

Figure 1 gives average values for the responses to the 'objective quality criteria' section on page 2 of the questionnaire. The rating scale used simply asked for a mark to be placed indicating whether the item listed was 'very relevant', through to 'irrelevant'. Each value has been rescaled so that a high value (long bar) indicates that the item is thought important by the respondents.

Figure 1.



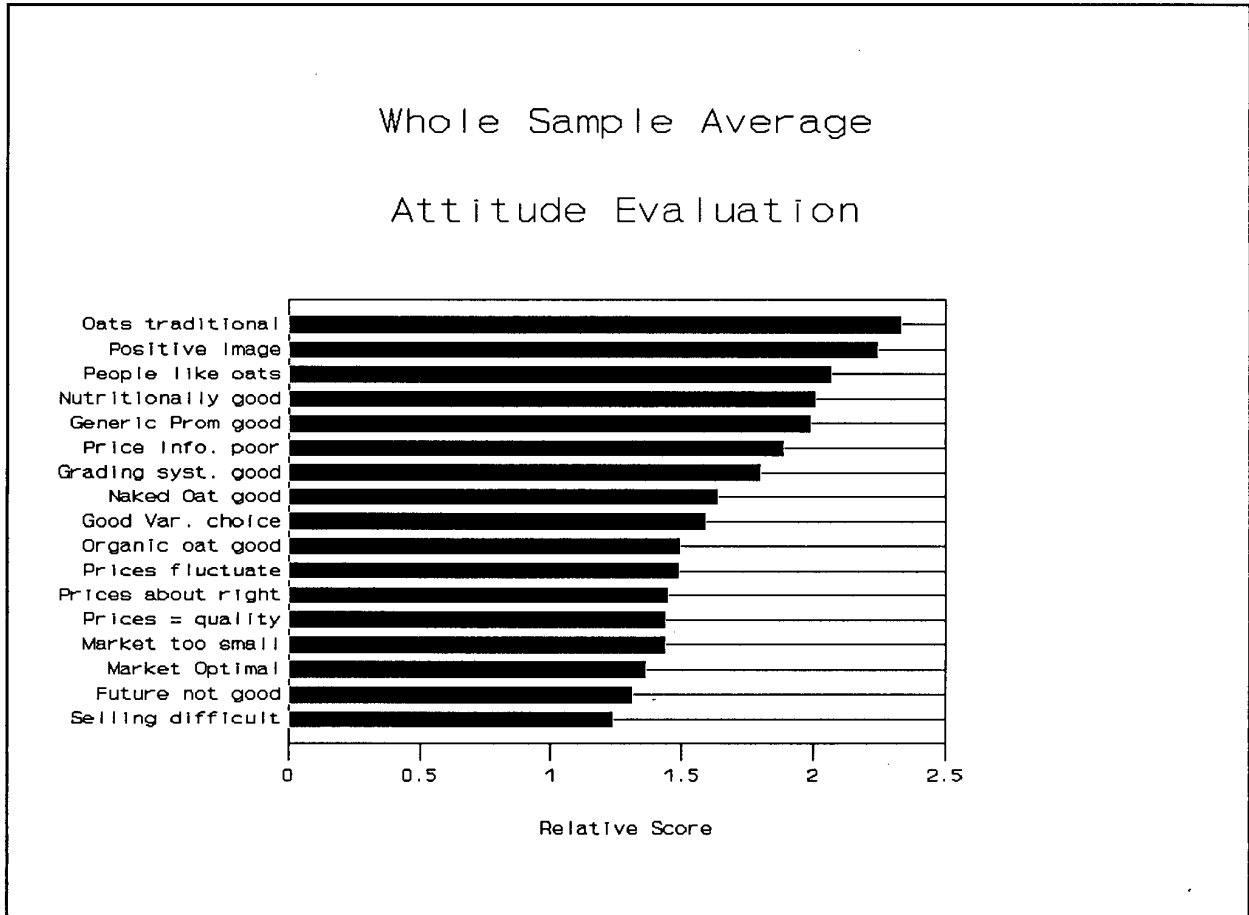
Freedom from disease, cleanliness, and optimal grain size are considered especially relevant over the sample as a whole, with geographical origin and beta-glucan levels being relatively less important.

Attitudes Towards Oats

Page 3 of the questionnaire invited respondents to consider their overall attitudes to various aspects of the crop. The responses were arranged on a six-point scale ranging from 'strongly agree' with the statement to 'strongly disagree'.

The results, presented in Figure 2, show that many respondents agreed that oats was a traditional product, that oats have a positive image, and that a generic promotional campaign would be beneficial.

Figure 2.

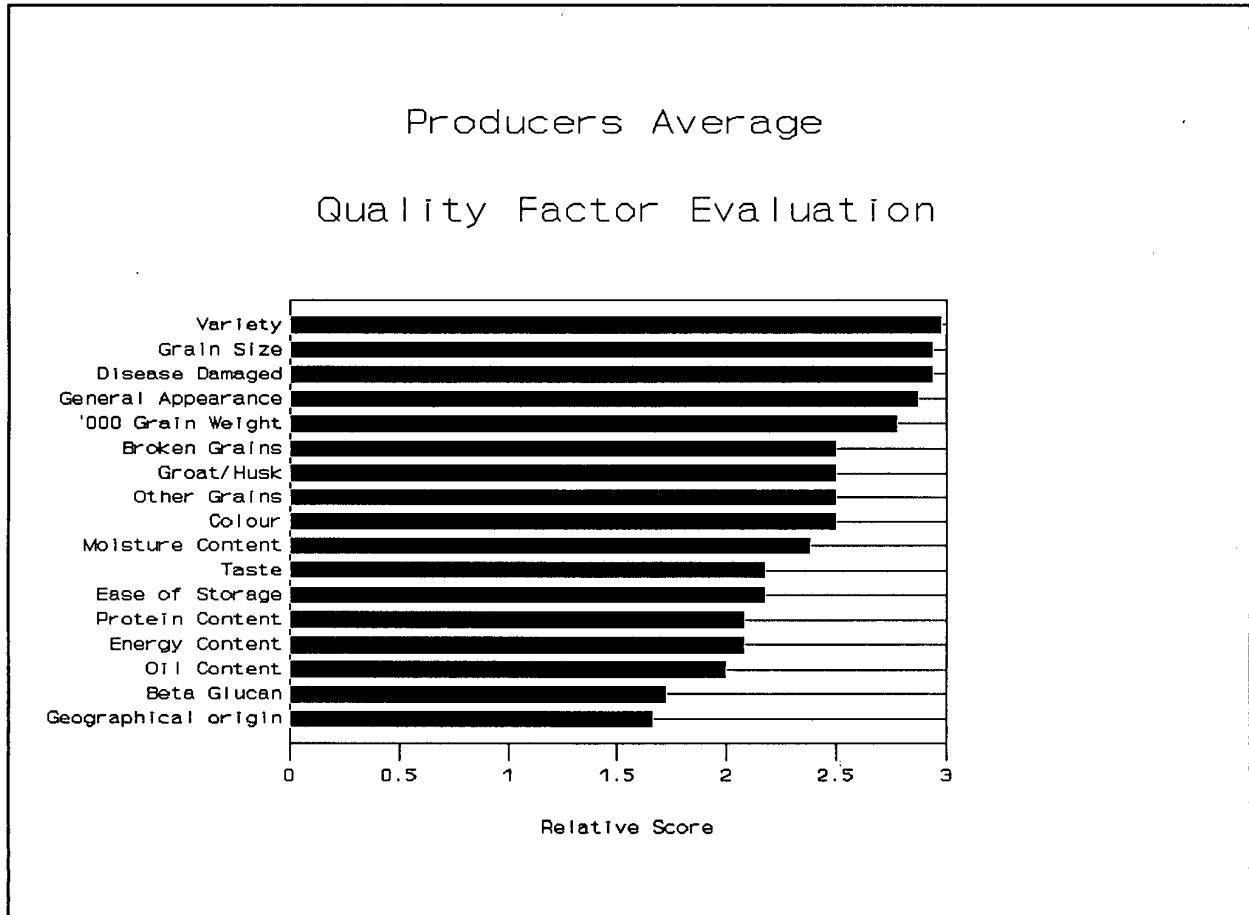


Respondents seemed reasonably confident about the future of the sector, but did not agree that prices of oats accurately reflect their quality.

