THE Mushroom JOURNAL

OFFICIAL JOURNAL OF THE MUSHROOM GROWERS' ASSOCIATION
OCTOBER 1998 NUMBER 585 ISSN 0144-0551

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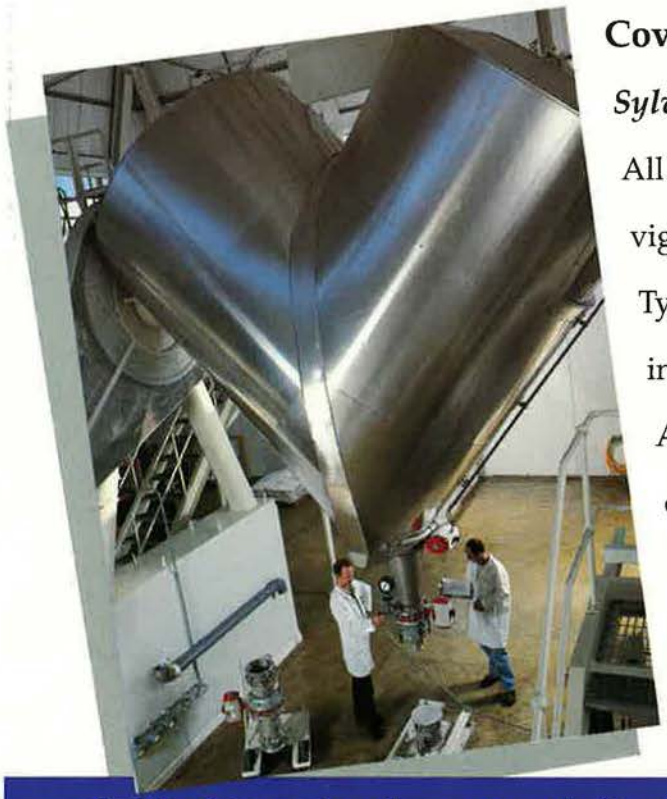

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From a series of drawings by Anatoly Dyorin

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ISSN 0144-0551

THE Mushroom JOURNAL

October 1998 **No 585**

EDITORIAL

Organics again

Only two months ago, the subject of the Editorial was organic mushroom production, so why return to it so soon? Because one can see the situation changing by the minute and one wonders how the industry's thinking is evolving.

In relation to organic production, there are perhaps three schools of thought within the UK mushroom industry. There is that of the established organic producers who have experimented with and developed their production systems over the years, obtained the necessary official accreditations and built a market for their product. They are now actively considering the way forward for their businesses in the light of the recent new Regulation from Brussels which imposes stringent new criteria. For those who cannot comply fully with the new rules from 1st December 1998, their produce must be labelled "Mushrooms cultivated on a substrate from extensive agriculture which is permitted in organic farming during a transitional period", with the word "organic" no more prominent, anywhere, than the other words in the statement. The transitional period ends on 1st December 2001.

There is a school of thought which recognises that the demand for organic produce will increase and that one should arm oneself with the facts.

There is a third grouping which sees organics as a minority interest within the mushroom industry and amongst consumers, and perhaps even a small farm marketing ploy to secure a premium in a local or niche market.

Who is to say which one has judged the situation correctly for the longer term, but if and when UK supermarkets want organic mushrooms in volume, who's going to supply them? The existing organic grower has a head start perhaps, or those who are considering the prospect. But one suspects that a new breed of Grower or marketeer will rapidly emerge to fill any gap. There are always those who 'can do' and one wonders who will be first to fill supermarket shelves with mushrooms labelled "Organic" in big letters?

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For further details contact Rebecca Ryan on Tel (+44) 0171 862 2106.

For full details of the
1998 M.G.A. Scarborough Conference Sponsors
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1998 M.A.T.A. Trade Exhibitors
turn to pages 13 & 14

WORLD OF MUSHROOMS

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Blake and Mann Mushroom Farm in Flixton, Suffolk, recently announced, as part of the continued growth of the business, that as from 1st July 1998 the company became Flixton Mushrooms, Ltd.

The address and contact numbers remain unchanged. The contact details are:

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Van Leer's mushroom division moves to France

Van Leer Packaging Systems Ltd. has moved its mushroom division from its UK site in Poole, Dorset, to its site at Pont-Audemer in France. The French site is also part of the Van Leer company and operates under the name of "Sacherie de Pont-Audemer". Business continues as before with the following new contact details:-

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Mushroom workers give colleague a birthday to remember

Our Pam's still pick of the packers

She may be 70 years old but Pamela Whitburn can still pack mushrooms as well as ever.

Mrs Whitburn, from Bishop's Cleeve, has worked full-time packing mushrooms at Haymes Farm Produce Ltd in Southam for the past 20 years.

She is such a valued member of the team that when she turned 70 her friends and colleagues threw a party in her honour.

Pamela Whitburn celebrates her 70th birthday with work colleagues

There was champagne, flowers, a huge birthday cake and, of course, loads of mushrooms.

Mrs Whitburn said: "I enjoy the job and I like the company of the people there. And the money's nice." Mrs Whitburn says her husband Jack, 81, doesn't mind her going out to work each day. She said: "I think he enjoys being left on his own." Peter Howard, Farm Manager, said: "Pamela is a wonderful member of the team, a real asset to the farm." "She's an amazing lady, managing to pack mushrooms and look after our farm shop, all at 70 years old."

(Photograph courtesy of The Gloucestershire Echo)

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Director's Notes

Welcome to the Conference Edition!

The MGA Office is a flurry of activity at the moment as we finalise preparations for this year's Conference and Trade Exhibition to be held in Scarborough from Wednesday 12th to Saturday 14th November. There will only be a matter of days to go by the time you read this, but if your reaction is ***"Oh no — I forgot to book!"***, don't despair! Give us a call immediately on +44 (0)1780 766888 and we'll see what we can do.

This year will be different in some respects from last year — notably the split venue — but, we sincerely hope, just as good as Brighton in 1997. Although the Conference Hotel and the Spa Complex are only a few minutes' walk apart, a shuttle bus will operate all day.

The Speaker Programme is an interesting and varied one, covering a good mix of practical and business-related subjects. We'll hear about growing quality and crop timing, the dry matter content of compost and farm hygiene, in addition to information technology on the mushroom farm, employment legislation, a Grower's perspective on managing human resources, and more. The Farm Walks too, have been a huge draw this year. For a preview of Monaghan Middlebrook's shelf farm at Whitley and Tunnel Tech's modern composting facility near Doncaster see the July Journal.

A wide range of goods and services from UK and overseas companies will again be represented at the Trade Exhibition and we're pleased to welcome a number of new Exhibitors this year. Within the Trade Exhibition, we'll also have the HRI Growers' Surgery so don't forget to bring your problems for discussion!

On the social side, there's the Race Night following the Chairman's Reception on the Thursday — a chance to try your luck on the horses — and of course, the Conference Banquet on the Friday.

In past years, a disco has rounded off the Thursday evening but experience has shown that it's not a great draw. So, this year, we thought you would prefer to return from the Race Night to your hotels at 23.00 for the most enjoyable kind of socialising — with friends in the Bar! But do bring your dancing shoes — there'll be a lively band at the Friday Banquet!

The most frequently heard comment from Delegates after each Conference is "I wish there had been more time to talk to everyone I met and to relax and to browse around the exhibition and to do everything else I wanted to do". As organisers, we wrestle with this one every year. The format of serving food and refreshments within the Trade Exhibition worked well last year and so we've repeated it, and made the breaks long enough to eat and drink, talk, visit the Trade stands, do business, go for a walk or whatever. The Trade Exhibition will be open from 18.30-21.00 on the Thursday evening and 10.15-16.00 on the Friday.

Again this year, a number of companies and individuals have very generously sponsored many of the Conference items and events and we are indebted to them for their support which has enabled us to enhance the content and format of the Conference for the benefit of all Delegates.

For those of you who won't be able to make it to Scarborough, we will, as usual, be publishing a report on the event and reproducing some of the Speaker's presentations in th Mushroom Journal over the coming months.

Cecilia, Melissa, Lynda, Teresa and I look forward to welcoming you all to the Conference. I hope to have the opportunity to speak to many of you and will make a point of looking out for those of you who will be attending for the first time. See you there!

