

Project title: Mushrooms: Addressing the problems of the mushroom industry in the UK

Project number: CP 25

Project leaders: John Fenlon  
Reader in Statistics  
RISCU, Department of Statistics  
University of Warwick  
Coventry CV4 7AL

Report: Final report, August 2004

Previous reports:

Location: Desk study and workshop at Warwick-HRI

Project co-ordinator: Mark Komatsu  
Oakfield Farm Products Ltd  
Bethel  
18 Frome Road  
Bradford-on-Avon  
Wiltshire  
BA15 2EA

Date commenced: 1 March 2004

Date completed: 31 August 2004

Key words: the mushroom industry, imports, costs, statistics, bench-marking

Whist reports issued under the auspices of the HDC are prepared from the best available information, neither the authors nor the HDC can accept any responsibility for inaccuracy or liability for loss, damage or injury from the application of any concept or procedure discussed.

The contents of this publication are strictly private to HDC members. No part of this publication may be copied or reproduced in any form or by any means without prior written permission of the Horticultural Development Council.

## **CP 25**

### **Mushrooms: Addressing the problems of the mushroom industry in the UK**

#### **Contents**

Headline	4
Background and expected deliverables	4
Summary of the project and main conclusions	5
Meetings with industry representatives	5
The current state of the industry	6
Other horticultural crops	6
Workshop	7
Financial benefits	8
Action points for growers	8
Some final comments	9
Appendix 1: Addressing the problems of the mushroom industry in the UK	10
Appendix 2: Workshop presentations	26
Appendix 3: Attendees at workshop	27

## CP 25

# Mushrooms: Addressing the problems of the mushroom industry in the UK

## Headline

- The British mushroom industry is in crisis due to the fact that its costs are beginning to outstrip its income. In the past 5 years capacity has almost halved, and a significant number of growers have gone out of business.
- Growers need to collaborate to reduce costs in order to respond to European growers who are competing in the UK market. Currently there appears to be no mechanism to do this, and previous attempts at collaboration between medium-sized firms have failed because of perceived vested interests. The choices facing growers now is quite stark - there is little point in competing for a dwindling UK market-share: it would be better to collaborate and compete against imports.
- The industry should consider vertical re-organisation into three tiers: composting, growing and marketing.
- There is a general dearth of good information (statistics) about the industry (i.e. production statistics, productivity rates, comparative costs, product quality, etc.). This makes individual growers vulnerable to divisive bargaining and pre-emptive pricing by retailers.

## Background and expected deliverables

The British mushroom industry remains the largest sector in protected horticulture with a retail value of around £170m per annum. Despite its size, the industry is diverse, and is served by both small independent growers and large co-operative and corporate organisations. Within the last ten years the industry has seen its market eroded, primarily by imports from the Irish Republic and the Netherlands, but more recently by increasing production from Eastern Europe, particularly Poland. More recently (since 1999) the industry has been 'haemorrhaging' with several larger growers going out of business, and many of the remainder losing money.

This project aimed to undertake a more formal risk analysis of the industry, to look at the underlying economics of the mushroom sector, and to compare it with other sectors of horticulture that are experiencing, or have experienced, similar problems. Whilst many of the problems facing the industry are based on competitive pressures, there are limits to how far an industry can reduce costs, particularly if its production costs are converging on the market value of the product. A crucial question is whether the pursuit of an automated industry is achievable.

The expected deliverables from this work are:

- The collation of facts and statistics of the industry, together with comparative information with regard to other sectors of horticulture.
- An exploration of the risks and benefits of different strategies that the industry might adopt.
- This would enable different economic and business models to be examined with regard to fixed parameters within the horticulture sector, e.g. the market, labour, product exchangeability, diversification, automation, etc.
- The project would culminate with a workshop involving growers, retailers and academics to explore some of these concepts in depth.

- At the end of this process, it should be much clearer what decisions should be taken to benefit the future sustainability of the industry.

## **Summary of the project and main conclusions**

### **Meetings with industry representatives**

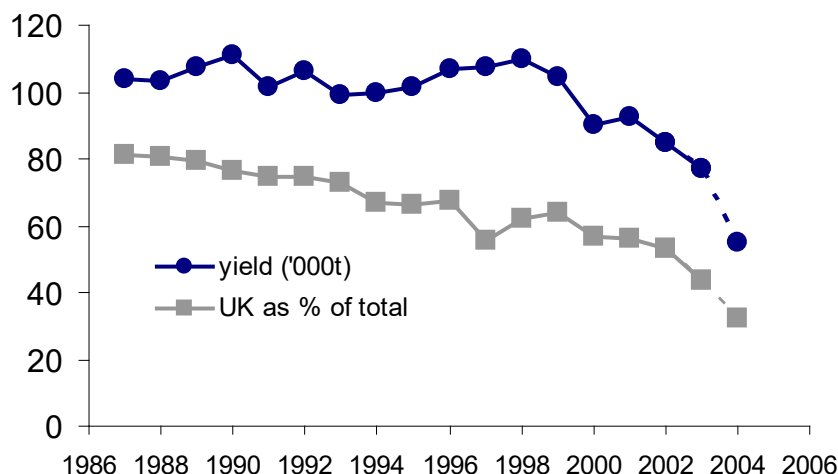
Some 30 interviews were conducted with various stakeholders in the industry: growers, advisors, retailers, researchers (both horticultural and engineering), predominantly by telephone. Whilst all interviews must remain confidential, nearly all were minuted, and the results used to compile a record of the industry at the time of this report. The following bullet points summarise the major findings from these interviews:

- More than 70% of the product is now sold through supermarkets. The large retailers judge the product primarily on cost (assuming similar quality) and have little regard for promoting a British product. Mushrooms have become a commodity, so that the industry has no alternative but to move to a lower cost base, since other countries can produce a similar product at lower cost.
- Currently there are some 70 to 100 growers, although about 90% of production comes from about a dozen growers. The structure of the industry makes it vulnerable, as many of the major investment and business decisions are made by international (i.e. Irish-owned or Dutch-owned) companies: approximately 50% of British production is Irish- or Dutch-owned. Medium-sized growers (owner-growers) will not have much impact on the overall survival of the industry.
- British growers are very diverse, both in their degree of co-operation and in the nature of the equipment they use. There is little uniformity or commonality of growing systems, so that investment costs are higher because of the uniqueness of each facility. There is also an innate conservatism: many growers agree that there is a need for specialisation (i.e. vertical tiering) and integration, but little action has been taken.
- Many medium-sized growers are second-generation family businesses, whilst newer entrants stem from farming or horticultural backgrounds. Few of them have strong business backgrounds.
- Succession is proving to be a problem in several family businesses, and needs addressing.
- Apart from Defra statistics (which can be up to 2 years out-of-date), industry statistics are generally poor, with the possible exception of cost data.

### **The current state of the industry**

Examination of Defra statistics over the last fifteen years shows that production was fairly static at c.105,000 tonnes between 1988 and 1999, but has fallen by more than 25% in the last four years. Current estimates put 2004 production at close to 50% of that in 2000! Home production as a proportion of total consumption has fallen in the same period from 81% to 44%. Accompanying this, prices have not moved in five years – currently quoted supermarket prices are £1.96 per kg, the same as six years ago – and the Ministry's quoted price has been around £1,600 per tonne since 1995, though Defra recorded a 5% fall in 2003. In real terms, prices have declined by over one-third since 1986, 20% since 1995.