A. Producers

Although size and colour were again especially relevant, the type of variety grown (naked or husked) is the most important feature for producers. Kynon and Rhiannon are the two main varieties of naked oats.

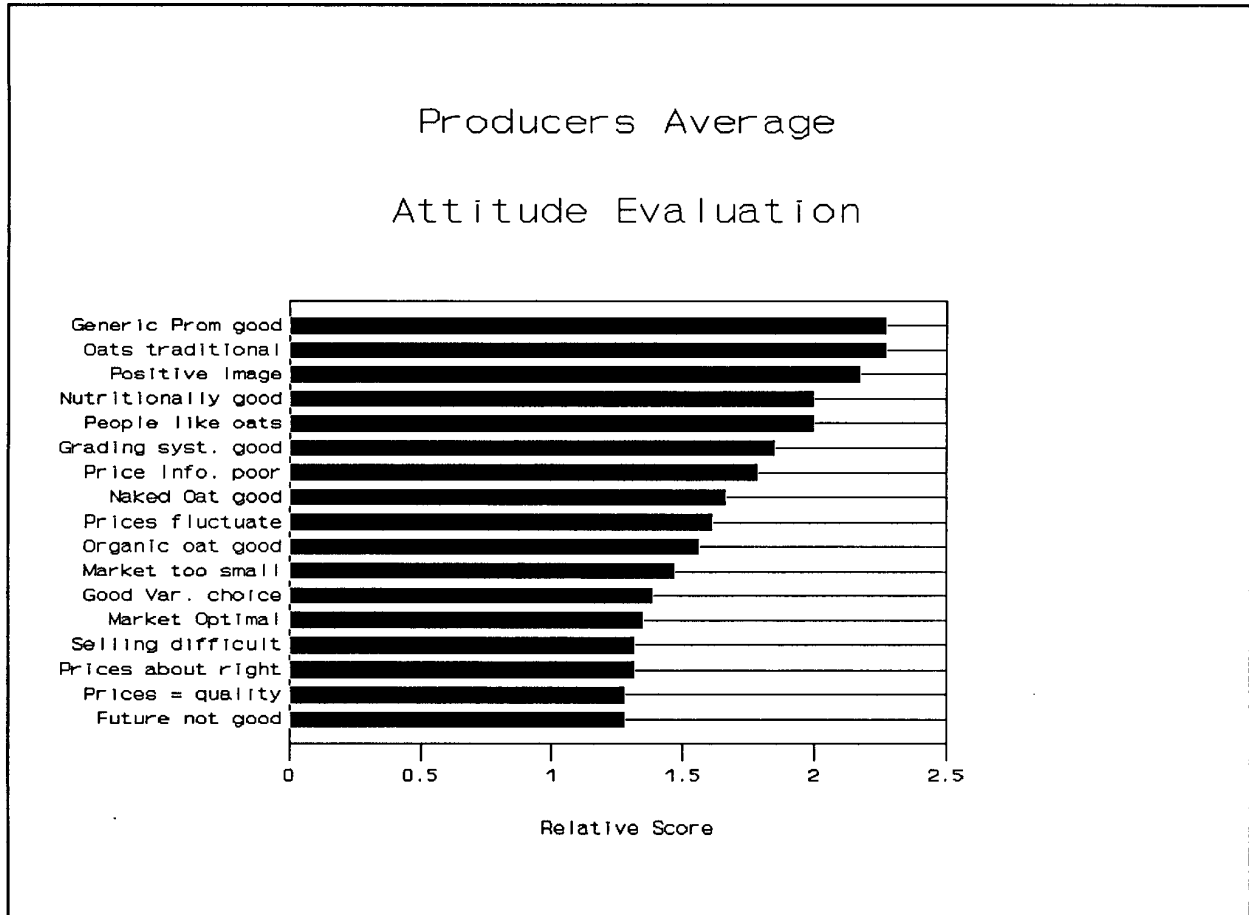
Figure 3.



Geographical origin and beta-glucan levels were relatively unimportant.

Strong agreement was expressed with the need for generic promotion, and for the fact that oats are a traditional product. However producers believe that prices do not reflect the quality of grain supplied, that prices are too low, and that there is an insufficient choice of oat varieties.

Figure 4.



Respondents were asked to identify various aspects of the oats crop which were relevant to them. The results of the analysis of these responses are shown below.

The questions asked were as follows:

- * What would prompt you to increase the area of oats grown?
- * What particular factors do you feel motivate MERCHANTS to buy your oats?
- * If you retain oats for on-farm feeding, what are the advantages of using oats?
 - What are the limitations?

- What influences the tonnages you retain?

* Please indicate your recommendations as to areas where research into oats might be directed.

In response to these questions, the following results emerged.

The majority of producers would be prepared to increase the area of oats they grow if the price was higher. Demand was also seen as a constraint, and some producers mentioned the need for increased yield as a motivation to grow more. There was also support for earlier varieties. Producers felt that merchants were motivated to buy their product because of its quality. This was backed up by considerations such as bushel weight and price. The overwhelming reason for retaining the crop was its nutritional value for animals, with numbers of stock being an important determinant of how much is kept.

Respondents in this category suggested a fairly even spread of research recommendations. In particular, the need for earlier varieties and increased yield was mentioned, with shorter straw, better marketing and varieties specific to human consumption also prominent among recommendations.