Trudy Johnston

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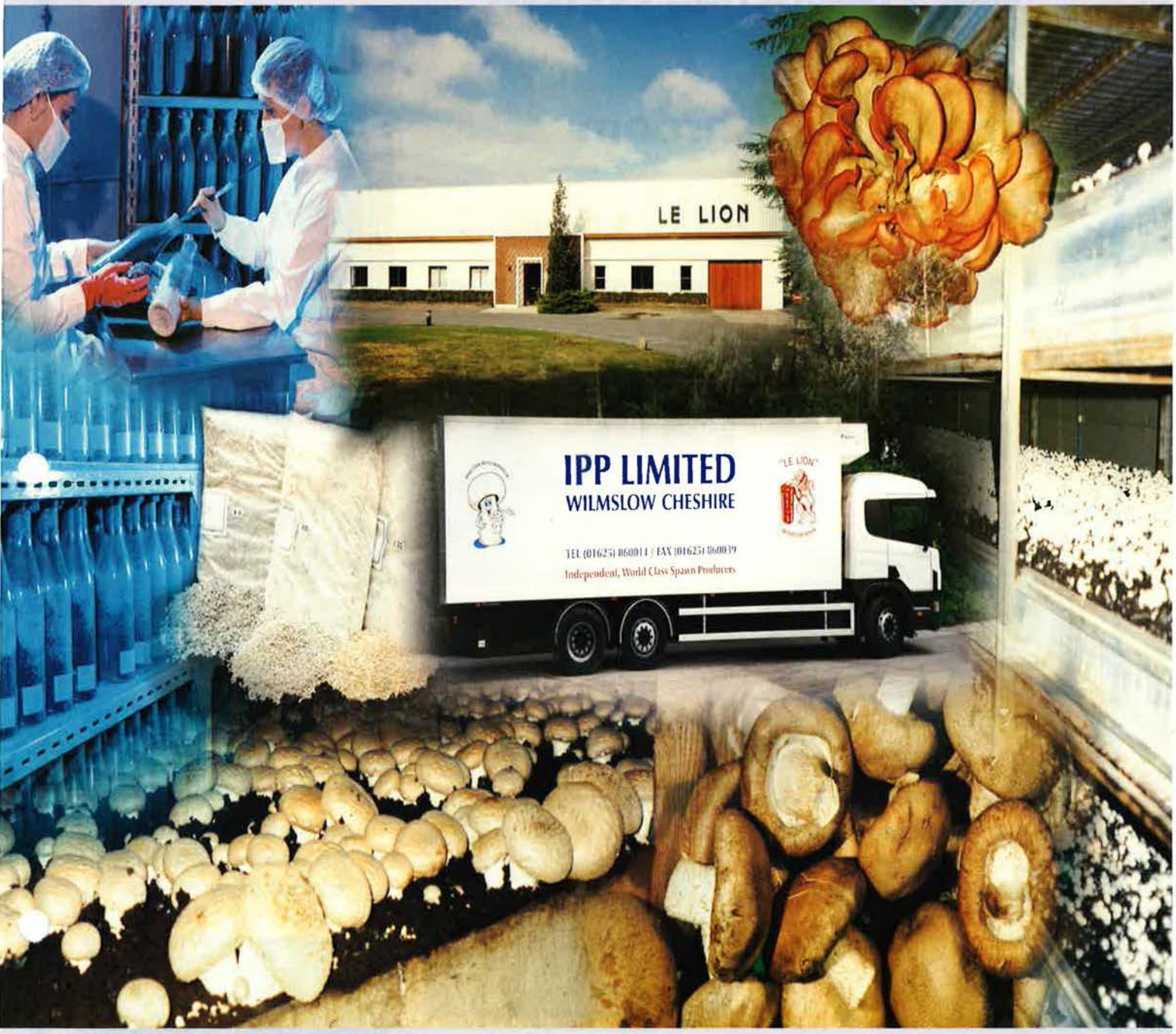

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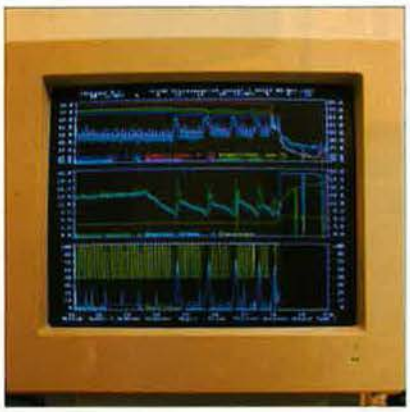

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THE LAST OF GEOFF GANNEY'S GROWING PAINS

After almost twenty-five years, I suppose we can't complain that Geoff Ganney has decided to call it a day as far as *Growing Pains* is concerned. Over the years, we have enjoyed being educated by one of the industry's best-known elder statesmen as he shared with us the trials and tribulations of mushroom growing, and sometimes the joys, in a diary peppered with the expressive phrases, wry comments and dry wit for which he is known. The column certainly generated a great deal of comment and debate over the years and will be missed; readers often told us it was the first page they turned to. Look out for a new feature in the coming months. This month, Peter Flegg looks back over the history of *Geoff Ganney's Growing Pains*.

Trudy Johnston, Editor in Chief

Growing Pains in Retrospect

By Peter Flegg

A mushroom grower's diary by Geoff Ganney was started, under the heading 'Growing Pains' nearly 25 years ago, Mushroom Journal No. 14 (February 1974) to be precise. In his introductory paragraphs, Geoff tells us that on their farms they religiously record important happenings and 'a series of jottings may be of interest to other members'.

Well, it certainly has been. I am sure that for many readers, the current set of Growing Pains has been one of the first items in the Journal to be read.

After recording his 'happenings' for the best part of three years, Geoff felt that the diary was becoming 'old hat' and he decided to stop writing it. However, he had hardly laid his pen to rest before there were letters to the Editor asking for it to be continued.

Barrie Hughes (Mushroom Journal No. 51, March 1977) referred to Geoff's refreshing style and subtlety and how he, time after time, hit growers on a sensitive spot, jogging them into revising their thoughts and reorganising how they did things. He also pointed out how comforting it was to read that other growers suffer from similar problems to ones self.

So, within a twelve month period, Geoff was recording his diary again. Growing Pains, second series, began in December 1978 (Mushroom Journal No. 72) and continued for the next twenty or so years.

Whether Geoff's 'Diary' farm was really as recorded or perhaps embroidered a bit to make a point we cannot be sure, but its effect on the management of countless mushroom farms must have been profound.

Certainly Geoff's diary records a farm which was never short of 'events'.

3rd January 1974
Vandals slashed the plastic covering the spawning house. Angry, but glad we have only one plastic shed.

12th May 1974
Vandals switched peak-heat fan off on a compost that had just finished ....

2nd July 1974
One of those days! JCB driver severed the main electricity supply, some clown ran into the back of the new van, a cement lorry sunk into the newly-laid drains, received and fitted 20 non-return valves that we are told were faulty when shipped out, lost three pickers ....

22nd October 1974
Read that fuel oil was going up 14 percent in the New Year. Can that be possible?

13th December 1974
Two fork-lifts broke down, market van had minor accident, blew cylinder head gasket on car, told price of oil going up, again; prices down, mild weather likely to make it very difficult at Christmas — must be a Friday.

That and more, all in the first year of the diary, it has, however, not been all gloom and disaster.

27th May 1980
Compost quality excellent today with bed temperatures well up only a few hours after filling ....

20th June 1991
Tremendous day's cricket at Lords with the added value of an in-depth discussion — between overs — on mushroom marketing with Barney Greenhill! Great day watching, evaluating and debating does a power of good to the old battery system. Must try Trent Bridge, Edgbaston ....

Geoff often debated with his readers and himself in his diary. Many times he has passed on words of advice, reminded his readers to check this, think about that, think and rethink and question.....

18th March 1980
Reduced level of filling by 15% as this week's compost on heavy side; need, therefore, to allow for greater losses at spawning. Must adjust weekly according to the condition of the compost and prevailing weather and not work to a rigid system.

15th September 1983
Continuing treatment after casing with Sporgon as a prophylactic treatment to see how much control we gain. The cost of labour for diseasing can be quite alarming but, remembering the Benlate story, we don't want to fall down on general hygiene precautions. People very quickly forget what is necessary to avoid these general problems by not becoming slack around a mushroom farm. You know - like watering on infected sporophores ....