## Mushroom production 1987 - 2004



Today some 70% of production is handled by the supermarkets, and the large retailers are held responsible for forcing down the 'real' price over recent years. The purchasing skills of the big supermarket groups, the growth of the industry in other European countries (and improvements in transportation, distribution and post-harvest quality) and general oversupply in the market place, have left British growers vulnerable. Faced with this situation, growers felt that the only way they could respond was to reduce (or even eliminate) labour costs by turning to automation or robotics. Labour costs are estimated at between 27 and 48% of total, one of the highest in the whole horticulture industry.

### Other horticultural crops

The underlying statistics for most horticultural crops is complicated by the fact that, while the land for production has declined in nearly all sectors, productivity (yield per ha) has increased dramatically. Furthermore, over the past 15 years, consumption of horticultural products has generally increased, so that where UK production has not kept pace, foreign imports have been drawn in. So, for example, in Table 1 it can be seen that the area of field-grown edible crops has declined significantly in the last 15 years together with the area of glass-grown vegetables. Starting from a negligible base there has been considerable investment in protected structures for soft fruit (primarily strawberries grown in tunnels). The sector that is seeing considerable growth is ornamental crops with outdoor and protected areas growing by 33 and 48% respectively.

### Planted area† of crops (1987-2002) and %change

	1987	2002	%change
<b>Field veg.</b>	171.5	131.3	-23.4
<b>Field-grown fruit</b>	43.75	27.5	-37.1
<b>ONS (outside)</b>	12.45	16.55	+32.9
<b>Protected veg.</b>	2538	1062	-58.2
<b>Glasshouse fruit</b>	0.027	0.108	+300
<b>Protected ONS</b>	0.674	0.994	+47.5

Changes in certain sectors (e.g. mushrooms and strawberries) have been dramatic in the last 2 -3 years, and the Defra statistics are not sufficiently contemporary to reflect that.

A typical example of change has been in the tomato industry. It has changed drastically in the last 25 years: the UK tomato growing area is now less than half what it was in 1975, although productivity has doubled in that time. There are fewer growers, though the units are larger frequently with multiple sites. Something like 90% of the growers of 30 years ago have disappeared. About 30% of total sales derive from the UK, which, although it is more expensive and production is lower (than from Mediterranean countries), can be sold as a 'quality' product – and sales do not just depend on price. This is an important part of the Tomato Growers' Association's drive for British tomatoes, the aim of which is to protect British growers' market share.

### **Workshop**

The workshop brought together representatives of various groups within the industry, although, unfortunately no spokesperson for the retail sector was present. Also present were Warwick HRI managers and researchers, together with academic staff from the University representing the Departments of Economics, Politics, Engineering and Employment Research. The meeting started with a formal presentation of the Background document (see Appendix 1), together with shorter presentations on Economics, Engineering and Employment (the Powerpoint presentations are given in Appendix 2), before moving to a 'chaired' discussion. The following is a summary of the main discussion points of the meeting and agreed actions:

1. The agreed aim of the discussion was to promote/suggest ways of ensuring the survival of the UK mushroom industry. However, the timescale of survival was not agreed although in subsequent discussion the subject of short-termism *versus* long-termism was raised together with their implications on decisions taken.
2. There was general agreement that it was currently not possible to differentiate UK mushrooms from mushrooms sourced elsewhere, although food miles and better shelf life (see action point 4) might be used in future. Note also the comments made above about the Tomato Growers' Association, and its emphasis on quality. There was an acceptance that the industry had to compete on price and therefore had to reduce production costs.
3. It was felt that the 'corporate' approach of the Dutch industry had given them an advantage in developing and optimising a more standardised production system which was more efficient and cost effective than the vast majority of the UK production systems. Attempts to transfer the Dutch production system to the UK had failed to reduce costs but subsequent discussion revealed that the system had been modified in the UK. The diversity of production systems in the UK meant that there was not the equivalent 'corporate' development ethos.
4. The group agreed that there was a need for greater collaboration to reduce costs so that the UK industry could compete with both the Dutch and the Polish. Currently there appeared to be no mechanism to do this and there was a need to build trust. Previous attempt to initiate collaboration between middle sized firms had failed because of perceived vested interests, though the pressure on the industry was not as intense then as it is now. The current situation as outlined in the report may be more conducive to collaboration – there seems little point in competing for a dwindling UK share of the market. Would it not be better to collaborate to compete against imports?
5. It was also recognised that many of the representatives present were not in a position to effect change in that they were managers rather than owners/proprietors. It was obviously incumbent on them to represent the concerns of the 'general' industry to their bosses.

Action points from the meeting:

- Reconvene the meeting of medium-sized firms under neutral chairmanship to address the questions of collaboration and its consequences, i.e. the 'division of the spoils'.
- Discuss the formation of producer organisation(s) to enable access to EU funding to facilitate the sharing and gathering of technical information and training.
- Companies to take part in an anonymous benchmarking exercise via an independent body.
- Carry out a test of shelf life of mushrooms from different countries of origin to see if 'home-grown' mushrooms have better shelf life than imports.
- Gather information about the strategies of other UK horticultural industries to reduce costs in response to imports.
- Analyse the report of the Irish task force and see if there is anything of relevance to the UK industry.
- Identify a task force and meet to formulate an action plan.

It was acknowledged that the above action points would go back to HDC as 'recommendations' but that left several important management decisions open. Two fairly crucial questions are:

- Who 'owns' the above action points?
- Who monitors any subsequent actions?

It was also noted (somewhat wryly) that the third action point (undertaking an industry-wide benchmarking exercise) could be viewed as a test of collaboration. A minimum level of co-operation should be the sharing of information – if that failed there could be little hope of a collaborative future!

One final observation: despite a very powerful presentation by Jim Rowley (University of Warwick) on the options for automation, and the original proposals by the HDC that this was one of the most important features of the project, there was virtually no discussion on the removal of labour costs through automation.

## **Financial benefits**

The project did not undertake to examine specific financial benefits, rather to look at the viability of the industry in the future.

## **Action points for growers**

The following list incorporates many of the points from above, but also includes further points arising from the interviews and discussions conducted during the project. In practice the following are action points primarily for the industry.

- Identify a task force and meet to formulate an action plan.
- Analyse the report of the Irish task force and see if there is anything of relevance to the UK industry.
- Reconvene the meeting of medium-sized firms under neutral chairmanship to address the questions of collaboration and its consequences, i.e. the 'division of the spoils'.
- Discuss the formation of producer organisation(s) to enable access to EU funding to facilitate the sharing and gathering of technical information and training.
- Companies to take part in an anonymous benchmarking exercise via an independent body.
- Carry out a test of shelf-life of mushrooms from different countries of origin to see if 'home-grown' mushrooms have better shelf-life than imports.

- Gather and share information about the French and Spanish industries.
- Gather information about the strategies of other UK horticultural industries to reduce costs in response to imports.
- The HDC and the MGA should arrange a meeting with the Defra Economics and Statistics Unit (Mrs Lindsey Holmes) to discuss the collation of statistics with regard to the industry, and try to make progress on obtaining data from the supermarkets.
- Growers should consider the options of (a) diversifying into other businesses, and (b) moving out of the 'commodity' mushroom business altogether.
- Producers should try to avoid getting into a situation where most of their supply goes to one purchaser. They must maintain contacts with other purchasers.