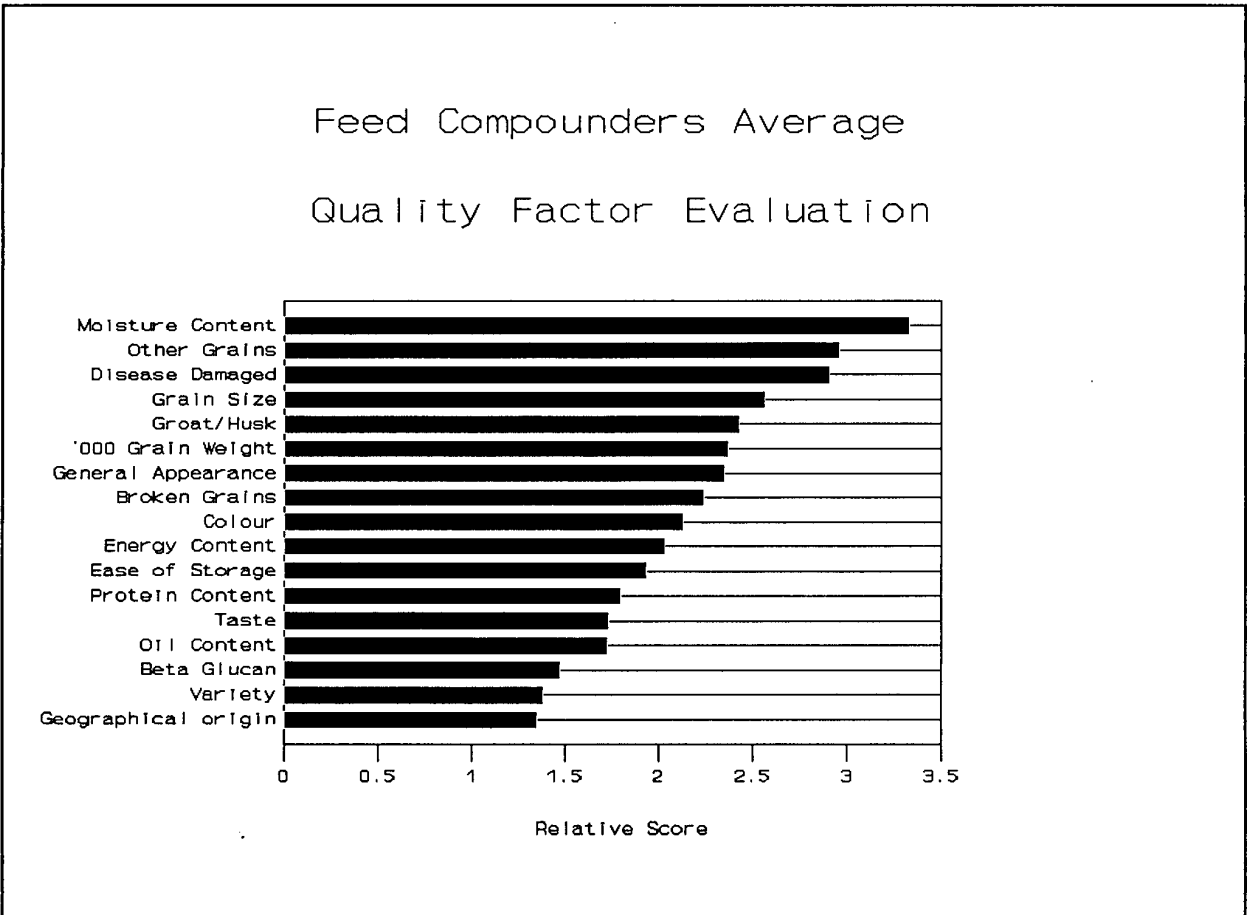
The average acreage of oats harvested by these producers in 1990 was 50.3 acres (with a maximum of 520 acres). Most of the sample crop (87.8%) is sold, with the balance being kept for feeding on farm, and a small amount being kept for feed.

83% of producers use contracts of some sort for the selling of all or part of their crop, and the majority (85%) are satisfied or quite satisfied with the terms of their arrangements.

B. Animal Feed Compounders

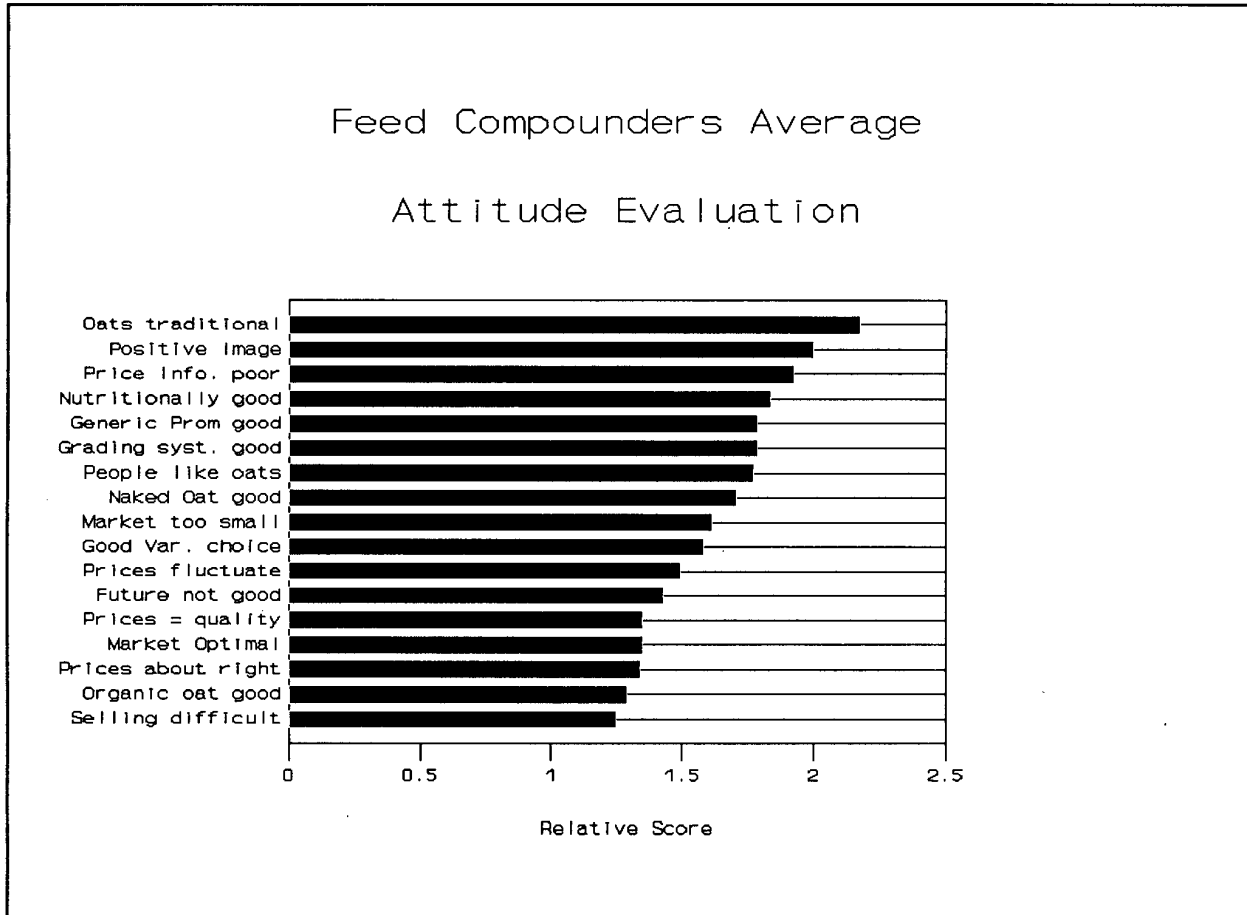
The feed compounder sector places a premium (Figure 5) on the correct moisture content, size of grain, and freedom from disease, with less relevance attached to variety and geographical origin of the grain.

Figure 5.



This sector believes (Figure 6) particularly that oats are a traditional product with a positive image, and that price information about oats is too limited.

Figure 6.



Animal Feed compounders were asked to indicate: the different quality requirements of oats in different feed formulations; the reasons why farmers buy products containing oats; the key factors determining the quantity of oats used; the limitations of the crop in formulations; and any recommendations for research.