3rd January 1987
What effect has compost formation on the quality of the mushrooms? Does a totally horse manure compost produce a better quality product than a straw based compost? If nitrogen level is high are the mushrooms smaller and softer? Maybe it is related to the ash content? What a subject to discuss ....

4th February 1991
Pretty sure we need a casing depth up to 6cm on these bags! Perhaps the depth in relation to actual specific gravity would be a better way of assuming the requirements? Certainly applying a much coarser mixture has enabled us to get enough back into subsequent flushes. Mind you, the production of third breaks is generally far too low and occasionally is nearly the same as second breaks. Why?

Frequently he exhibited his own inimitable sense of humour ....

1st January 1988
*Formulated plan for a year with **Zero Defect** — based on removing all the people.*

1st January 1992
'The world is full of idiots but the worst is that it is CONTAGIOUS'.

24th March 1996
Come to the agonising conclusion that running a commercial mushroom farm requires an even greater degree of insanity than previously realised.

From time to time Geoff passed on to his readers the benefit of detailed comment and advice from well-known mushroom personalities. Among those with whom he shared his column have been Sylvia Hensby who took issue with him on the effect of green mould, Mariet Vedder who wrote him a detailed letter on the skills of picking mushrooms and John Fletcher who wrote about evaporation.

To drive his points home he would frequently deliver short, snappy sayings....

19th March 1988
Observation is essentially one of the most important pieces of armoury a Mushroom Grower has and should be continually developed. Never accept the accepted.

14th March 1996
'Judgement in haste will lead to waste'.

18th March 1996
'Basic principles must be followed'.

5th June 1996
The ability to extricate oneself from the mire as quickly as possible is essential to mushroom survival.

There can be little doubt that 'Growing Pains' will be missed —
No chance of a series three one day is there Geoff? ■

PETER FLEGG INVESTIGATES

Supplements and Supplementation

For centuries mushrooms have been grown on a composted substrate based on cereal straw. A few, at least, of those early growers must have noticed that some differences in the quality of the compost and of its initial ingredients apparently were reflected in the yield of mushrooms. No doubt they would have tried to repeat the sets of circumstances which led to good results and to avoid those which led to failure.

As understanding of mushroom nutrition increased, attempts to improve composting methods and the nutritional value of composts could follow more informed lines of development. Although, up to the 1960s, considerable improvements were made in providing the mushroom crop with a better diet, most additions to the compost are liable to some transformation as a result of the microbial activity during phase I and phase II.

A new idea

The Fifth International Mushroom Conference was notable in several respects. One was that it was the first time an international mushroom conference was held outside Europe. It was in fact held in Philadelphia, USA, from October 28th to November 2nd, 1962.

Another important feature of the event was that the idea of adding nutrients to compost after the composting process had been completed was put forward and supported by plenty of experimental evidence to show the potential for higher yields.

There were two papers, Schisler and Sinden Mushroom Science 5, pages 150 to 164, and Sinden and Schisler pages 267 to 280. The first one was concerned with adding protein-rich materials to the compost at spawning. Among the supplements tested were cotton-seed meal, dried skim milk, soya-bean meal and corn gluten meal. It was important that the supplements were very well mixed into the compost and those rich in protein gave the best results. The implication was that mushroom composts are generally deficient in some proteins and amino acids which are supplied by the supplements.

The second of the two papers went on to examine the effects of adding supplements at the time of casing. It seemed that a limiting factor to adding supplements at spawning is competition for the supplement between the mushroom and the various moulds and other micro-organisms in the compost. By adding the supplements later, when the mushroom mycelium had colonised the compost, it was hoped that the competitive edge would be in favour of the mushroom. So it turned out to be. However, it was important that the spawn run compost should be free from weed moulds and pathogens. There were also cultural problems in dealing with high yielding beds.

As before, it was the protein-rich substances which produced the greater yield increases.

Delayed availability

As word of the possibilities of obtaining 25% or more yield increases spread (Schisler, 1964 MGA Gleneagles Conference, MGA Bulletin No. 179) many growers tried supplementing their composts. If there were no burnt fingers, there were certainly some overheated mushroom beds as a result. The introduction of readily available nutrients to a compost which has, through the composting process, become selective for the mushroom,can easily bring disaster. Reactivation of the composting microbes is a real possibility and a rapid burst of microbial activity can send bed temperatures soaring. Weed moulds will often multiply alarmingly and red pepper mites, among other creepie-crawlies, will follow on in swift succession. Some growers were successful though, low supplementation rates and plenty of cooling capacity helped. Supplementation at casing seemed safer than doing it at spawning. This much was discovered through trial and error on the part of growers and through careful experimentation by researchers (eg. J. Delmas and J. Laborde in 1969, Mushroom Science 7 and J. Koenig in 1970, MGA Bulletin No. 249).

Rasmussen (1965) in Mushroom Science 6 suggested that the Sinden and Schisler results could in part be due to the 'shake-up' given to the compost (a technique he had developed earlier, Mushroom Science 4 in 1959) and he also showed that supplementing the beds after the second and fourth flushes and even after the eighth and ninth flushes resulted in higher yields.

All that was very interesting and encouraging, but adding supplements to beds at casing and even later when the casing is on the beds has significant drawbacks. There is the additional danger of introducing and spreading pests and diseases when breaking up spawn run compost and, moreover, it does not fit very well into some growing systems. Adding a supplement along with the spawn seemed to be so much more convenient and to achieve that successfully it was necessary to overcome the problems arising from introducing easily broken down food sources into the compost.

The idea of somehow making the supplements rather less readily available (delayed release) was eventually developed by Carroll and Schisler of Penn State University (1974, Mush- ➤

room News 22, 12, 10-11). Essentially the idea was to treat a mixture of a cotton-seed meal derivative and peanut oil with 10% formaldehyde which denatured the proteins. This approach has similarities to one developed a few years previously to produce delayed release cattle feeds. All this and more is described by Phyllis Randle in Crop Research (Horticultural Research) 23, 51-69 where she reviewed the developments in mushroom crop supplements up to 1983.

It was the successful development of delayed release nutrients and the introduction of Spawn Mate in 1975 which led to the widespread adoption of supplementation by mushroom growers.

Progress and development ...

Since then there has been remarkable progress. The beneficial effects of supplementation with so-called delayed release nutrients seem to have been well established though it is less certain that the nutrients are in fact released in the latter stages of the cropping period to boost later flushes. A more certain effect is that on reducing the risks of overheating. This may possibly be an anti-microbial effect of the formaldehyde residues in the supplements. Reference to the compost microbes reminds me that, at around this time, Fermor and his colleagues demonstrated that the mushroom is able to feed on the bodies of dead microbes in the compost (eg. G.C.R.I. Annual Report for 1979). These dead microbes have been referred to by Carapiet (1981, Mushroom Science 11) as 'nature's delayed release nutrient'.

Naturally enough, once a positive step forward is made there is often a rush to develop and extend the field, for example, Overstijns and Olivier of Belgium (1981 Mushroom Journal No 106).

Workers at the G.C.R.I., Littlehampton, in 1983 (Mushroom Journal No. 130, October) evaluated a number of potential supplements, some having been manufactured as cattle feeds, and in 1986, Randle and Smith (Mushroom Journal No. 165) discussed the economic aspects of supplementation. They took into account the costs of supplements, of extra labour for application and harvesting the increased yield, of temperature control during spawn running and of extra marketing. At least 15% more crop could be expected and they calculated that the cost of supplementation would be covered by a yield gain of 1.5kg/m^2 (0.3lb/ft^2) provided that crop quality and marketing were unaffected.

At the 1986 MGA Conference held in Bristol, F. Perry, with a background of animal nutrition, showed how supplements could affect the composition of mushrooms as well as increase yields. He reported that the protein and mineral content of mushrooms could be enhanced, concluding that there were similarities between the nutritional requirements of mushrooms and ruminants.

Another new idea

In recording the continuing development of mushroom supplements, three recent articles serve as an important landmark (Mushroom News 46 No. 7). One explains what supplements are and why they are used, a second reports briefly on a new combined spawn and supplement and a third describes experiments which show how the new improved spawn-supplement may contribute towards the fight against green mould.

The first paper, by Wach and Wheeler, points out that it took nearly 20 years from the early work by Sinden and Schisler in 1962 before supplements became widely used. This may be an example to those who are impatient over the speed at which mushroom R&D reaches growing practice. Despite an initially clear indication of real commercial benefits, 25% yield increases, it took a lot of work and time to solve the practical problems before reliable commercial benefits could be achieved.