## Some final comments

Since the preparation of the consultation document and the workshop, the Report of the Irish Taskforce has been published (see at [www.agriculture.gov.ie/publicat/mush\\_taskforce\\_rep.pdf](http://www.agriculture.gov.ie/publicat/mush_taskforce_rep.pdf)). A similar review of the Northern Ireland industry had been undertaken some months earlier by MIANI. One of the recommendations of the workshop was that the Irish 'taskforce' document should be studied and any appropriate recommendations taken from it. Having read through the document, a first comment would be to counsel against assuming that the recommendations being proposed there are relevant to the situation in the UK, for political as well as practical reasons. What is now required in the UK may well be radically different from what is being proposed on the other side of the Irish Sea, though the fact that half the remaining UK capacity is Irish-owned does also come into the equation.

In July the Defra horticulture statistics for 2003 were published. I have incorporated the updated mushroom production figures into the Grower Summary graphs above, although I have not altered the data in the Appendix document. In actual fact the predicted figures for 2003 mushroom production were very close to the figures now published by Defra; however, the data for glasshouse production (for example) have been significantly revised from 2002 to 2003, and it would be difficult to resolve the disparity, which, anyway, is not so urgent.

Dr Simon Croom (Warwick Business School) was unable to make the workshop because of other commitments. In a subsequent meeting with him, he endorsed most of the findings of the report. One point he stressed about business generally was the failure of groups of manufacturers to (a) co-operate, and (b) address their market. Until there are major changes in the way people shop, then suppliers have to accept that power now lies with the supermarkets. To live with that, growers have to accept the reality of commodity supply: i.e. large-scale, efficient, 'lean' operations, or move to specialist supply, which may mean 'teaming-up' with category managers to help provide the complete profile of goods that the supermarkets want. There was also an obvious need to increase awareness of, and expand the market of the product.

Finally, I have already alluded to the presentation by Jim Rowley at the workshop with regard to automation within the mushroom industry, and his slides are attached in Appendix 2. There were also significant comments at the workshop from John Read and Dr Ken Young with regard to engineering matters, but these were not taken forward in the substantive discussion.



## Addressing the problems of the mushroom industry in the United Kingdom

### Statistics of mushroom production

#### Production and prices

Defra produce annual statistics on horticultural crop production, which are now generally available on the Defra website. They are presented as a ten-year rolling summary, with a new edition incorporating the previous year's statistics published at the beginning of July. For most crops there is an annual survey together with an occasional census to verify trends. The data-base for mushrooms was extensively revised in 2002 to try and take account of recent changes in the industry.

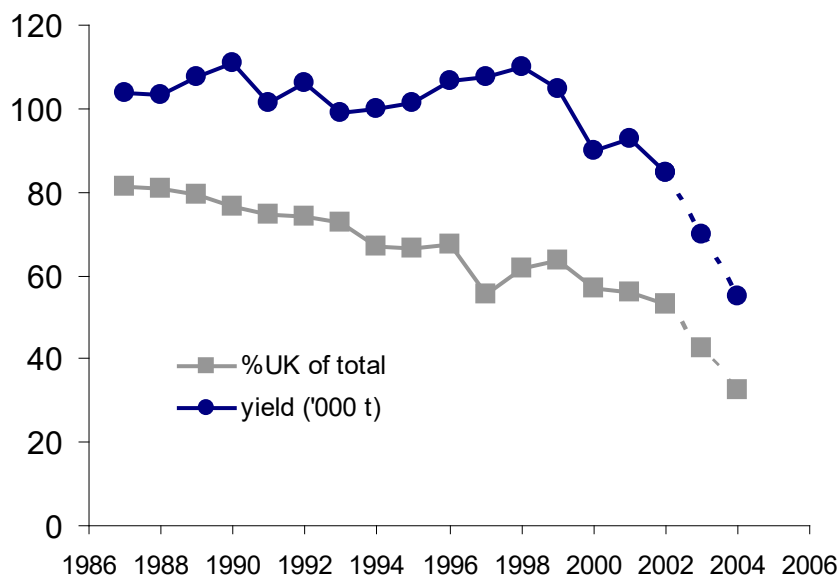
All the figures presented in this part of the report are taken from the Defra source, though later I shall make comparisons with other figures that circulate within the industry. It is worth emphasising that in any negotiations good statistical evidence is essential – Defra statistics are extensively verified and validated and should be taken as the standard. If growers feel that the Defra statistics do not represent their industry fairly, then they need to inform Defra accordingly.

#### Production 1987-2004

The following graph (Figure 1) shows the production output over the last 15 or so years and the proportion of total sales that that output represents. Virtually all British

**Figure 1: UK mushroom production 1987 to 2004**

Data for 2003/4 are estimates



production is for the fresh market in the UK. Separate Defra figures put the quantity marketed (or sold) at approximately 75% of the figures in Figure 1. Between 1987 and 1999 production averaged 105,000 tonnes, but declined by some 20% in the three succeeding years, and it is claimed that the decline has continued at a more dramatic rate: the last year for which official figures are available (2002) shows an output of 85,000 tonnes, with import penetration now 47%, but industry estimates are very

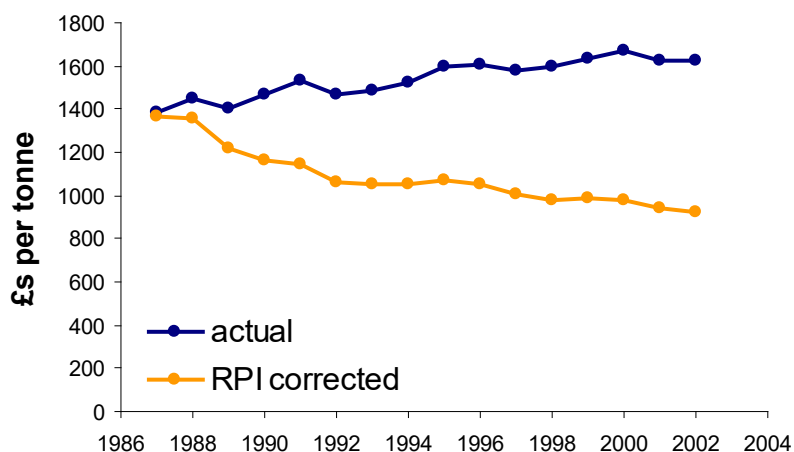
pessimistic, proposing corresponding figures of 55,000 tonnes and 68% for 2004 (The Mushroom Journal, May 2004). Conversations with some growers suggest that the current level of production (mid-2004) is equivalent to an annual production rate of only 40,000 tonnes!

Note that, at the same time, import penetration has increased steadily from just under 20% in 1987 to some 50% in 2002. Unconfirmed reports say that imports now account for 60% to 70% of all sales. Detailed figures for 2002 (Defra publication 31/07/2003) put Irish and Dutch imports at c. 30% and 15% respectively, but the market is known to be in considerable flux at the moment, and both Dutch and Polish imports have increased in the last couple of years. Figures for 2002 suggest that some 71% of total sales went directly to supermarkets, with 13.5% going to wholesalers and 7% to co-op and marketing agents.