This analysis revealed that in coarse rations a bold, good sized and correctly coloured oat was essential. For pelleted feeds, moisture content and protein levels were important. Farmers buy the feed products (containing oats) for reasons of tradition and animal nutrition - the belief that oats are particularly good for their stock.

The main limitations experienced, apart from the availability of good supplies, were identified as value for money, and the fibre content of the grain (especially with respect to the effects on grinding

procedures and pelletability).

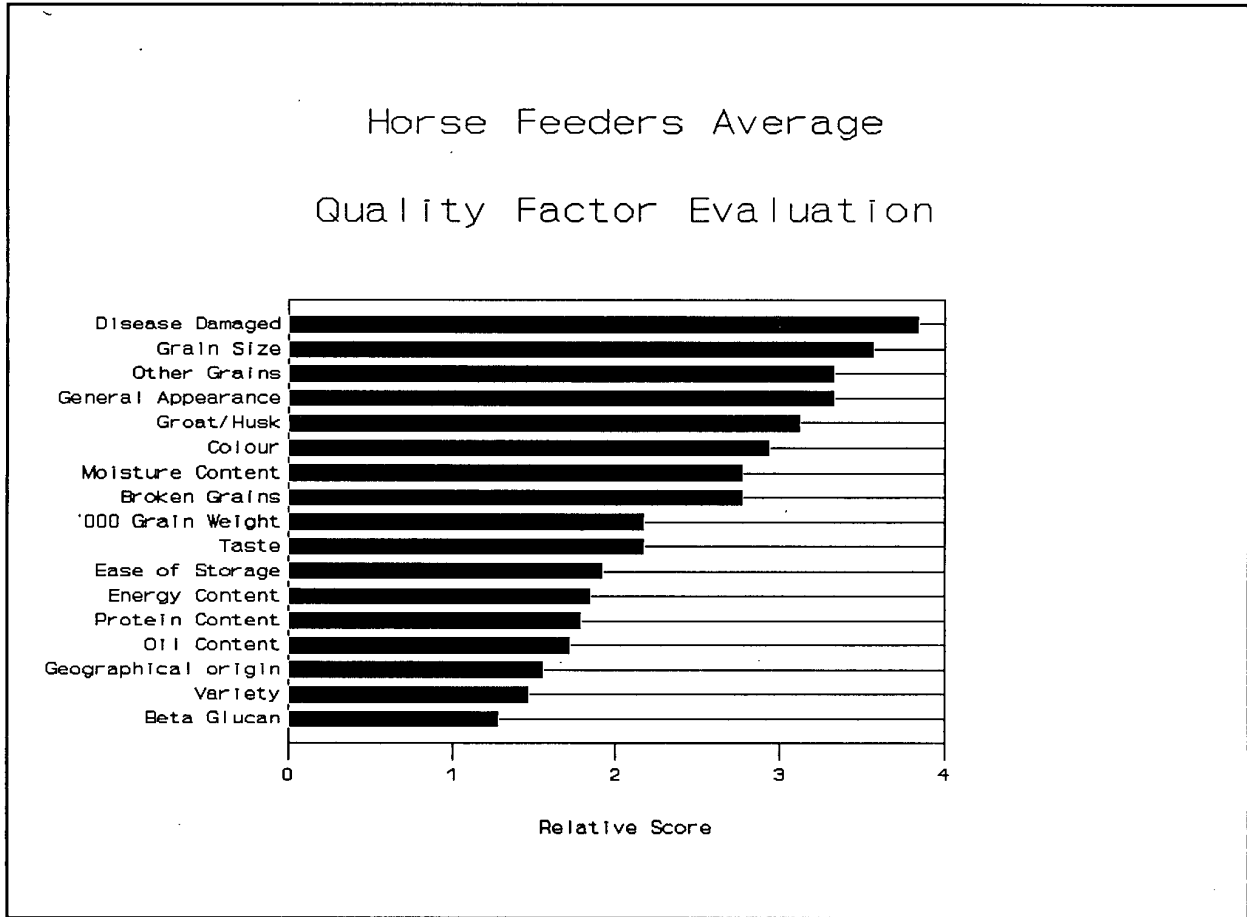
There was considerable support for research into naked oats from this sector, for work on increasing its nutritional value, marketing, crop yield, and the development of varieties with less husk.

The average tonnage purchased was 1400 tonnes in 1990, although this figure was distorted by one large figure, and perhaps 1000 tonnes would be a less distorted median. Although again corrected for distortions, much of this tonnage (across the sample) was being used in rations for poultry, although horses, dairy animals and pigs also featured.

C. Animal Feed Compounders for Horse Feed

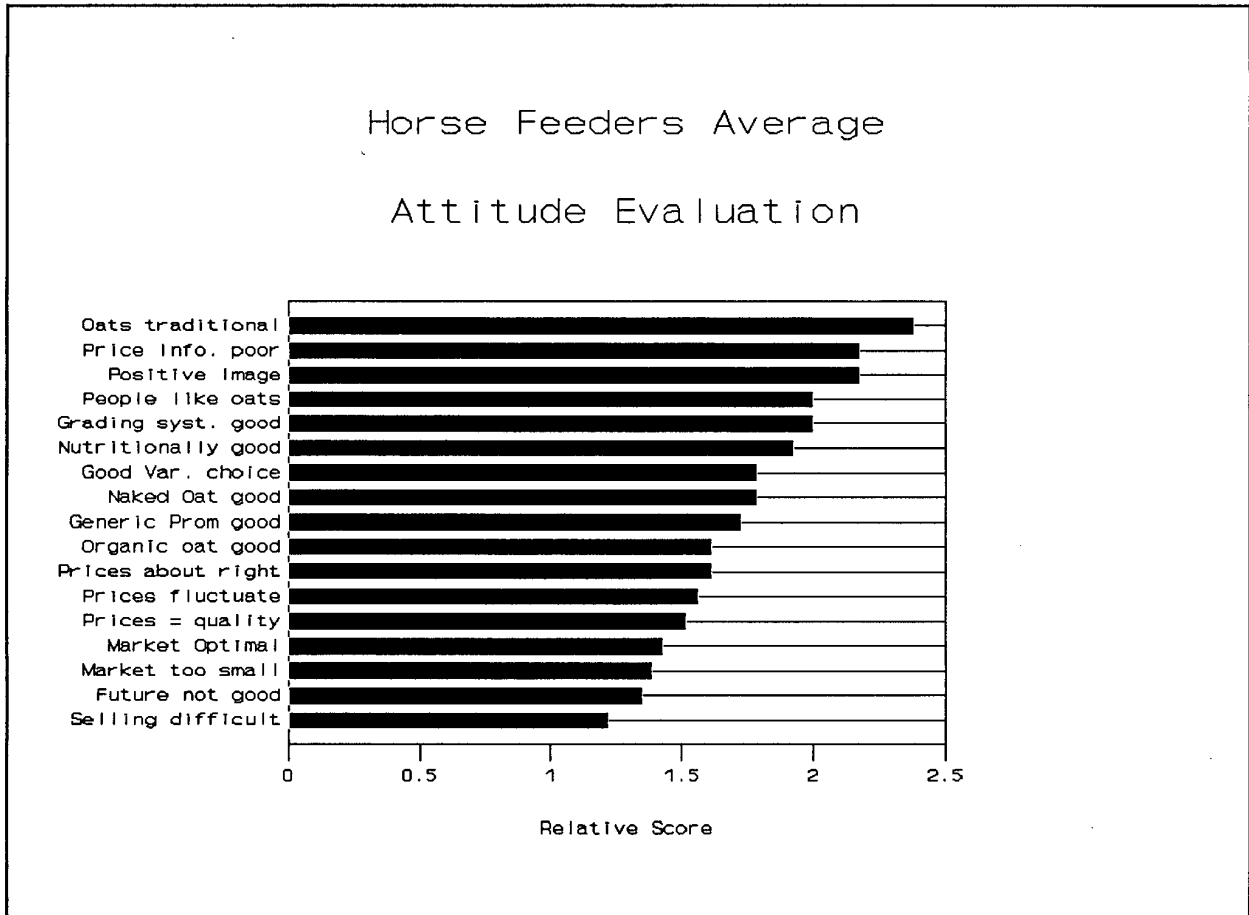
The most important quality feature (Figure 7) for horse feed compounders is freedom from disease, followed by grain size and appearance. beta-glucan levels, variety and origin of the grain are again relatively less important.