Wach and Wheeler list eleven modern commercial supplements with brief indications of their composition. Soya bean, gluten meal and feather meal in various formulations and mixtures seem to be the main basic constituents and they can be divided into four types, low protein-low fat, medium protein-low fat, medium pr tein-high fat and high protein-low fat. Details of their fat and protein contents, application rates and times and their respective advantages and special requirements are tabulated. The need to choose the type of supplement to suit the cultural conditions on the farm is emphasised. What is represented as a radically new product which serves not only as a spawn but also as a supplement is reported on by D. Kananen. It has been developed by Vlasic Farms Inc. which was previously known as Campbell's Fresh Inc.

The spur to the new development, apparently, was the realisation that the use of grain spawn can also aid the development and spread of *Trichoderma* green mould. There was perceived to be a need for a spawn which did not contain the level of nutrients, especially carbohydrates, on which the green mould could feed.

The new product is described, unrevealingly, as a granular, non-grain spawn containing high levels of nitrogen.

In the third of this trio of articles Rinker and Alm of the Vineland Station, Ontario, describe how they compared the effectiveness of the new spawn-supplement and of benomyl-coated grain spawn in repelling green mould infection. Both the new product and the treated grain spawn restricted the ill-effects of the green mould. Rinker and Alm conclude that the new product shows significant promise as a way of combating *Trichoderma* green mould infections.

It seems that the new spawn-supplement is one development which may not take twenty years to catch on. What, though, I wonder are the possibilities for a supplement based on dead microbes? Perhaps better than one might think, according to some research done in India (Ahlawat and Rai, 1997, Mushroom Research 6 (2), 69-73). They have found that biofertilisers based on bacterial biomass and used in growing green crops, can improve the growth and yield of mushrooms. ■

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1998 Trade Exhibitors and Product Guide (As at 7th October 1998)

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Bumpacrop Lime	Casing Ingredient	E35
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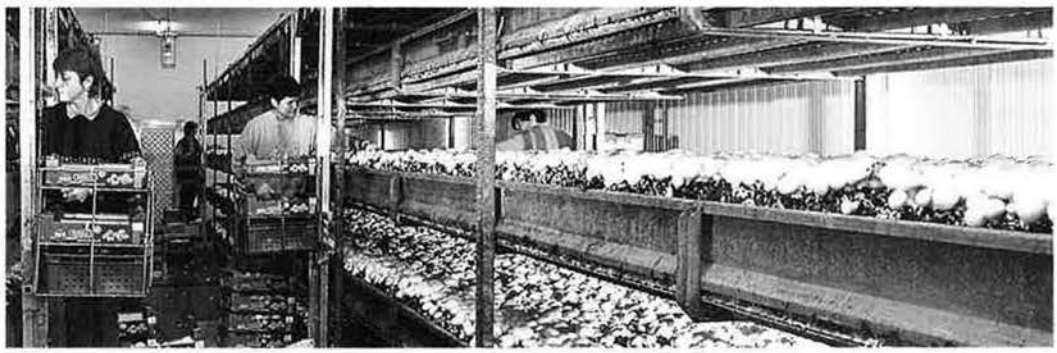
FROM COMPOST TO CROP



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The Problem Page

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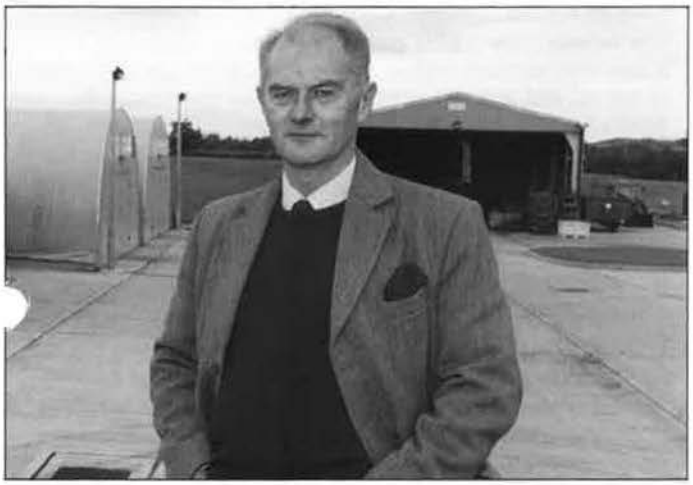

Disease Control – A Postscript

By R H Gaze of HRI

Postscript

With the sort of irony that makes one half believe in malignant intervention from powerful outside forces I would like (well no I wouldn't but feel it apt) to report that we suffered an outbreak of *Dactylium* on the HRI Mushroom Unit whilst September's Journal was in print. So yes, it is still about. We think it was a 'wild' strain, it's currently being tested. The first such outbreak that we ever experienced was immediately after the unit was completed, at almost precisely the same time of year as this one. Cobweb used to be considered an autumnal problem when it wasn't yet considered an important problem. One grower used to ring me every year to tell me of its arrival. A bit like reports of the first cuckoo in the Times. I hope it proves to be a wild isolate. If it isn't I've no doubt we will be having 'meaningful' internal discussions.

One of the reasons for including this postscript was also to emphasise something omitted from last month's summary of high priority *Dactylium* control measures. The omission was due to our taking it for granted. The crop referred to above was immediately cooked out as soon as we discovered *Dactylium,* even though we hadn't picked any of the third flush. It was then that I realised that no mention had been made in September's Journal of the importance of good crop termination techniques. Forgive me, we cook out everything, several times, whatever the state of the crop. It is so routine one forgets to mention it.

Introduction

On to this month proper. I don't get too many suggestions concerning this column or not ones that I wish to pass on anyway. Recently, however, I did have one which made me pause for thought. It was a question more than a suggestion. The question was whether or not working within the title of Problem Page was too restrictive. Was the questioner trying to tell me something? Were they detecting in the column a growing strain of depressive paranoia brought on by a continual obsession with bad news? Or simply getting a bit depressed themselves by an endless stream of problems? I probably will never know for sure.

On reflection I don't think I feel too constrained by the concept of 'Problems'. Almost everything is a problem if you look at it in the 'right' way. Even having none at all. All mushroom growers know that feeling. When everything is going swimmingly and you have no problems at all you realise you have almost the worst one possible. When you are up you can only go down and you know that out there, somewhere, there's a total ____ disaster (fill in your own favoured adjective) just waiting to strike. And you've no idea what it might be. So no, being restricted to the subject of problems is no constraint. It means one can discuss absolutely anything.

But, for those of more sombre leanings, I hope you will agree, for the most part the column does try to identify and suggest solutions or consolations (consolutions would be a good new word in this context) for the real problems that beset us as an industry.

So, with apologies for this long response to the question posed by a reader, on with this month's problem or subject. On the basis that a change is as good as a treat, this month, a different tack. Not really a different subject as you will see, but a different approach. On the whole this column's strength, and at times weakness, is that it is mercifully short. That sums up its strengths admirably. Occasionally, however, the shortness of it dictates that subjects have to be dealt with broadly and with little detail. Now and then, I think, that perhaps does constitute a weakness.

Efficient Use of Pesticides

Having repeatedly reported the results of the HDC disease control programme, carried out by Helen Grogan, I have equally often written that efficient use of pesticides is increasingly important as a result of the current levels of pesticide resistance exhibited by pathogens (*Verticillium* and *Dactylium*). It strikes me that this is a good example of where a little more detail might be helpful. The concept of efficient use is simple and fairly unarguable. Partial resistance indicates quite clearly that it must be a good idea to achieve a level of pesticide in the casing capable of combating the pathogen, which is legally permissible and non-phytotoxic to mushrooms (or fungitoxic if you favour p.c.).

Putting this simple concept into practice isn't quite that simple, as efficient use, as defined above, consists of a number of factors, all of which can have a compounding effect. I thought, therefore, for a change that I would delve a little deeper into one subject rather than my usual conceptual skating over the surface. Apart from the usual ➤

introspection concerning the column's contents I've been prompted to go in this direction by a number of conversations with growers all dealing with the subject of partial resistance and maximising pesticide levels. These have forced the realisation that the bald statement, 'efficient use of pesticides' is very bald indeed.