### Prices 1987-2002

If we look at prices for the same period, we see that they have been stagnant since about 1995, although they have obviously declined in real terms. Much of the reason for this must be attributed to supermarkets holding prices which have hardly moved in that time, and which were drastically reduced in 1996, in a pre-emptive move by ASDA. Standard supermarket prices (for loose product) are £2.40 per kg, and most growers will say that the supermarkets are making between 32 and 36% gross profit on the product which would put the grower price at between £1.76 and £1.82 per kg.

**Figure 2: Mushroom prices 1987 to 2002**



### Number of farms

Defra no longer produce data on the number of mushroom farms in the UK, but I was informed that the total number of farms at the last census (2003) was just under 100. Historically there would have been several hundred farms, say 25 years ago, generally associated with the market gardening areas of the UK. Looking at the statistics for MGA (Mushroom Grower Association) membership, the number of farm members was running at around 175 in 1990, but had declined to around 96 by 1999 and had fallen yet further to 64 in 2003. Ignoring for the moment any political factors associated with these figures a decline of over 30% is suggested in the last four years, which seems to be in line with comments made to me by growers. Nevertheless this does not take account of the further losses of the last 12 months. A technical publication published by SAC (Scottish Agricultural College) in 1997 suggested that

at that time there were some 280 commercial mushroom farms in the United Kingdom. Defra suggest that the number 12 months ago was about 100 – the more pessimistic estimates of attrition in the last year would make the current number of growers of the order of 60.

## Other commodities

### Overall fruit, vegetable and ornamental production

The underlying statistics for most horticultural crops is complicated by the fact that, while the land for production has declined in nearly all sectors, productivity (yield per ha) has increased dramatically. Furthermore, over the past 15 years, consumption of horticultural products has generally increased, so that where UK production has not kept pace foreign imports have been drawn in. So, for example, in Table 1 it can be seen that the area of field-grown edible crops has declined significantly in the last 15 years together with the area of glass-grown vegetables. Starting from a negligible base there has been considerable investment in protected structures for soft fruit (primarily strawberries grown in tunnels). The sector that is seeing considerable growth is ornamental crops with outdoor and protected areas growing by 33 and 48% respectively.

**Table 1: Planted area† of crops (1987-2002) and %change**

	1987	2002	%change
Field veg.	171.5	131.3	-23.4
Field-grown fruit	43.75	27.5	-37.1
ONS (outside)	12.45	16.55	+32.9
Protected veg.	2538	1062	-58.2
Glasshouse fruit	27	108	+300
Protected ONS	674	994	+47.5

† figures represent '000s ha for field grown crops and ha for protected crops

Table 2 shows the corresponding crop values for these sectors, with mushrooms (often quoted as the most valuable single crop) inserted for comparison. For field grown crops these figures represent productivity increases of over 60%, while for protected vegetables it is a staggering 124%, i.e. 2¼ times. So, while the production area has got smaller the output has increased relatively. Unfortunately these figures do not reflect changes that are taking place currently, particularly in the mushroom and strawberry sectors.

**Table 2: Value of crops £000s (1987-2002) and %change**

	1987	2002	%change
Field veg.	542.1	686.3	+26.6
Field-grown fruit	223.4	227.5	+1.8
ONS (outside)	195.9	470.9	+140.4
Protected veg.	308.8	289.4	-6.3
Glasshouse fruit	0.2	23.57	*
Protected ONS	147	267	+81.8
Mushrooms	144	137	-4.6

In the next table (Table 3) can be seen the proportion of the home-grown product that goes to satisfy UK demand for four particular commodities (including mushrooms).

By 1987 apple production was already in decline, and that has continued. Winter-grown tomatoes have always been imported, but there has been deeper market penetration by both the Spanish and the Dutch. The decline in strawberry production as a percentage of the total does not reflect the considerable investment that has taken place in the last couple of years in tunnel-grown crops in the UK. Further, strawberry production has benefited markedly from breeding developments that have produced considerable seasonal extension. Changes in mushroom production reflect an import onslaught from Ireland (from the mid 80s onwards), and, more recently, from the Netherlands (see later).

**Table 3: %age of home-grown crop of total marketed (1987 and 2002)**

	1987	2002
Mushrooms	81.2	53.1
Tomatoes	32.5	24.6
Apples	40.8	29.0
Strawberries	65.6†	51.3

† this may well be an underestimate as the basis for the statistics changed in 2000

### Change in other sectors

#### Tomatoes

The tomato industry has changed drastically in the last 25 years. The UK tomato growing area is now less than half what it was in 1975, although productivity has doubled in that time. There are fewer but larger growers; indeed something like 90% of the growers of 30 years ago have disappeared. As an example, of 125 growers who benefited from the land settlement of the early 1980s in Sidlesham, West Sussex, only one remains! The largest grower of tomatoes in the UK is Wight Salads, whose web-site reads as follows:

“The Wight Salads Group is the largest producer of tomatoes in the U.K. The group, consisting of 6 growers and its marketing arm represents fruit from the Isle of Wight, mainland U.K, Spain and Portugal. [We are] a dedicated year round supplier, procuring fruit from Europe, Republic of South Africa, Israel and the Canary Isles. Fruit is also sourced from our own wholly owned nurseries in San Martin, Southern Spain and Hortivilha Agro-Industria SA, Portugal.”

The growth of the supermarkets, which now control some 80% of tomato sales has caused the structure of tomato-growing to change, particularly in terms of scale and investment. Whilst the tomato industry was always ‘high-tech’ relative to much of the rest of horticulture, it has had to invest to move forward. Another significant change has been the product mix: twenty years ago, over 90% of the fruit sold were ‘classic’ round tomatoes, with 10% of other types, mainly cherry tomatoes. Currently <50% of sales will be rounds; cherries and plums will account for between 10 and 12% each, cocktail tomatoes 8-9% and beef tomatoes about 5%. Of these specialist types about 30% will be ‘vine-ripened’ with the remainder loose. A very important part of marketing today relates to novelty, driven by consumer demand.

About 30% of total sales derive from the UK, which although it is more expensive and production is lower (than from Mediterranean countries) can be sold as a ‘quality’ product – and sales do not just depend on price. This is an important part of the Tomato Growers’ Association’s drive for British tomatoes, which aims to protect British growers’ market share.

## **Soft fruit**

The soft fruit industry, particularly strawberry production, has seen a dramatic turn in its fortunes in the last few years. Strawberries used to be a field-grown crop, typically grown in the south-east, and with a very short seasonality. Advances in breeding methods, and increased availability, particularly after Spain's accession to the EU, have led to several growers investing in modern factory-scale production systems. The investment has been huge, and has effectively driven out the smaller growers. It has been aided and abetted by the supermarkets, who have offered shelf-space to the expanded availability of the crop, and one only has to notice that in the last few years strawberries are not just available at the end of June, beginning of July, but have a season that stretches from March (imports of June bearers) and April (protected crops) through to September (ever-bearers). Large enterprising growers such as Angus Davidson (Ledbury) have expanded into tunnel-growing systems (Davidson runs Haygrove Tunnels) and ten 'state of the art' pack-houses have been built to service the demand for fresh English soft fruit that has been built up. The business relies on supplying the supermarkets with fresh fruit of known quality, but the rewards are significant: some growers reckon on repaying the investment costs of a tunnel within ten months. Many of you will have been made aware of the pressures on labour, particularly in the Herefordshire area, where the establishment of migrant worker villages has hit the national headlines. Although significant costs are involved, significant sums are also being put into research, with the development of 'programmed planting' algorithms at the University of Reading and ADAS.