Figure 7.



This sector believes that oats are a traditional product (perhaps particularly relevant to horse owners and their suppliers), and the fact that price information is too limited. In contrast, many horse feed compounders feel that selling their final oats product is relatively easy. They do not feel that the market is too small nor is its future in doubt.

Figure 8.



Colour and boldness of the oats used in both coarse and other rations were the main features perceived as important by horse feed compounders. 55% of them felt that horse owners bought oat-based rations because of their traditional role, with a number also indicating the energy value of the crop as important. The quantity of oats which the compounders bought depended mainly on the demand for the final product, but quality, price, colour and bushel weight are significant factors. The use of oats in horse feed formulations may be limited by the poor grinding of the crop and value for money (relative to other ingredients), as well as availability, and the possible effects on horses' nerves.

Horse feed compounders expressed the need for research into yields, marketing and quality control. Decisions on buying oats may be made on traditional and subjective grounds, and on the assumption that horses have always been fed oats. The bulkiness of oats may make grinding and processing

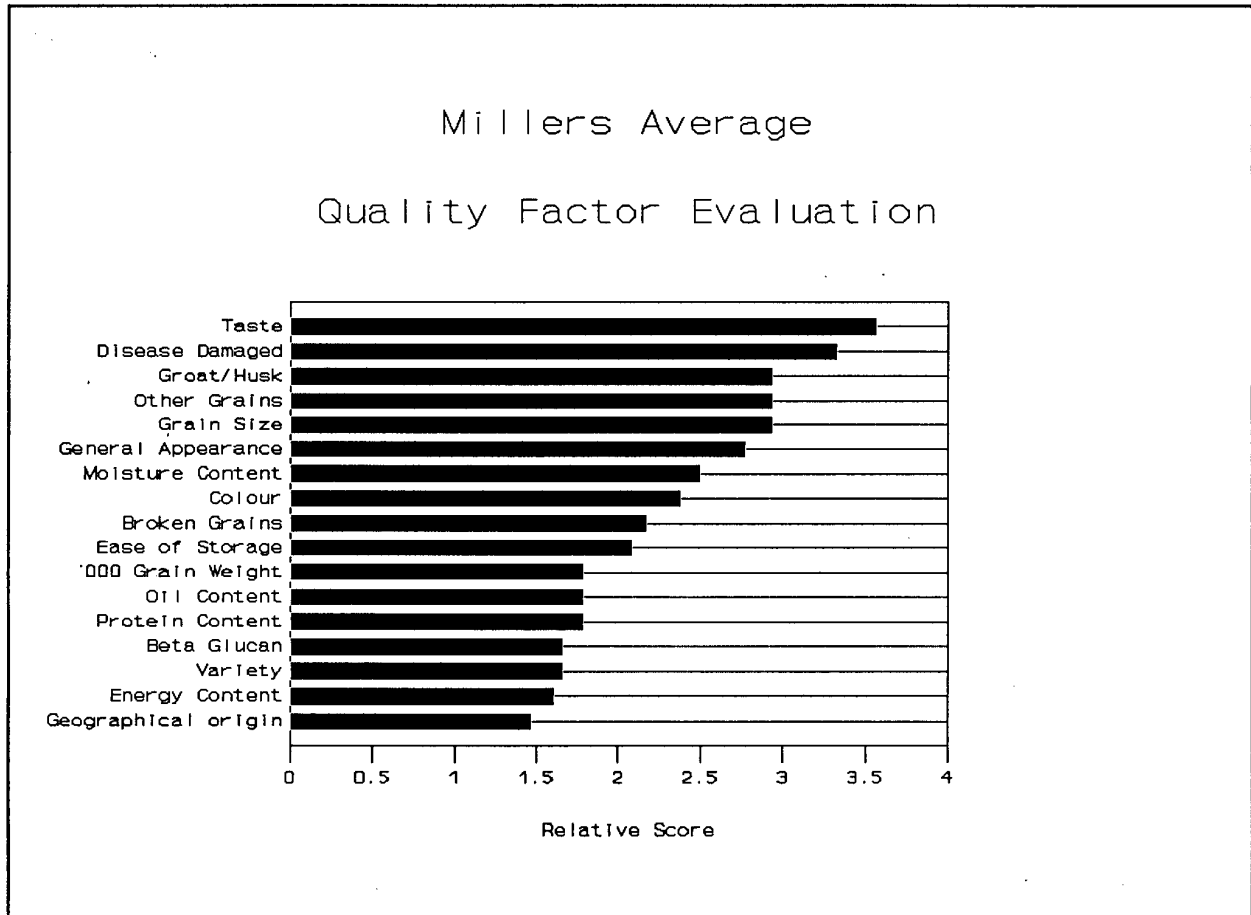
difficult.

The sample of horse feed compounders bought an average of 450 tonnes of oats in 1990 (again excluding one very large user (20,000 tonnes)), with rather more of it bought on the open market than on contract.

D. Millers and Food Manufacturers

Figure 9 shows the quality factor evaluation results by millers and food manufacturers. Taste is rated of higher relevance than any other factor, with freedom from disease, size and appearance also being important.

Figure 9.