The starting point is to remind ourselves of the experience in establishing the validity of our analytical techniques in the recent work on the fate of Sporgon (prochloraz-MN) in casing. What we thought was a fairly good application resulted in only about 60% recovery of the calculated level. So all is not always what it seems. It was this that set us thinking about the whole subject. So using Sporgon as an example, and it's probably an extreme one because of the variations in application allowable, I'll try to cover the main points which may need considering.

Main Components of Efficient Use

It is at this stage that I appreciate why, in a short column, one avoids too much specific detail. Detail breeds more detail, mainly in explanation and qualification of what has been written and a page soon becomes six. Which none of us wants, so a little more detail but not too much.

The following seem to me to be the major factors to be considered when applying Sporgon, in order that the concentration of pesticide is maximised and in the correct, effective place for maximum control.

Dosage:
There are a number of dose options permissible. Single or double 120 g/100 m², or triple 60 g/100 m². Careful consideration should be given to this choice. Bearing in mind the arithmetic of one single 120 g/100 m² dose providing 15-20 ppm throughout the casing and also that there appears to be a decline in concentration once picking has begun, the common industry practice of using two 120 g/100 m² drenches rather than only one and not incorporating the first dose but drenching both, seems to be very sensible. One still hears of people only using a single dose or using the three lower doses. Throughout all this discussion one is of course assuming the need for the treatment. All the arguments against unnecessary prophylactic treatments still hold good, perhaps better.

Application rates/water:
The label recommendations are for all doses to be in *up to* 180 litres of water per 100 m². There are some indications from the HDC Sporgon project that a reduction in water quantity results in a higher concentration of pesticide in the effective surface zone.

There are two problems with this. The lower the volume the more difficulty there is in distributing it onto the bed, evenly. Also if you go too far down this route the concentration is likely to be more fungitoxic. 90 litres/100 m² were used in the experiments. My guess is that this volume is too low for many circumstances but the point remains. It would seem worthwhile to explore how far one can go on both accounts.

Hit and miss
So far so good. Having sorted out points one and two, the application is calculated and applied. How much goes into the casing? Whatever goes onto the floor, side boards etc isn't going on to the casing. If you are to put the 120 g/100 m² onto the 100 m², this 'miss factor' must be calculated and allowed for. This is, I'm sure, one of the biggest losses we observed in our calibration work in the Sporgon trial. The easiest way to overcome this is to add the estimated loss to the calculated volume. The best way is more difficult which is not to put it on the floor in the first place. Once there it's obviously potentially polluting.

I know. It's easier said than done.

Take-back:
Having calculated and applied it, all of it must be used. If not you've missed with that too. Anything left in the tank has reduced the calculated level of application. And drenching what is left over onto the last tray doesn't really count!

Deposited:
In the same vein any product that has precipitated in the spray tank has been debited from your calculated dose, so good tank agitation/recirculation during application is essential.

Evenness of drench:
The final compounding effect linked to hit and miss and take-back, but an issue in its own right, is evenness of drench. The question is how even is your application? Is the 180 l or whatever going evenly onto the 100 m² or is it patchy? When concentrations of pesticide in the casing are likely to be giving only partial control, underdosed areas are an open invitation for disaster.

One technique for quickly gauging evenness of application is to dot a bed with identical shallow dishes, Petri-dishes are ideal. Drench as normal and measure what you catch. All dishes should contain exactly the same amount.

Summary

1. Pick the right dose.
2. Reduce water volume a *little*, if you can.
3. Calculate for what misses and adjust.
4. Use it all.
5. Agitate the tank.
6. Calibrate your drenching equipment/techniques.
7. If in doubt test the levels achieved. Helen Grogan will advise on the sampling technique required.

I'm not sure there is a conclusion except to say that when your sword is blunt you have to wield it much harder or, perhaps, more accurately.

P.P.S. The *Dactylium* was a 'wild strain' or so Helen says but then she would wouldn't she? ■

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Looking back.....

TRAYS AS GROWING CONTAINERS

One of the great developments soon after the end of World War II was the use of trays as growing containers instead of shelves. Small wooden fish boxes became very popular. They were cheap, and when filled with compost were light enought to be handled by one man (what machinery?)

They probably had several disadvantages but one in particular was they had to be stacked in what was then called "chequer-board" fashion. The fish box chequer-board system is shown here, taken from MGA Bulletin No 40, April 1953.

The difficulties in getting access to water, to pick and, to inspect the crop are obvious from the picture. No wonder larger trays and fork lifts caught on!

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Nominations for the 1999 Award are now invited. The Award is open to anyone involved in the Mushroom Industry worldwide and there is no age limit, but no individual may nominate himself/herself.

All nominations for consideration should be in English and should be made to the MGA Director by 31st December 1998 at the latest, accompanied by a paper of not more than 200 words in length, giving biographical details of the nominee and outlining the reason for the nomination.

The recipient of the Award may be invited to give the Sinden Lecture at the ensuing MGA Annual Conference and/or to submit a relevant article for publication in the Journal, as appropriate, at the discretion of Council.

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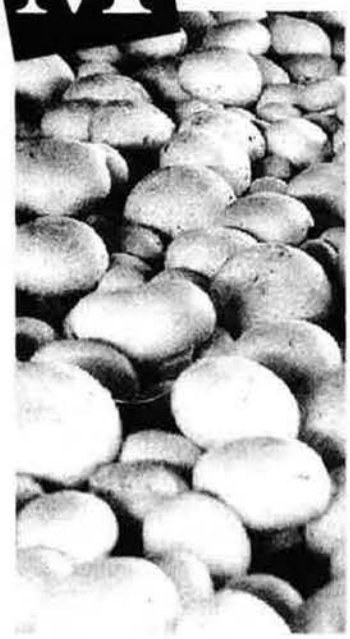

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A Sample of Aerated Phase I Composting Across Europe

David M. Beyer, John Pecchia and Sarah Labance*
Department of Plant Pathology
***Department of Agricultural and Biological Engineering**
The Pennsylvania State University

Introduction

Historically over the last few decades, it has been a practice of many farms to start Phase I composting by applying large quantities of water onto the dry bulk ingredients. The concept was to soften and soak these ingredients before forming a stack. This system of low temperature, high moisture, high heap piles during "preconditioning" not only contradicts modern theories of mushroom composting, but is also a source of offensive odor production. The primary source of offensive odours during Phase I composting is thought to be from anaerobic conditions within the pile or bulk ingredients. The smells associated with anaerobic conditions are caused by compounds in a reduced state: hydrogen sulphides (rotten eggs), acetic acids (vinegar), valeic acids (vomit) and alcohols and phenolic compounds (putrefying smells). When composting proceeds aerobically, the intermediates formed are in an oxidized state, while those formed under anaerobic conditions are in a reduced state and, thus, tend to be odorous. For example, under anaerobic conditions, reduction of organic sulphur to volatile organic compounds is favoured over oxidation of sulphur to sulphate. These reactions, therefore, lead to odour-producing conditions.

As part of the Mushroom Industry Farmer Based Applied Research (MIFBAR) project to reduce odour emissions from mushroom composting, four industry and four Penn Sate personnel visited several mushroom composting operations in Europe. The primary objective was to gain understanding into odour reducing technology and systems for Phase I composting that could be used in a research programme at Penn State. In North America, only a few Phase I bunker, systems have been built and eventually they may be adopted by many other commercial operations. This article is a summary of the reports and conversations of the MIFBAR investigators, Tom Brosius, Bob Canterera, Ewan Harper, Joe Plageman, and Paul Walker. For purposes of this article, the term bunker is used to describe a Phase I system that is not totally enclosed, but may be covered, and air is not recirculated. A Phase I tunnel is defined as a totally enclosed room with the option of recirculating or capturing the exhaust air. Although not planned, it turned out that we visited aerated Phase I facilities from the most complex to the more simple applications.

Environmental regulations in several European countries regarding the emission of odorous air from Phase I substrate preparation farms and other agricultural operations have motivated the initiation of new techniques and processes aimed at reducing the production and release of odours. For example, strict environmental standards in Belgium mandate the containment of all odours produced during Phase I. Consequently, farms in Belgium which produce mushroom substrate have totally enclosed operations and have adopted complex odour-reducing technologies such as bunkers, chemical scrubbers, biofilters, and emission stacks. While not requiring total odour elimination, environmental enforcement agencies throughout Europe have imposed restrictions on odour production which have led to alterations in the way that Phase I mushroom substrate preparation processes are carried out. Environmental agencies in the United States have yet to ➤

impose restrictions on odours released during mushroom substrate preparation. However, urban encroachment on rural farmland has resulted in odour related complaints from residents and legal battles, suggesting more stringent odour management regulations may soon be enacted.