## **Nursery stock**

The nursery stock sector represents a success story in British horticulture. The figures in Table 2 represent year on year growth figures of 4% and 6% for the outdoor and protected sectors of ONS (ornamental nursery stock) over the last 15 years. Nevertheless, the ONS growers are now also coming up against the power of the supermarkets, as the supermarkets and 'sheds' (home and garden retail centres such as B+Q and Homebase) compete with the traditional garden centres. In a classic case of the switch from a supply-led to a demand-led market, the supermarkets are laying down strict conditions and standards for the larger growers to join the club. There is resistance in that the drive for quality (or perhaps, more truthfully, uniformity!) is forcing many of the larger growers to re-think their traditional business which relied on literally hundreds of lines. The discipline of supplying perhaps hundreds of thousands of uniform container plants (of a single species) annually demands a more industrial approach to growing. The dilemma is that faced by many horticulturists, and there is fierce competition from both the near continent (The Netherlands and Denmark), and newer EU competitors such as Poland which still have a strong land-based economy.

## **The mushroom industry**

### **A short history**

The Pharaohs regarded mushrooms as food from heaven, and the Romans spread them throughout their empire. During the Middle Ages they were seen as an autumn feast. The first written accounts of cultivated mushrooms date from around 1650. France was the leader in the formal cultivation of mushrooms, and some accounts say that Louis XIV was the first mushroom grower. Around this time mushrooms were grown in special caves near Paris set aside for this somewhat unique crop. From France, the gardeners of England found mushrooms a very easy crop to grow, requiring little labour, investment and space. Mushroom cultivation began to gain popularity in England, benefiting from experimentation with spawn and increasing

publicity in journals and magazines. Initially grown out of doors, it was soon found beneficial to grow it in houses and mushrooms soon became a catch-crop following cucumbers or tomatoes. With the expansion of the industry to the United States, the industry began to become intensive with tiered growing systems, and various different formats, shelves, trays, etc. developed.

By the early 1970s the British mushroom industry was producing some 50,000 tonnes per annum, and the market was predominantly supply-led. In the early 1980s growth took off: increasing affluence and the growth of the supermarkets led to a doubling of production. Between 1985 and 1999 production averaged 104,000 tonnes per year. In that same period the proportion of the total market supplied by British growers fell from 86 to 64%, so, although the market was growing, production was static. Figures for the decline of the industry in the last five years are detailed above.

### **Mushroom production**

Mushroom production simulates the autumn growth of wild fungi, in which mycelium is stimulated by changes in the soil structure, following which leaf-fall appears to stimulate the production of fruiting bodies. Cultivation requires the manufacture of appropriate composts and the management of the growing environment. Initial (Phase I) composting involves mixing straw, chicken litter and gypsum which is stacked, softened with water and turned to accelerate decomposition. Originally horse manure was used, but the dramatic decline in the numbers of horses between the wars, led to the development of synthetic composts. Phase II composting involves pasteurisation (at temperatures up to 60°C) to remove pests and chemical by-products such as ammonia before inoculating with mushroom spawn. Spawn running takes some 2 to 3 weeks, and requires careful temperature control. Increasingly the end of this stage is referred to as Phase III, and is essentially the status prior to casing, i.e. covering the prepared compost with a peat-based layer that stimulates pinning, the growth of primordia that develop into mushrooms. Mushrooms appear in flushes, starting about 18 days after casing. During flushes the mushrooms grow and can be harvested continually; most growers would terminate the crop after 2 to 3 flushes. A larger mushroom is simply an 'older' mushroom. Most mushrooms are sold as 'closed cups', but there is also a market for 'buttons' and 'flats' or open mushrooms.

Most mushrooms are grown in purpose-built tunnels or sheds, though there are still some growers using caves (the traditional method of growing in France until quite recently). Growers use a mixture of systems for growing:

- trays (i.e. moveable and stackable units that provide a compact arrangement);
- shelves, originally introduced by the Dutch and used extensively by them;
- blocks, compressed compost units, increasingly used in place of
- bags – essentially black polythene bags filled with compost.

Larger farms would tend to be based on tray- or shelf-growing systems. Bags became popular in the 1980s, particularly in Ireland, as a cheap, low-cost way of growing using pre-prepared composts. They might frequently be single-layer systems, but are now regarded as being uneconomic. Most bag and block growers would now grow under some form of shelf system. Differences in different countries partly reflect the age of the industry, but also its structure which is discussed below. The Dutch tend to have common systems far more than do the British.

### **The market**

Until the early 1980s the market was traditional, with growers taking their product to one of the large regional wholesale markets. As the supermarkets began to expand through the 1980s they also began to change the food-supply chain. Growers were

generally pleased to take contracts from the supermarkets, as it gave them security, and a guaranteed market. The technology-pull associated with this (e.g. choice, diversity, quality, cool-chain technology) certainly benefited the consumer, and, indeed, it benefited the growers too. Many growers will testify as to how the supermarket ethos has changed standards and quality.

As noted above consumption grew from around 100,000 tonnes per year to 150,000 tonnes, and currently runs close to 170,000 tonnes. The last available figures from Defra, suggest that 71% of the crop goes directly to supermarkets, though another 7% passes to marketing agents. The industry often quotes a figure of 80% as the supermarket share of the total market. It is more difficult to find historical comparisons, but 20 years ago that figure would have been below 50%.

The domination of the food chain in the UK by the large supermarkets has generally benefited the consumer. It has certainly led to lower prices, and, in some areas, particularly with regard to highly perishable produce, to improved quality. The last five years have not benefited the growers who have seen their margins cut, and have effectively had to live in a deflationary market exacerbated by a volatile exchange rate. The situation has not been helped by the growth of a strong export drive from the expanding Polish industry which has put a lot more product onto the market. Although the supermarkets have 'contracts' with specific growers, supermarket buyers are not afraid of putting pressure on growers to reduce prices.

The United Kingdom is Europe's most important market – the average British consumer eats 2.5kg of mushrooms per year! Consumption is similar in the Netherlands but with only a quarter the population it is a less buoyant market. Germans by contrast eat only 1 kg per year of the fresh product, though they consume 2 kg of canned mushrooms. The French, Italian and Spanish markets are more closed, focusing more on their own production and more diverse tastes. In the last year or two the Dutch have made some inroads into the French market. Exotic fungi make up a very small percentage of the British market, and until recently, much of it was satisfied via imports from the Far East. Some growers have started to specialise in exotic mushrooms, but only after testing and establishing a market for their product.

### **The growers**

Mushroom growing is now a vertically-integrated industry involving several specialities: straw providers, compost-makers, growers, pickers and packers, and chill-train distribution systems. Many British growers still try to perform nearly all of these operations: for example, there are still several dozen farms that make their own compost, whereas in Holland and Ireland there are a handful of specialist compost manufacturers. Specialist composters are increasing their share of the business in the UK, particularly as the newer growers concentrate on the production side of their businesses. Further, many British growers still market their own crop, again in contrast to both Ireland and Holland where the business is effectively dominated by 'marketers'. All growers complain of the high cost of labour, which is estimated to consume between 35 and 40% of the total cost of mushroom production, although labour costs in the UK are considerably less than those in Holland. However, the cost is significantly greater than it is in Poland.