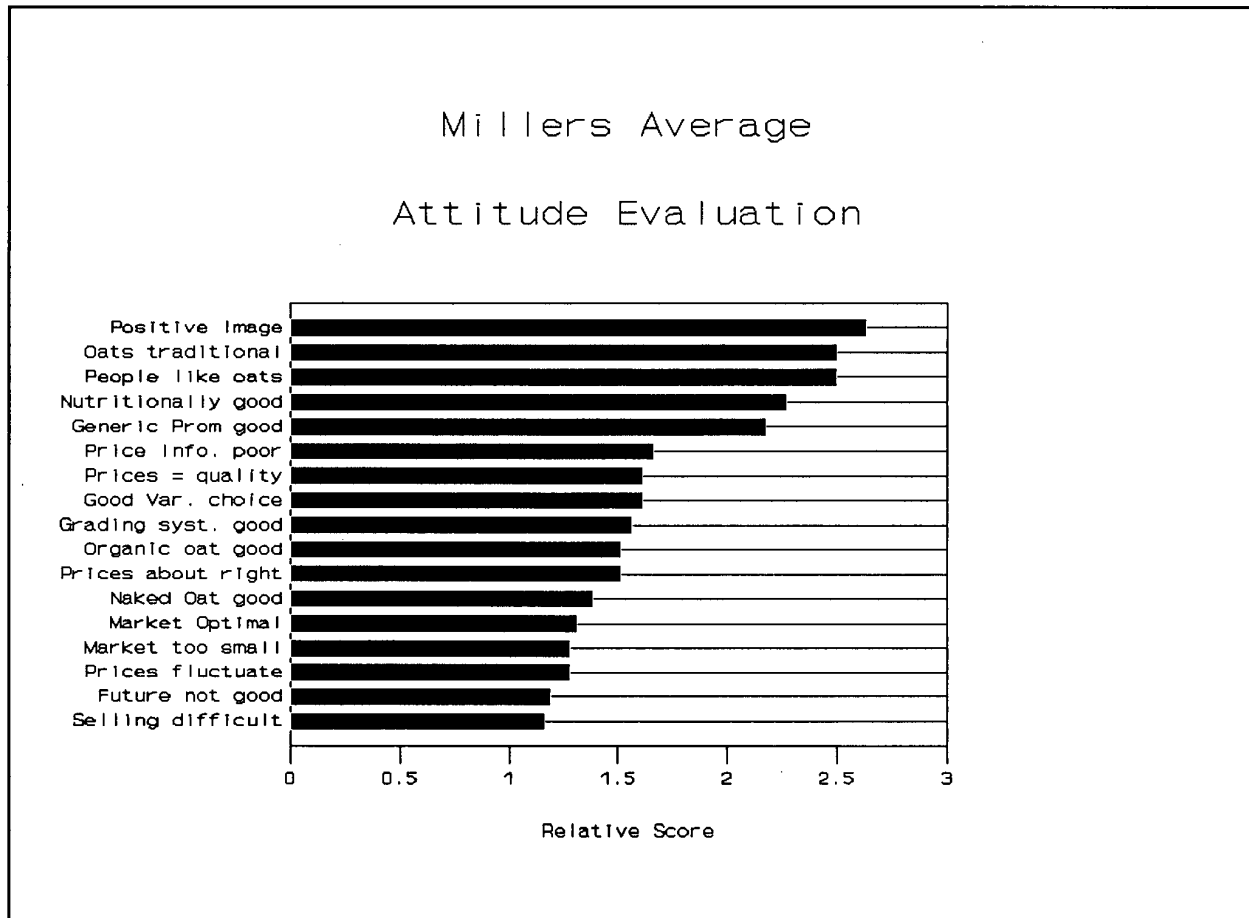


Oat millers and manufacturers are reasonably confident about the future of the sector, and have no problem in selling their products. They do not agree that the market is too small.

This sector also believes that the product is a traditional one, and that it has a positive image.

90% of oat millers and manufacturers maintain that consumers purchase oat-based products for their nutritional and health properties, but tradition and taste are also important. 50% of them maintain that the demand for the final product is the prime determinant of quantity, with price, quality and the size of the grain also being highlighted.

Figure 10.



Potential research areas are the breeding of longer/fatter grains, and improved nutritional quality. A small number indicated that naked oats should be investigated, with a similar number suggesting quality control as an area requiring research.

The average size of respondent (in terms of the tonnage purchased in 1990) was distorted by the inclusion of two very large operators (100,000 tonnes and 35,000 tonnes), so the adjusted average usage for the sample is around 400 tonnes.

The form in which the oats are purchased is split according to the category of the user, with a large amount taken in the raw form, and the balance taken as rolled and cooked oats (for further manufacture).

As far as usage in different products is concerned, biscuits, cereals, and bread feature particularly.

Further Analysis

A factor analysis of the data was performed, to identify any patterns among the variables. The logic behind this procedure is that if there is a consistent pattern of response to certain variables, then these can be grouped together and called a 'factor'. For example, if there were consistent responses to the variables 'energy', 'protein' and 'fibre', then it may be justified to express these three variables as a single new 'nutrition' factor, and to use this in interpreting the data.

The objective of factor analysis is to explain as much of the variation in the data with as few factors as possible. The largest amount of variation is explained by Factor 1; Factor 2 explains the next largest amount and so on.

The whole data set was subjected to factor analysis. The results show a grouping of the 'objectively measurable' characteristics - bushel weight, colour, appearance, size, moisture content, broken grains - and the 'market efficiency' attitudes - promotion and grading, under Factor 1. Factor 2 isolates the 'nutritional' variables of protein, beta glucan, oil and energy.

When the physical factors are considered alone, Factor 1 groups beta-glucan, oil, energy and protein together first (the nutritional factor); Factor 2 groups moisture content, broken grains, other grains, and disease damage (largely a 'foreign material' factor); while Factor 3 groups colour, appearance and taste (a 'subjective quality' factor).

Factor 1 variables based on attitudes relate to tradition, image, consumer taste, and nutritional awareness (an 'image' factor), while the second set (limited price information, the market is too small, fluctuating prices) represents a 'market/price problems' factor.

The naming and identification of factors is not an objective process, but in terms of communication and advertising, as well as policy making, the ability to see which particular variables act or react together in forming users' judgements is most important. Thus for the whole data set (not sorted by category)

it is possible to identify the strength, for example, of the nutritional perception factor referred to above, as a fundamental former of opinion in the market.

CONCLUDING DISCUSSION

The economic issues which arise as a result of this work are examined below. They relate to product quality evaluation by different users, and to the way in which systems can be designed which provide a reliable and effective means of communicating quality requirements, and prices.

Key Issues in Oats Marketing

- * The oats market is relatively small (approximately 500,000 tonnes) compared with other cereals in the U.K..
- * The oats market is fundamentally split between human and animal feed uses, with a small amount of industrial use.
- * Usage of oats in the animal feed market has declined in recent years. The human food market has expanded.
- * Oats prices have in practice been related to barley prices.
- * There is no intervention buying system for oats.
- * International trade in oats is small, and in the U.K. is of marginal importance.
- * Oat quality is not classified. Milling and feed standards are set on an *ad hoc* basis according to the season.
- * Oat quality is partly a visual concept. There are limits to the objective measures which can be economically applied.
- * The quality of the milling crop will vary according to the season, and according to the availability of good quality supplies. Millers are prepared to compromise their requirements

somewhat (with the added expense of grading out unwanted product) before resorting to imported supplies.

- * The quality of the feed crop falls into two categories. For feeding to horses, quality requirements are similar in many cases to the milling crop (again a visual assessment is important). For ration formulation, the nutritional value of the crop, balanced carefully against its cost in relation to other possible inputs, is crucial.
- * The human market for oats is still increasing.
- * The human market is characterised by the first stage processors - less than ten major buyers of oats for milling.
- * There is a notable sense of co-operation in the market. The majority of participants feel that the market only needs small changes to be made for it to suit most of them - largely questions of price and communication.
- * It is assumed that in the short term, E.E.C. policy will not change in favour of the oats crop, unless there is an initiative to restrict the entry of imported feed ingredients.
- * The human food market is relatively polarised, with the milling sector concentrated in the hands of a few buyers.
- * A good marketing system should be able to generate and communicate the necessary information on price and quality. Individual buyers would make their own arrangements within this broad system.
- * Suitable proxies should be found for the subjective quality parameters (such as the visual assessment of colour and taste), but some visual assessments would still be required.
- * Farmers in general aim to produce the highest quality crop, and resort to the lower quality markets if their crop does not satisfy the standards required, or if there is no demand for their quality crop.