The trip started for most of the group at The Dutch Mushroom Days in Maastricht, Netherlands. A few serious students took part in the Horst conducted workshop on controlled Phase I composting. Much insight was gained thanks to Henk van Gerwen and IPC Plant for taking the time to share their experiences and knowledge regarding Phase I mushroom substrate preparation. Overwhelmed with the vast array of equipment for mushroom growers, the group concentrated on visiting displays that were related to equipment that addressed Phase I bunker or tunnel technology. These displays included oxygen measuring equipment as well as conveyors and mixing equipment. Later, thanks to Bram van Nieuwenhuijzen, of IPC Plant, the group toured De Klein and CNC substrate preparation operations. Substrate preparation at these farms meant that fully colonized spawn run compost (Phase III) was the product. At De Klein, the mostly horse manure formula compost was stored in large piles, before wet and mixed. An essential component for successful Phase I composting is the uniform mixing and wetting of bulk ingredients. Prewet processing systems are becoming more complex. Compost turners designed to thoroughly mix and distribute water during the Phase I process are generally not used in Europe. Stationary

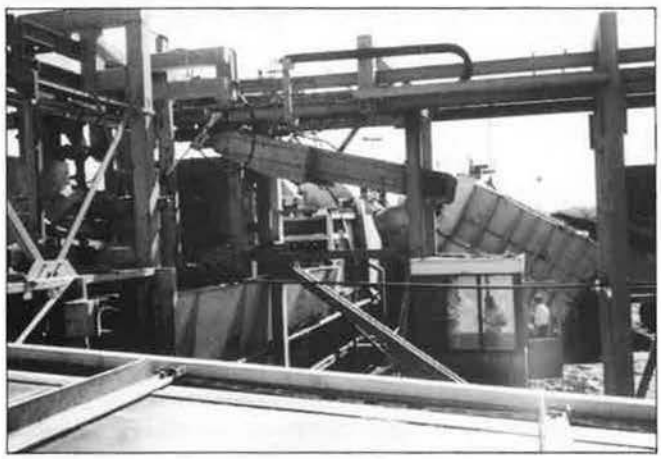

Figure 1. Stationary Line.

mixing lines seemed to be the most common and efficient system used on the farms visited, (Figure 1). After a thorough mixing the material was filled into aerated pre-wet bunkers. Henk Schreurs was kind enough to show the group the operation from start to finish, although they were in construction to totally enclose the whole wharf. Phase I was completed in about 10 days inside tunnels that were equipped with ammonia scrubbers and biofilter. This operation also mixes a small amount of surplus Phase II (1-10%) substrate to serve as microbial inoculum for Phase II. The mixing occurs when Phase I substrate is removed from the Phase I tunnel and while the Phase II tunnel is filled. Phase II and III tunnels were used to finish the preparation process, which produced a consistent and productive looking compost. It must be noted that the water run-off collection system, equipped with filters, reduced any odours associated with the stored recycled water area.

Next was the impressive and engineering miracle known as the CNC mushroom substrate factory. Not a handful of compost could be seen, heard nor smelled. This facility is a totally enclosed system, including the unloading and storage of bulk ingredients. Jan Pijnenborg explained that the movement and mixing of the compost volumes are computer controlled. Mixing is accomplished with three cross mixers inside a box. Supplements are added in an enclosed mixing chamber and then composting is done inside plenum-floor tunnels, all equipped with filling nets. There is no waste generated from the operation; everything, including exhaust air, is collected and reused.

Most farms have reduced Phase I to between five and eight days, a processing time which was usually coupled with an extensive Prewet period. Although the CNC does not manipulate the compost once it is loaded into the tunnels, most farms remove and mix the substrate partway through Phase I processing.

These two extensively equipped farms demonstrated the totally enclosed Phase I concept, where the air emitted by the substrate could be filtered, scrubbed, or sent through a biofilter before being released into the atmosphere, (Figure 2). In addition, totally enclosed Phase I tunnels often include recirculated air systems.

In Italy, the farms emphasized the importance of re-inoculation. That is, when bunkers are used for Phase I, temperatures of approximately 80°C are maintained throughout the substrate mass. Therefore, the bunkers must be managed to preserve microbial populations to serve as inoculum for Phase II composting. At the first stop Fungicoltural Billio, demonstrated what we might consider an average aerated Phase I schedule and the importance of microbial inoculation before Phase II. The simple straw, poultry manure and gypsum formula was quickly pre-conditioned for 2 days, then placed in the Phase I tunnel. Compost was removed and mixed once during the 12 day Phase I. Tunnels were managed in a way to provide air so that the bottom 5 cm maintained temperatures in a moderately thermophilic range while the remaining portion of the substrate was allowed to heat to 80°C. Afterwards, compost cooled down under a covered roof to further increase the inoculum for Phase II. Tarcisio Billio and staff are to be thanked for their generous hospitality and candour in explaining their system.

The next stop was Agrifung, home of the original enclosed Phase I system. We met Gerard Derks and Luca Francescut co-inventors of the first Phase I bunker in 1970. We were lucky to catch Gerard at the farm, for his busy schedule keeps him young and mobile, (Figure 3). He impressed upon us the importance of compost water holding capacity and quality by showing us some of the finest fresh quality mushrooms grown. The low pressure, large opening floor nozzles used in

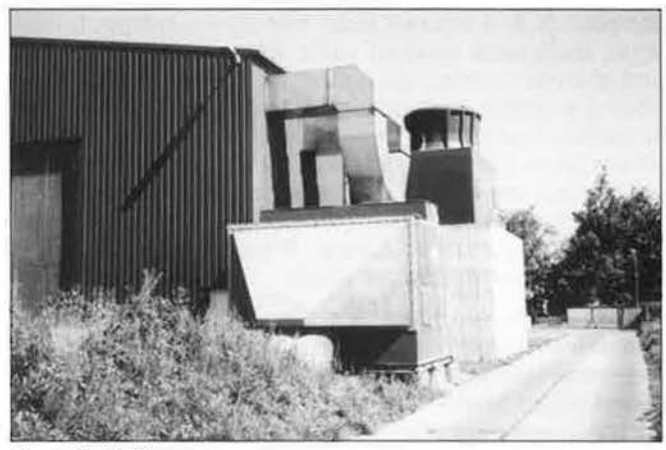

Figure 2. Biofilter.

their tunnels differed from other Phase I tunnels, but are similar to many of the pre-wet aeration systems.

Champignon Trentino, the next farm visited, had bunkers specially designed with pre-conditioning in mind. Wilbert Smeets generously took time away from the daunting task of revitalizing this farm, to show us his unique systems. In addition to the open aerated floor bunker for pre-conditioning, there were Gicom designed high pressure- nozzle (spigot) floor tunnels used for Phase I, II and III. In a nozzle floor, a blower forces air through a manifold and into a series of pipes embedded in the concrete floor along the length of the bunker, (Figure 4). A series of cone-shaped nozzles are evenly distributed along the top of each lateral. The nozzles contain a small opening (between 0.5 and 1 cm) at the top, through which air is forced into the substrate material. The concept of high-pressure aeration by nozzle design at the opening of the nozzle will create uniform air distribution. Regardless of the amount (volume), moisture content or structure of the compost ingredients, the air is evenly distributed. The one advantage of a spigot floor is that it better accommodates a partially filled or unevenly filled bunker. It is also believed that spigots provide better drainage for high moisture substrates and by using high air pressure, nozzle blockage is minimized. One disadvantage with a spigot floor is the possibility of a malfunction due to nozzle damage.

Figure 3. Gerard Derks.