In the 1980s three of the largest mushroom growers in the UK were subsidiaries of large food companies:

- Darlington / Blue Prince were owned by Heinz
- Howard Linfield (Chesswood) by Rank Hovis McDougall

- Middlebrook by Booker Foods

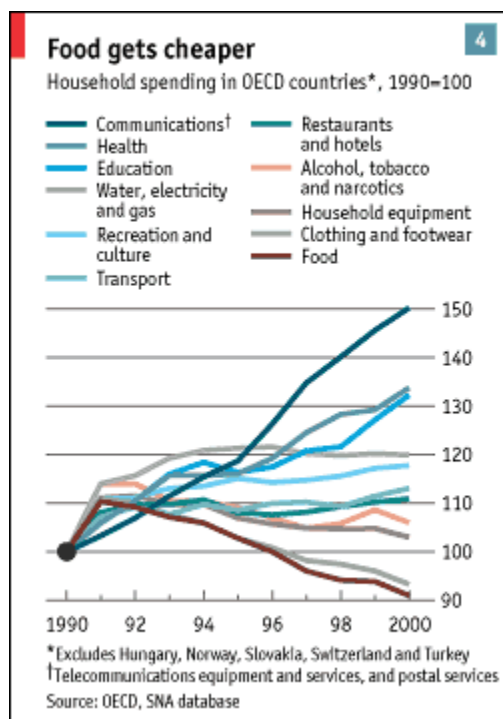
These enterprises were not a great success financially – all the corporate groups have since withdrawn. There was a management buy-out at Blue Prince. The company was seriously affected by Virus X, but just as it was coming through that, it lost one of its major contracts at an internet auction (see below), and finally went into liquidation last September. Chesswoods was taken over by the Dutch conglomerate Heveco in 2001, and Middlebrook Mushrooms merged with (was incorporated into) Monaghan Mushrooms. These latter two, essentially European companies are said to hold about 70% of the UK home market.

British growers are very diverse, both in their co-operativeness and in their equipment. There is little uniformity or commonality of growing systems, so that investment costs are higher because of the uniqueness of each facility. Many growers agree that there is a need for specialisation and integration, but little progress is made. A group in East Anglia (The Waveney Group) have gone down the co-operative route and, apparently, quite successfully. But there has always been something of the Dutch spirit in the intensive horticultural areas of Eastern England. Another group, Southern Mushrooms, has formed from three other, geographically spread, companies. Other growers are forming producer groups which sometimes involve satellite or sub-contracted growing. The formation of producer organisations benefits from a grant of 4½% from the EU.

Currently there are some 70 to 100 growers, although about 90% of production comes from about a dozen growers. Apart from structural problems there are also considerable difficulties associated with successful companies who have not planned succession strategies. There is a Producer Organisation in the UK, but it is not particularly co-operative, and exists primarily to benefit from a grant of 4½% from the EU.

The corporate days of the 1980s did impose financial discipline on the then companies, and some of that has passed down. Most growers now have good accounting systems, and data collection / monitoring procedures. Certainly growers are now very aware of production costs for different operations. Several of the medium-sized growers are second-generation family businesses, whilst newer entrants stem from farming or horticultural backgrounds. Few of them have strong business backgrounds.

### The supermarkets



In 2003 the Competition Commission ruled that Morrisons (then the 6<sup>th</sup> largest grocery retailer in the UK) could take over Safeway (at that time the 4<sup>th</sup> largest). This meant that Morrisons would ‘leap-frog’ Sainsbury’s to become the third largest supermarket chain behind Tesco and Asda. Commenting on this at the beginning of the year, Sir Don Currie, who chaired the Policy Commission on Food and Framing, said that he was deeply concerned that prices were being cut on the high street



without serious thought being given to the impact on the supply chain.<sup>1</sup> However, as the accompanying figure shows, deflation is affecting the food industry more than most

sectors of industry. The data are taken from an article in *The Economist*<sup>2</sup> which comments that deflation has characterised the food industry for centuries. More and more food is being produced by fewer and fewer people, so that it is both more plentiful and cheaper. “Since demand is to some extent limited by the size of people’s stomachs, spending on food compared with other goods has been falling for many years and continues to drop.”

All the supermarkets use category management methods which essentially pass down the responsibility of ‘managing’ the procurement of the crop to a major supplier. Over the years they have reduced the number of suppliers for all commodities, which puts much pressure on the growers to rationalise or co-operate. This has occurred to some extent, although there remains a staunch independence among the growers who have survived the recent round of cuts. Mushrooms were on the *The Grocer 33* list until a few weeks ago, which meant that there would always be fierce competition between supermarkets on price.

A couple of recent books<sup>3,4</sup> are highly critical of the supermarkets’ dominance of the food retail system, and the ‘climate of fear’ engendered by them among the suppliers. A Supermarkets Code of Practice was introduced on 17 March 2002 following the Competition Commission’s report on supermarkets in 2000. The Code was reviewed earlier this year, and press release 28/04 from the Office of Fair Trading (20 February 2004) begins

“The OFT’s review of the Supermarket Code of Practice, published today, found a widespread belief among suppliers that the Code is not working effectively. There is no hard evidence to support this, however. The OFT is therefore commissioning further work to establish how supermarkets deal with suppliers under the Code.”

It continues

“Fear of complaining was the main reason identified for the Code’s perceived lack of effectiveness. 73% of respondents reported a fear of complaining amongst suppliers.”

This seems very much in accord with comments by growers. Almost unanimously they complain about the power of the supermarkets, particularly

- the fact that there are no negotiations on price – a price is given to which the growers have to work; several growers cited instances where lower prices from foreign suppliers were expected to be matched;
- growers have to pay ‘extras’, including ‘club membership’, marketing and promotion costs, and the costs of increasing ‘welfare’ and ‘compliance’ auditing;
- areas such as packaging are dictated by the customer;
- contracts carry little guarantee, and can be ended or reduced somewhat arbitrarily.

Despite this, many growers conceded that the supermarkets had brought advantages in terms of guaranteed markets, had enabled (and encouraged) several of them to grow as businesses, and had generally caused them to improve standards.

## **Competition**

Since the 1980s the primary import pressure has come from Ireland; and Ireland it was that caused the decline in the proportion of the market taken by British growers. Since 2000, there has been increasing pressure from the Dutch, capitalising on the strength of Sterling but also looking for new markets to replace those that they were losing to a burgeoning Polish industry. In the last couple of years Polish produce has started entering the British food chain, both directly and via the Netherlands. We will look at each of these countries briefly.

### **Ireland**

#### **South**

From an essentially moribund industry in the 1980s, the Irish mushroom business grew rapidly using a new 'model' based on a low cost / low capital central composting and marketing system with growing outsourced to small farms to which the compost was delivered and the product collected. The principal method of growing was in bags. A small group of entrepreneurs invested in new composting and collection facilities targeted the English wholesale markets which English growers were abandoning as they were drawn into direct contracts with the supermarkets. The Irish product was seen by many as being of better quality and soon made inroads into the British supermarket trade. In the late 1990s the Irish benefited from favourable exchange rates and gained a higher proportion of the British market, but since then currency fluctuations, Virus X, a static market price and increased competition from the Netherlands and Poland have seen the industry suffer similar problems to those in the UK.