Marketing Alternatives

This section attempts to draw together some of the above issues, and suggest some areas for further consideration.

Promotion

Generic promotion, is costly to implement and may have effects which are difficult to measure, but it is widely used in the milk, meat and potato markets.

A working party would be set up to ascertain how such a scheme might be financed, and to ensure that the potential benefits would be effectively communicated to the whole marketing chain.

It could be argued that such a scheme should be considered soon in order to capture the current positive attitudes towards oats and oat products. The question as to whether there should be a combined effort to raise the profile of oats for both animals and humans, or whether it should be entirely human food product based needs to be addressed.

Contracts

The importance of contractual arrangements for buying oats from farmers and merchants is fully acknowledged, and is an integral part of the marketing of the crop. It is assumed that many of these arrangements will continue. However, this report makes no recommendations for a larger scale of contracting of the crop. Such a system would undoubtedly induce stagnation of the market, and act as a real disincentive for new producers to join.

It may also give unacceptable market power to the buyers of the crops.

Varieties

The suitability of varieties for different uses, and a means of indicating preferred varieties to the market would be beneficial as would an expansion of the variety quality descriptors and indices used by plant breeders.

Prices and Quality

There is scope for research into two aspects of price and quality.

An analysis of the current situation is merited, using data on sales prices of crops at different quality levels. This would be one means of ascertaining how important each quality parameter is - that is how much it contributes to the price of the product - and therefore its relative value.

An alternative to the above (which may be restricted due to lack of data), would be an experimental approach which took into account market participants' 'willingness to pay' for various quality aspects.

Inputs and Outputs

There is still scope to carry out work on the relationship between the inputs applied (perhaps especially to the organic and naked oat crops), and their output values.

This follows from the fact that if producers are able (through improved communication in the market) to know exactly what market they wish to produce for, then they will need to hold better information on the exact costs of producing that crop.

Classification Issues

Any change in the way the crop is marketed must be easy to instigate, simple to use, easy to maintain,

and repeatable. It should not entail a significant amount of intervention in the market, given the prevailing opinion in government and the EC Commission regarding intervention in agricultural markets, and the experience of other sectors. It must be relatively cheap to administer. It must be measurable and objective. It must encourage co-operation and communication in the market.

Grading of Oats

This section considers the possibility of instigating a common scheme for the grading of the oats crop which extends beyond the 'milling' and 'feed' designations.

The model for such a scheme might be the Canadian example, shown in Table 7.

Such a scheme would enable producers and users to be more aware of their mutual requirements in terms of oats quality, would provide the necessary incentive for effect, to producers and should mean that price information is provided in more detail. If adopted, a useful feature of the system would be its international comparability.

The problem with such a scheme is that it may be costly to implement, and the fixed nature of the grade level may, in particular years, make the top grades superfluous, with a concentration of quality in the lower grades.

Quality Communication

The main theme of this report, as a result of the discussions (and questionnaires returned), has been one of communication.

A device needs to be instigated which makes all members of the market more confident in its reliability. This, in the medium term (that is in two or three seasons), will be the means to maintain (and start to expand) market size and strength.

The assumptions underlying the scheme outlined below are that grain prices will continue to fluctuate,

but that there will be no possibility of formally tying the oats price to that of another crop, such as barley. It is also assumed that international trade will continue to remain relatively insignificant.

The basis of the scheme is as follows:

General Quality Setting

1. There would be two sets of oats quality parameters under consideration. Firstly a set of **base parameters** would be used in the determination of an average market quality. (A second set, the **variable parameters**, would be for individual buyers to decide upon.)
2. The base parameters would be decided in consultation, but might be expected to include grain size, grain colour, specific weight, thousand grain weight, protein level, kernel content, oil level, energy content (Metabolisable Energy). It is also felt that variety is currently not given enough weight in terms of which varieties are more appropriate for different needs, and that this aspect should be communicated in terms of preferred varieties for different uses.
3. In consultation with market members, two series of quality levels would be identified, one of **minimum quality levels** - that is a quality definition below which crop in each grade should not fall - and the other of **(realistic) optimum quality levels**, on as many parameters as possible. These would be formally communicated to the market. They would be set on the base parameters described above.
4. In addition, guidelines on the requirements for the variable parameters, such as screenings, broken grains and moisture content would be communicated, but not formally laid down.

Quality Setting in Specific Years

5. In any particular season the HGCA would, as soon as possible after harvesting, take a number

of oats samples from around the country and test them for a number of the base quality parameters.

6. The measured average quality parameter levels for the specific year would then be used to decide upon a series of quality levels, as in a conventional grading system, which a crop would have to attain before it was placed in a particular category. The crucial element of this system, however, is that the actual values of each parameter will vary according to the year in question and the general level of crop quality.
7. These quality levels would be outlined, would not be lower than the absolute minima outlined above, and would in general indicate to the market the relative availability of crops of different qualities in that year.
8. The market participants would then compare their own base quality levels (and possibly the percentage premia and discounts available - see below) in order to determine the price they should expect to pay for a particular quality of crop in a particular season.
9. This should then give the opportunity for producers and their agents to assess more accurately the prices they should expect to receive, and the relative availability of the crop.
10. The distinct needs of the different parts of the market suggests that a 'straight through' grade system on a continuous scale would not be suitable. Rather a scale that isolated levels for particular uses (with the different minima and optima set separately) would be more appropriate.
11. The figure below is one possible representation. There might be two milling grades, with slightly different characteristics depending on the end use of the grain, a top feed grade (rated on visual as well as nutritional factors), a secondary feed grade (based on composition) - largely

as an incentive for the development and production of varieties which will in the long term compete more effectively with other potential feed ingredients - and an 'Other' grade, for crop that did not fall into the above categories.

<p>HGCA MILLING GRADE 1 (YEAR)</p> <p>Indications: Specific weight: x kg/hl Protein: x percent Kernel content: x percent</p> <p>also: Bold grain White</p>
<p>HGCA MILLING GRADE 2 (YEAR)</p>
<p>HGCA FEED GRADE 1 (YEAR)</p> <p>Indications: Specific Weight: y kg/hl Protein: y percent etc.</p>
<p>HGCA FEED GRADE 2 (YEAR)</p>
<p>HGCA OTHER OATS</p>

It would be necessary for this system to be flexible for it to succeed. It would have to be market-led, and adapt quickly to market conditions, and to the possible development of new uses of the crop with

different overall quality needs.

Examples

This section presents three brief examples of the scheme at work.

Example 1 - the meaning of the standards

In the 1992 marketing year, a producer indicates that he has 40 tonnes of HGCA Milling 2 (1992) available. This would indicate that his crop is suitable for milling - that is it is above the minimum milling level - and that it falls within the designated 'Milling 2' guidelines for 1992, given the overall 1992 quality levels set by the HGCA earlier in the season.