Frank Stewart-Wood met us at Aylesbury Mushrooms in England, and showed us that a plenum floor with slats running perpendicular to the bunker sidewalls, remains a viable alternative. The addition of tracks running lengthwise within the bunker allowed for filling and emptying equipment to operate without damaging the floor. The plenum floor involves pressurizing the entire airspace beneath the concrete floor, allowing air to move up into the substrate through a series of slats in the concrete, (Figure 5). The asset of a plenum floor is that it can better maintain aerobic conditions within the substrate in case of an air handling or computer system breakdown. Ian McClay explained that if such a situation occurred, a plenum floor would maintain partial aerobic conditions within the substrate through natural convection, while such conditions would be more difficult to attain through pipes and nozzles. Some plenum-style Phase I systems may use filling nets, similar to those used to fill Phase II tunnels. However, nets are considered an additional cost, require more cleaning and are prone to rip with the heavier Phase I material. Filling nets also restrict air movement when they become water logged with higher moisture compost. This farm, along with others, upheld the concept that the cold zones maintained along the

Figure 4. Nozzle Foor.

sides and bottom of the bunker provide sufficient inoculum for Phase II. Most operators employed the technique in which the bottom and top 25-30 cm of the substrate mass is maintained at 48-50°C, while the remaining portion is allowed to heat to 80°C.

We surprised Richard Gaze and Ralph Noble of HRI by dropping by to discuss more of the science behind aerated Phase I. These two researchers have done quite a bit to take the mystery out of how aerated Phase I composting works. Both of them were able to shed some light on the compost oxygen requirement during Phase I and in general how odours might be reduced.

The length of time required for pre-conditioning bulk ingredients, and to wet the substrate before initiation of Phase I varied greatly among farms. Our next farm to visit was Gateforth Park Ltd., which used an aerated floor during prewet. Here David Walker and Simon Middlebrook made it evident that, while an effective prewet is important, care must be taken to avoid excessive wetting that impeded the flow of air into the substrate material. During this trip, differences between farms existed regarding the length of time required to complete Phase I, and whether substrate placed in Phase II bunkers should be removed and mixed/watered one or more times over the course of processing. Extensive research is currently underway to identify ways to improve bulk density of mushroom compost prepared in a Phase I bunker system. Thus far, it has been concluded that the best solution for the bulk density dilemma is adequate shortening, mixing and wetting of the material before the Phase I process. Therefore, for Phase I ➤

Figure 5. Plenum Floor.

substrate preparation to be successful indoors, it is vitally important that it is carried out in conjunction with an effective prewet programme. Gateforth, like all farms visited, had developed a Phase I schedule that accommodated the needs of the mushrooms and the labour force.

Another important factor is to load the substrate material into the bunker in such a way that the material remains homogeneous. The simplest filling method involves filling the bunker with a front-end loader. While easy and inexpensive to operate, this technique cannot mix the substrate as it is being loaded and material uniformity may be a problem. Some bunkers and tunnels were equipped with overhead conveyors to provide even mixing and distribution of the substrate as it is loaded into the bunkers. In addition to other farms, at our last two stops, Carbury and Custom Composting in Ireland, both used hoppers equipped with an oscillating conveyor specifically designed for bunker loading.

When contemplating Phase I aeration, the issue of clogging nozzles must be addressed. We were lucky to find Pat Walsh and Michael O'Sullivan in an early stage of their Phase I tunnel construction and we were able to observe first hand how these floors were constructed. The problem of clogging and nozzle damage has been greatly eliminated in spigot floors by constructing grooves in the concrete, which coincide with the rows of nozzle openings, (Figure 6). In this way, as machinery is driven through the bunker, substrate material is less likely to be compacted into the openings. However, it is usually necessary to periodically unclog the aeration holes, either manually or by blowing air at high pressure through them. Several farms accomplish this by blowing out the nozzles with water.

Shortening of the raw materials was accomplished at some operations by some type of chopping or mechanical thrashing during the mixing process. Several other mixing and watering systems were seen at the different farms, but the all growers emphasized the importance of achieving a uniform mix of ingredients and water before filling a bunker or tunnel. When discussing the history behind their move into aerated Phase I composting, both Cahal McCanna and Michael Cusak of Carbury emphasized this need for thorough mixing of bulk ingredients.

The variation among the preconditioning strategies being used is great with respect to length, mixing techniques, water supply, and aeration. Regardless of the approach, the objective of the Prewet period is to increase density through sufficient watering, turning, and, often, mechanical grinding and chopping of the straw. In order to obtain bulk densities in a range that is profitable, most operators agree on the necessity to mechanically break down the raw ingredients through mixing or grinding. Some farms, however, continue to use long straw based on the philosophy that chopped straw has poor structure, which results in an inability to absorb water. Farms that fill into Phase II tunnels often prefer longer structure compost, then after Phase II additional mixing and shortening of the compost occurs. In addition, on farms that have Phase III bulk spawn run, the compost would get an additional mix and would be denser at casing time.

Conclusions

Aside from an aerated floor and structural sidewalls, there is great variation among the multitude of bunker systems currently being used for Phase I composting. Several approaches are being used regarding: length of processing, operating

Figure 6. Nozzle floor with grooves for cleaning.

regime, physical parameters within the substrate material, aeration techniques, and material handling. Depending upon the raw ingredients, mixing equipment and desired compost characteristics, each farm has developed its own process. The most successful odour reduction was on farms where the early stages of Phase I are aerated and water additions are distributed throughout the composting process.

Although a capital investment is required to transform a conventional outdoor Phase I rick facility to an indoor bunker facility, there are several incentives. First, the use of bunkers has shortened the Phase I process time. In addition, the space and labour required to operator Phase I using bunkers is greatly decreased. Finally, many operators advocate bunkers based on the resulting high quality substrate attributed to uniform temperature and oxygen distribution. Whether these advantages outweigh the cost is subject to debate. While some farms may have implemented bunkers as a result of environmental pressure, operators there feel the labour savings resulting from the bunkers has made the system worthwhile. Other operators, however, admit that they would not choose bunkers over conventional Phase I composting if not required to by environmental regulation. Obviously a great deal of research is still required to adequately refine Phase I bunker systems, but in spite of the shortcomings, our trip confirmed that use such systems has been successful in reducing odours and preparing a prolific substrate for mushroom production.

Acknowledgements

Much thanks to all of the above mentioned farms, growers and operators. They include: Henk Schreurs, De Klein; Jan Pijnenborg, CNC; Tarcisio Billio, Fungicoltural Billio; Wilbert Smeets, Trentino; Luca Francescutti, Gerard Derks, Agrifung; Frank Stewart-Wood and Ian McClay, Aylesbury Mushrooms; Richard Gaze and Ralph Noble, HRI; David Walker and Simon Middlebrook, Gateforth Park; Pat Walsh and Michael O'Sullivan, Custom Compost; Cahal McCanna, Michael Cusak, Carbury Mushrooms. Also our thanks to Henk van Gerwen and IPC Plant for taking the time to share their experiences and knowledge regarding Phase I mushroom substrate preparation. Additional gratitude is extended to Dal Compare Gabriele, Italspawn; Bram van Nieuwenhuijzen, IPC Plant; Cecilia Timewell, MGA; Liam Staunton, TEAGASC and all others for their invaluable and professional assistance in arranging farm visits and accommodations. Our sincerest thanks should go to Paul Wuest for his incredible effort to organize this tour. ■

Research Round-up

Peter Flegg brings together research reports from around the world . . .

. . . A new cultural technique, pest control, a new combined spawn and supplement, fungicides against green mould and Verticillium resistance to Sporgon.

(Those with a special interest in any of the topics are advised to consult the original source).

Sandwich technique

(Mark Spear, Sylvan Spawn Laboratory Inc., West Hills Industrial Park, Kittanning, PA 16201, USA)

The Sandwich technique is a method of shortening the mushroom cropping cycle. It allows spawn run and case hold to overlap by one week so reducing the 'lost time', when no mushrooms are being produced, from just over four to around three weeks.

Earlier attempts to reduce the time between spawning and casing have usually failed because the CI (casing inoculum) or CAC material introduced into the casing layer was starved of food before it could connect well enough with the mushroom mycelium in the compost.

Using the Sandwich technique, a top-dressing provides immediate sustenance in the casing layer, resulting in an even colonisation of the casing and earlier fruiting. Other possible benefits are higher yields resulting from lower dry matter loss before the first flush, less tray handling and reduced disease because cropping duration is shorter.

Three versions of the technique are suggested.

1) Spawning, top-dressing and casing (using CI or CAC) all completed on the same day then held for 6 days of spawn running followed by normal case hold,
2) Spawning and top-dressing on the same day, followed by 6 days of spawn running before casing then a normal case hold, and
3) Spawning and spawn run for 6 days before top-dressing and casing then normal case hold.

In all instances cropping was handled normally and the top-dressing, spread on top of the compost, consisted of commercial casing inoculum (CI).

Four experiments to compare the different versions of the technique were carried out. It is expected that the best practice will vary from farm to farm.