A recent report from Teagasc<sup>5</sup> stated that the number of growers in Ireland had declined rapidly from 400 to around 250, although it stated that farm sizes had tended to increase. Ireland still has many growers who grow in single-tier bags (the original system pioneered in Ireland in the 1980s) but the report suggested that such 'low tech' growers did not have a future "because of market pressures". Growers with multiple tiers, but were 'low tech' were still doing reasonably well. The larger growers who had invested in high capital cost equipment were seen as vulnerable if the market collapses. The Irish industry is currently rationalising: the biggest player Monaghan has recently acquired Carberry, and there is rumour of yet further contraction involving the other major groups: Walsh and McGeary. The Irish Minister for Agriculture, Mr. Noel Treacy has put together a task force to report on the best way forward for the industry.

#### **North**

In one sense the Northern Irish industry grew in tandem with that in the south, benefiting from the central composting system. The number of growers in the North has also declined rapidly from around 360 in 1996 to perhaps 170 today. Nevertheless it was thought that capacity (and production) had remained fairly static. MIANI (Mushroom Industry Association of Northern Ireland), under the chairmanship of Mr. Gordon Orr has recently produced a Development Plan<sup>6</sup> outlining the steps that must be taken for the industry there to survive. It is a fairly blunt document – it outlines how a production orientated industry, combined with stagnation in demand, has led to

price pressure. It also points out how the Dutch have invested in R & D, particularly in compost and growing technology, although they have ignored the market. In Northern Ireland they have ignored both. The report calls for co-operation, market planning and innovation, and modernisation. A difficult task when profits are limited.

### **Holland**

The Dutch are, by far, the most significant producers of mushrooms in Europe. In Holland most growers use a 'shelf-system' and considerable efficiencies are gained through the use of common systems. Traditionally the Dutch have had a large industry with a sizeable proportion (2/3) going for high-quality processing (cans and bottles) whereas the French and Spanish have even higher rates of processing but generally of lower quality. The Dutch have stayed at the high-quality end of the market where they still make a profit, though in the last 18 months the Dutch have lost markets, effectively to the Polish. 70% of the processing product is mechanically harvested, which has represented a huge capital investment. The Dutch have also put huge investment into composting, aiming for high-quality Phase II and Phase III production. Some of this has been driven by environmental constraints and the need to move to 'housed' composting facilities. The Dutch government provide a subsidy on composting, but there are much harsher requirements on odour-abatement and bio-filtering than in the UK. Specialisation has led to the concentration of compost-making in four major providers – this contrasts with about 23 compost producers in the UK.

Dutch productivity is excellent, driven by an export philosophy. High labour costs have forced them to go along the processing / mechanical route, although attempts at mechanical harvesting for fresh mushrooms have not so far been successful. The Dutch horticultural business has innovated quite successfully with automated systems, particularly for produce movement.<sup>7</sup> Several attempts have been made at fully-automated farms, though they generally fell short of mechanical harvesting, relying rather on the transfer of trays to picking parlours. An article at the end of last year<sup>8</sup> suggested that Heveco were developing a mechanical harvesting system for fresh produce that did not involve robotics!

The Dutch horticultural trade has always had a strong centralised marketing arm which controlled the auction system. However, not all Dutch growers work through the markets today: companies such as Heveco are increasingly looking to make direct contracts with the supermarkets. Production in the Netherlands is estimated at around 350,000 tonnes p.a.

### **Poland**

In a presentation on the Polish mushroom industry at the HRI Mushroom Subject Day at HRI in June 2003, Dr Krystian Szudgya reported that fresh mushroom production was 115,000 tonnes of which some 26% was exported to EU countries. Current estimates put Polish production at closer to 150,000 tonnes p.a., with exports continuing to grow. Two-thirds of production is fresh produce, and all the growth in is fresh mushrooms. Growth in Poland in 2003 was about 10% – this year it could be between 15 and 17%!

Poland is essentially able to compete in the west European markets

- (a) because it produces at lower costs (by using both indigenous and Ukrainian labour) and
- (b) because the exchange rate for the Zloty was highly favourable, as the Polish currency effectively de-valued against the Euro (25% advantage).

A few years ago Poland had 10,000 mushroom farmers. Now there are fewer than 2,000, possibly even as few as 1,500. It is an emerging country with entrepreneurs and low labour rates. It has modernised using low-cost technology, primarily by purchasing de-commissioned Dutch equipment. The industry has learned from the Dutch to be 'market-led'. Recent reports speak of a new automatic harvester that relies on 'touch-screen technology' with an operator selecting the order of mushroom picking.

### **Labour**

Mushrooms are very delicate and easily prone to bruising. A crop of mushrooms will be picked over several times, every harvest making room for more sporophores to grow. Picking is either done *in situ*, or, where there are high levels of automated movement, picking parlours are used. A good manual picking rate would be of the order of 20 kg per hour.

Labour in the horticulture industry has always been an issue. In traditional horticultural areas such as Lincolnshire and Kent there would tend to be quite a lot of casual, often migrant labour, although the demands of a crop like mushrooms, which is continually cropped, are less seasonal. In the last ten years the problem became critical with falling unemployment and fewer and fewer of the workforce wanting to join an industry that was traditionally low-paid, and perceived to be old-fashioned. Certainly many growers from Eastern England have said that it is almost impossible to recruit and retain good-calibre staff from the local community. Many growers have had to rely increasingly on immigrant labour, which was not always regulated. Much of the current unskilled labour force comes from Eastern Europe (Poland, the Baltic countries, Kosovo and the Ukraine) or from war-affected regions of the Middle East and North Africa. The system is now regulated by the Home Office under the Sectors-Based Scheme, which was introduced in May 2003, and is due to be reviewed in January next year. Many growers now use this system, effectively sub-contracting the hire of labour through agencies.

The Mushroom Growers Association (MGA) is currently in dispute with the Agricultural Wages Board (AWB) over its exclusion from the so-called Manual Harvester Rate, which means that pickers have to be paid at a rate higher than the minimum wage. With costs already high, the growers feel that this is an added burden. Growers are also having to pay extra costs to supermarkets for ethnic and welfare audits, so employment costs are rising, though they are only about 60% of the costs incurred in Holland.

Traditionally the industry would have used piece-rates, and even now many employers use bonus systems to supplement the wages of good pickers. As the crop grows continuously and different-sized mushrooms are demanded by the market, many growers want considerable flexibility in their labour force. Larger farms try to harvest over long periods of the day but the unsociable hours do not attract many workers.

At the supervisory and management level, businesses are finding it hard to recruit. Many family-run farms speak of concerns over succession, and again, the difficulties of employing good-calibre staff.

### **Automated harvesting**

The continuing pressure on costs has led growers to again question whether the elimination of labour through automated picking is the way forward. The Dutch industry employs mechanical harvesting for mushrooms bound for the processing end of the market. The economics of this market and the quality requirements are somewhat different, so it is possible to destructively harvest a crop, i.e. remove all mushrooms whatever their growth stage. The crop is then cleaned, sorted, processed and packed. For the fresh market individual 'fruits' have to be selected and picked, which, until recently, was seen as too complex a task for any robotic system. Further, anything more than 'one touch' handling is deleterious to quality, which is a high priority.