Example 2 - achieving Feed 1 standard

A farmer knows the general requirements for growing a crop for the horse feed market - that is the minimum levels laid down and communicated by the HGCA. He therefore aims to grow for that market, choosing the right variety and husbandry techniques. When harvested, he finds that the crop's protein level is only 1% above the minimum level, and the energy level is similarly low. However, the Quality Communication Scheme indicates that for this year (1992) his crop reaches HGCA Feed 1 (1992) standard - that is, feeders will be prepared to accept this level of quality in the absence of anything better, before resorting to imported supplies.

Example 3 - missing the standard

A farmer knows the general requirements for growing a crop for the horse feed market - that is the minimum levels laid down and communicated by the HGCA. He therefore aims to grow for that market, choosing the right variety and husbandry techniques. When harvested, he finds that the crop's protein level is only 1% above the minimum level, and the energy level is similarly low. The Quality Communication Scheme indicates that for this year (1992) the base level for HGCA Feed 1 (1992) is higher than his crop, so in the knowledge that his crop will not be acceptable for that market, he sells quickly into the HGCA Feed 2 (1992) or HGCA Other Oats (1992) market.

Prices

Premia, in percentage terms, could be set, in careful consultation with all members of the market, according to the relative values of different levels of the quality parameters. This would be similar to the EEC scheme quoted above (Table 8). It should be stressed that the setting of the premia and discounts is a very precise process, and should be very carefully carried out, because the precise levels will be crucial to the efficacy of the scheme.

As was expressed above, such a scheme is flexible. No absolute prices are suggested, so no significant market intervention is required. The flexibility arises from the fact that percentages will always reflect relative values, regardless of the prevailing quality level of the market.

APPENDICES

I. Acknowledgements

The assistance of the large number of oats users and producers who responded to our questionnaires is gratefully acknowledged. It is to be hoped that most of those who helped will find something useful in the report.

In addition, the members of the British Oat and Barley Millers Association, and of the various other organisations who responded to letters, or met with us to discuss the work, provided a vital part of the information required for this report.

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III. The Economics of Product Quality

This section undertakes to describe some of the ways in which economists view the issue of product quality, and to illustrate how the improvement of quality information and communication through a marketing chain might be expected to improve the system itself.

As has been indicated throughout the main report, and the summaries of the analyses carried out, there are a number of different interested parties in the U.K. oats market, each with slightly different understandings of what the others see as the important issues regarding product quality, and the specific levels at which quality characteristics should ideally be set.

Market Considerations

In the economist's ideal of a perfect market, all market participants are described as having perfect information, and products (crops) are said to be homogeneous in quality. If various other criteria also hold, then the market is said to be economically efficient, with the quantities exchanged and the prices prevailing in it said to be in some sense natural and fair.

However, there are two important caveats to be expressed. The first is that agricultural markets are not perfect in nature (the influence of policy in particular mitigates against that), and secondly that 'nonefficiency' considerations are often important in practice - at least to the interested parties. For example, the milling sector might be prepared to bid up the price for a certain type of crop to ensure their supplies at a particular time, with the result that a relatively small part of the crop (effectively a sub-market or market segment) has its price distorted from what the market would 'naturally' dictate.

As far as quality is concerned, the U.K. oats crop is certainly not a homogeneous product, and therefore it is important to consider it in a wider context, and accept that, within a basically competitive structure, the market and its range of prices will adjust according to differing quality requirements.

This project then has considered the different quality requirements of the market. The next section explains how an improved understanding of product quality and price issues will benefit the whole

market.

Product and Price Considerations

Product Characteristics

Lancaster's 'new' approach to consumer theory suggested that consumers' real source of utility from consumption (or indeed the utility gained by an oat miller in purchasing a particular input) was not from the product itself, but from the characteristics of that product. For the purposes of this analysis, the characteristics referred to are the individual dimensions of product quality.

Lancaster called the process of consumption a 'consumption technology', which transforms goods (the inputs) into characteristics (intermediate outputs that produce utility).

One important feature of Lancaster's thinking was the fact that a consumer could in fact achieve a set of desired characteristics by consuming goods in combination, and there might be a variety of combinations that would yield the same desired bundle of characteristics.

Perhaps the best direct example of this is seen in the animal feed compounding industry, where the consumer (the mill), in trying to achieve the right characteristics of nutrient balance, animal health, cost etc., combines different goods (different ingredients) in different ways, (depending on their individual characteristics), and could yield a similar range of characteristics in the final feed by using different combinations.

Characteristics Prices

The price of the individual characteristics should be accurately reflected (in combination) in the price of the final product. Although a detailed price analysis has not been possible, further research would extend this idea and try to price certain of the key characteristics.

Economists have developed methods for isolating the prices of characteristics, in order to determine their contribution to total product price, and in order to gauge whether product prices are accurately reflecting the usefulness/utility of the individual factors to users.

Characteristics Prices and Product Classification

It is argued here that there are likely to be certain key characteristics that fundamentally discriminate among market participants' judgements of quality.

What this research has intended to achieve is the identification of these key characteristics by eliciting information from a variety of respondents as to their own evaluations of them. If there was universal agreement throughout the market as to the rankings of the importance of the various characteristics then it would be a simple matter to make recommendations to authorities and policy makers as to an ideal 'grade' of oats that all breeders and developers should strive to produce.

It is evident from the results section of the main report that this is not the case in the U.K. oats market.

The implications of this are that a range of key parameters have to be identified, and these parameters used to classify the product according to its characteristics. It is likely to be these key characteristics that actually determine the relevant parts of the price of the product (over some base level - perhaps related to underlying barley prices), and it should therefore be these characteristics that classify the product and the prices of the various classes identified that accurately reflect the underlying values placed on the characteristics.

This has been attempted in the summary report, where certain recommendations have been made as to the constitution of a descriptive system for the classification of oats in the U.K., on the assumption that there are advantages to a system that does not rely solely on personal inspection and testing, and that each market participant is unlikely to ever know the precise quality profile of every lot of the crop it uses.

Characteristics Levels

In the results section, where indicated by respondents, and by the evidence drawn from other systems, some recommendations for the ideal levels of various characteristics have been made. However, it is important to note that this report is not technical in nature, and is simply reporting directly the information passed on by the respondents.

It is to be assumed that the closer the classification system approaches a series of optima (each grade) in terms of the levels of each characteristic applicable to potential users of the product, the more economically efficient it becomes.

Marketing Considerations

As far as the marketing of the crop is concerned, the economics of quality as illustrated above have important practical implications.

Much of commercial marketing, at all levels (from producer-merchant exchange, through to retailer-consumer exchange), involves the accurate identification of specific market segments. Market segmentation requires that the firm can isolate distinct subsets within the mass market that have identifiable characteristics, and that will respond to the different variables in the firm's marketing mix in distinct ways. In changing aspects of the marketing mix, the firm can more accurately meet its customers' requirements.

Product quality is just one part of the marketing mix, but for heterogeneous agricultural produce it is vital, as has been stated above, that accurate descriptions of quality are communicated to all stages in the marketing chain. The question, then, of correctly identifying the quality features of the crop, and accurately matching them to market needs, is the basis of market segmentation, and can be applied throughout the marketing chain.

The marketing implications of the correct relationship between price and quality (and its communication through market information) are also of vital importance in the determination of marketing strategy, and as has already been stated, in the efficient working of the market. It is by ensuring that the market

is efficient in its price/quality relationships that policy makers can enhance market efficiency and encourage more orderly marketing of the crop.