Until ten years ago vision systems were seen as too complex, but in the mid 1990s a MAFF project with SRI and HRI, and an EU project demonstrated that such a system was quite feasible. By the end of the decade the prototype was ready for market development, but it never quite happened. In a research paper<sup>9</sup> the developers claimed that the single-head harvester was capable of picking at a rate equivalent to half that of a manual picker. It was felt that a multiple-head harvester could easily exceed standard picking rates, but the industry was not totally behind it, and development capital was not forthcoming. The researchers did not feel that their system could ever be fully automatic, and that there would have to be an element of pre-picking – I sensed some disagreements here between researchers and applied engineers! The Dutch are currently working on a non-robotic system (see above), and the Poles are reported to be looking at a somewhat different visual system.

The fact that automatic harvesting has not yet succeeded in the Netherlands with its more homogeneous growing systems, questions whether a more diverse British industry could make it work. Movement in modern mushroom houses is limited and the tiering of the crop means that any harvester would need to be very flexible. To link it (in the UK) with robotic transport systems would involve considerable extra investment which currently looks unlikely.

It should be added that several growers are now looking at semi-automatic systems which take the picked mushroom directly from the (human) harvester. These machines claim a processing rate 50% in excess of the best standard picking rates. For want of more advanced technology these machines are seen as giving some competitive edge.

## Summary

This document is primarily for briefing, and does not aim to reach any conclusions. This section records some milestones in the industry, and makes some general comments on the situation as the author currently sees it

### Some historical milestones:

- 1985-1999 – UK production running at annual rate of 105,000 tonnes.
- 1994-2000 – ASDA were very pro-British. From 2000 they started importing Dutch produce.
- In 1996 ASDA unilaterally reduced the price of mushrooms from £3.50 per kg to £2.40 where it has stayed ever since.
- In the late 90s Virus X became a significant problem, affecting both the composters and the growers. e.g. it is reported to have cost one grower £6m over several years in terms of losses.
- 2001 – Heveco and The Greenery (Dutch) decided to challenge the UK market. Heveco now supply ASDA, and The Greenery go into Safeway
- 2003 – Blue Prince Mushrooms collapses, though this is only the largest of many other companies that have ‘gone to the wall’.
- post-2000 – most of the major retailers have moved to a market based solely on price, and category management means that they are relying on fewer suppliers. Many growers report that loyalty to suppliers is dwindling.
- 2002/3 – Internet auctions were introduced by some supermarkets.

### Some perceptions of the problems facing the industry

1. As the Euro weakened against Sterling it gave a 15 to 20% price advantage to Ireland and the Netherlands, which led to a surge of imports three years ago.
2. Mushrooms were always in the forefront of the market because of their *Grocer* 33 listing, so there was always going to be fierce competition over prices.
3. As the price dropped from £1.59 per lb to 99p (driven by ASDA in 1996) growers were initially able to ride the losses using reserves from the good years of the 1990s. But the surge of imports three years ago forced prices even lower and growers are ‘hurting’.
4. The emergence of Virus X led to yield losses of 30 to 40% and a concurrent depression of prices. Among other things it was partially responsible for the demise of Blue Prince and Shepherd’s Grove, who were producing some 600,000 lbs per week.
5. Increasing labour costs and general lack of ‘good’ casual, and skilled labour.
6. Heavier insurance costs: some of this is extra costs being passed on by the insurance industry, recouping losses following September 11<sup>th</sup>, 2001; but some is also due to increasing public and employee liability costs. Some growers report four- to five-fold increases in premiums.

7. Increased fuel and distribution costs: the industry had high energy requirements (more sophisticated control equipment) and transport costs.
8. The mushroom industry is primarily run by growers, who are efficient at what they do, but are committed to growing. There is a general failure to respond to market needs and changes, i.e. lack of business focus.
9. There is a fierce independence and lack of co-operation among growers. Unless there is specialisation and integration it is difficult to see how the business will survive.
10. The UK industry lacks investment, and the supermarkets are increasingly prepared not to use a British product that they do not perceive as competitive.
11. Borrowing to invest is limited in the UK to short-term loans – banks will typically expect repayment within a few years unlike the 20 to 25 years loans offered by, say RaboBank in the Netherlands.

## References

1. The Guardian (19 January, 2004). *Supermarket price war threatens farmers.*
2. The Economist (11 December, 2003). *Make it cheaper and cheaper.*
3. Blythman, Joanna (2004). *Shopped – The Shocking Power of the Supermarkets*, Fourth Estate, London.
4. Lawrence, Felicity (2004). *Not on the Label*, Penguin, London.
5. Teagasc web-site (2004). *Decision Time for Mushroom Growers.*
6. MIANI (2003). Development Plan (draft).
7. The Grower (13 November, 2003). *No stopping Holland's robotic revolution.*
8. Glasshouse Mushroom Grower (October 2003). *Glasshouse mushrooms – an unlikely scenario.*
9. Reed, J N, Niles, S J, Butler J, Baldwin M, Noble R (2001). Automatic Mushroom Harvester Development. *J. agric. Engng Res.*, **78**, 15-23.

**John Fenlon**  
**21 June 2004**

## Appendix 2

### Powerpoint presentations:



- 1. John Fenlon**
- 2. Michael Waterson**
- 3. Jim Rowley**

## Delegate list:

<b>Delegates</b>	<b>Company</b>
Mr Ivan Doake (Ap)	Axis Systems
Ms Emma Garrod (Ap)	Horticultural Development Council (HDC)
Mr Martin Beckenham	Horticultural Development Council (HDC)
Mr John Fenlon	RISCU, Dept of Statistics, University of Warwick
Mr John Burden	Mill Farm Mushrooms
Mr Peter Howard	Haymes Farm Products Ltd
Mr Matthew Bell	Horticultural Crop Science Unit, DEFRA
Mr Mark Irwin	-
Professor Wyn Grant	Politics & International Studies, University of Warwick
Professor Michael Waterson	Dept of Economics, University of Warwick
Professor Robert Lindley	Institute for Employment Research, University of Warwick
Dr Dave Pink	Horticulture Research Institute (HRI)
Dr Helen Grogan	Horticulture Research Institute (HRI)
Mr Richard Gaze	Horticulture Research Institute (HRI)
Professor Peter Mills	Horticulture Research Institute (HRI)
Dr Ken Young	Dept of Engineering, University of Warwick
Professor Keith Cowling	Dept of Economics, University of Warwick
Mr John Hall	Middlebrook Mushrooms Ltd
Mr Peter Davies	Shackleford Mushrooms
Dr Simon Pearson (Ap)	Marks & Spencer
Mr Mark Komatsu	Oakfield Farm Products Ltd
Mr Martyn Dewhurst	Tunnel Tech Ltd
Mr Richard Green	Sylvan Spawn Ltd
Mr John Read	Silsoe Research Institute
Mr Jim Rowley	Warwick Manufacturing Group, University of Warwick
Dr Paul Jones	Institute for Employment Research, University of Warwick
Mr Stan Burns	Tesco
Mr Peter Woad (Ap)	Mushroom Growers Association, Chairman
Dr Simon Croom (Ap)	Warwick Business School, University of Warwick
(Ap) - Apologies	