The experiments showed repeatedly that one week could be cut from the normal cropping cycle, but attempts to shorten the cycle by two weeks were unsuccessful.

These early experiments suggested that rates of top dressing of 25g/square foot worked as well as much higher rates and that version 1 led to higher bed temperatures than version 3.

The author's final sentence runs, 'much remains to be done'.

(Summarised from Mushroom News 1998, 46 (7) 24-29).

Compatibility of the insect-parasitic nematode, *Steinernema feltiae*, with chemicals used in mushroom production

*(P. S. Grewal, T. Weber and D. A. Betterley, respectively from Department of Entomology, Ohio State University, O A R D C, 1680 Madison Avenue, Wooster, OH 44691-4096 *, P O Box 60562, Sunnyvale, CA 94068 and Amycel Spawn Mate, Watsonville, CA 95076, USA).*

Biological methods of insect control are receiving increased interest and may often need to be used in conjunction with chemical methods.

This paper is concerned with experiments to evaluate the degree of compatibility of parasitic nematodes with a range of chemicals used for pest and disease control in mushroom growing. All chemicals were tested at 'recommended field rates'.

Compatibility was tested when the materials were used as a tank mix and when applied directly to the casing layer. The paper abstract states 'when held in an aqueous phase for up to 24 h, Apex 5E, Azatin EC, Benlate, Bravo 500, Margo-San and Sporgon had no adverse effect on nematode viability but reduced their virulence'.

Three other chemicals were all lethal to nematodes but could be used applied to the casing provided there was a time interval between adding the chemicals and the nematodes. For calcium hypochlorite, Vertigo and Mertect 340F, a gap of at least 24 hours before adding the nematodes is recommended and after adding formalin the gap should be at least 3 days.

* Address for correspondence.

(Summarised from Mushroom News 1998, 46 (4) 6-10).

Control of the mushroom pests *Lycoriella auripila and Megaselia halterata* by *Steinernema feltiae* in field experiments

(J. W. A. Scheepmaker, F. P. Geels, P. H. Smits and L. J. L. D. Van Griensven, Mushroom Experiment Station, P. O. Box 6042, 5960 AA Horst, Netherlands). ➤

The effectiveness of the insect parasitic nematode *S. feltiae* was tested against both sciarids and phorids under conditions similar to those experienced commercially.

Against sciarids there was a clear difference in the effect on males and females. An application of nematodes 1 day before casing followed by another 1 day after casing resulted in practically complete control of females (97%).

The next generation of female sciarids was almost completely killed (95%) by adding nematodes 7 days after casing. A dose rate of 1 million nematodes per m^2 was just as effective as higher rates.

Diflubenzuron added to the casing remained effective throughout the cropping period killing from 72 to 99% of the sciarids.

The effectiveness of the nematode against phorids varied and it seemed to work best when there were sciarids present. Phorid levels were not significantly reduced by diflubenzuron.

(Summarised from Annals of Applied Biology 1997, 131 (3) 359-368).

Vlasic Farms spawn-supplement

(D. L. Kananen, Vlasic Farms inc., P-152 Country Road 12, Napoleon, OH 43545, USA)

A new combined spawn and supplement has recently been developed by Vlasic Farms Inc. (formerly Campbell's Fresh Inc.). A patent for the product is pending, but it is described as a granular, non-grain spawn which contains levels of nitrogen up to two to three times of those found in grain spawn. Vlasic Farm spawn-supplement (VFSS) is greyish-white to white depending on the duration and temperature of storage. It is stated that much of the mushroom mycelial growth is actually inside the individual particles and so is more resistant to adverse conditions than is grain spawn.

Whereas rye-grain spawn has around 1500 grains per 100g of fresh spawn and millet spawn has around 10,000 grains, VFSS is claimed to have over 40,000 particles per 100g which represents a greatly increased number of points from which mushroom mycelium can grow into the compost.

Comparative times are quoted for compost colonisation. At a 3% spawning rate, grain spawn fully colonises the substrate in 13 days, millet takes 12 days, but VFSS requires only 10 days. At a 5% rate of spawning, those times are each reduced by about a day. VFSS, at a 7% spawn rate, gains 3 days over the other spawns.

Data are presented to show that the use of VFSS brings a degree of protection from overheating the compost during spawn run, together with reduced levels of competition from other moulds. Costs of cooling during spawn run could be reduced.

(Summarised from Mushroom News 1998, 46 (7) 20-23).

Will fungicides stop an established green mould infection?

(D. L. Rinker and G. Alm, University of Guelph, H. R. I. of Ontario, 4890 Victoria Avenue, Box 7000, Vineland Station, ON L 0R 2E0, Canada)

While the main way of controlling green mould is based on good hygiene practices, they are not always completely effective. This paper attempts to find out if fungicides applied to compost or casing significantly affect an established infection of green mould. In Canada, only Benlate 50WP and Bravo 500 are registered for application to casing and none is available for compost use.

Benlate 50WP, Bravo 500 and Mertect 340F, when applied to the compost surface, failed to limit the spread of *T. harzianum* (Th 4) on the compost or into the casing.

Benlate 50WP applied to the compost at the rate recommended as a coating for grain spawn, while failing to restrict the growth of green mould, also did not always (2 out of 6 times) protect the compost when spawn grains were coated with it. It is thought this was probably because some of the grains were not sufficiently coated. If only a few grains are not properly treated then, it seems, the effect on the growth of green mould in the compost is as if none of the spawn had been treated at all.

The paper recommended that a thorough hygiene p. gramme remains essential for the control of initial infections of green mould.

(Summarised from Mushroom World 1998, 9 (2) 40-42).

Résistance de la môle sèche au Sporgon (*Verticillium fungicola* var *fungicola*) (Resistance of *Verticillium* to Sporgon)

(B. Desrumeaux, P. Sedeyn, A. Werbrouck and P. Lannoy, Centre de Recherche pour la Culture du Champignon, Ieperweg 87, 8800 Rumbeke-Beitem, Belgium)

Some growers have suggested that resistance to Sporgon has made *Verticillium* more difficult to control and, in Belgium, Sporgon is the only authorised fungicide for use against Dry Bubble. Research work on this subject in other countr is referred to.

Samples of *Verticillium* from mushroom farms were cultured and their growth measured when grown on media containing 0, 10, 20, 40 and 80 ppm Sporgon. After 3 weeks at 20°C colony diameters were measured.

The development of all the *Verticillium* isolates was partially inhibited by increasing concentrations of the fungicide. The average reduction in growth was 44%, 61%, 70% and 82% for the respectively increasing concentrations of Sporgon. None of the isolates was completely resistant.

Sensitivity to Sporgon varied between isolates. When exposed to 80 ppm Sporgon the growth of some isolates was six times better than that of some others. The difference in sensitivity to Sporgon between isolates from different farms explains why the use of Sporgon is more successful on some farms than on others.

(Summarised from Bulletin de la Fédération Nationale des Syndicats Agricoles de Cultivateurs de Champignons 1998, (77) 677-681). ■

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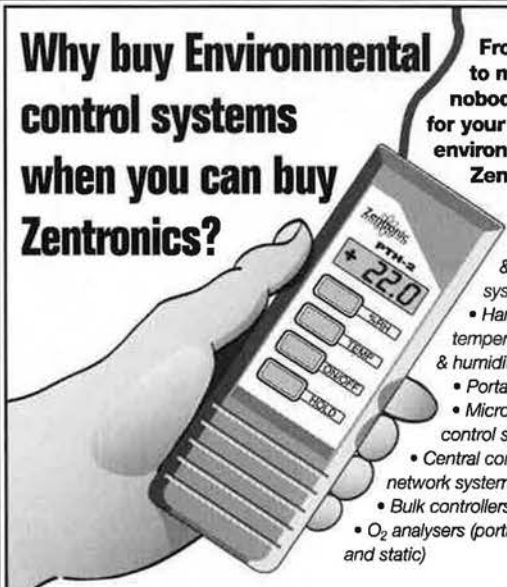

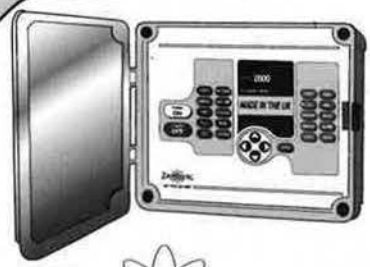

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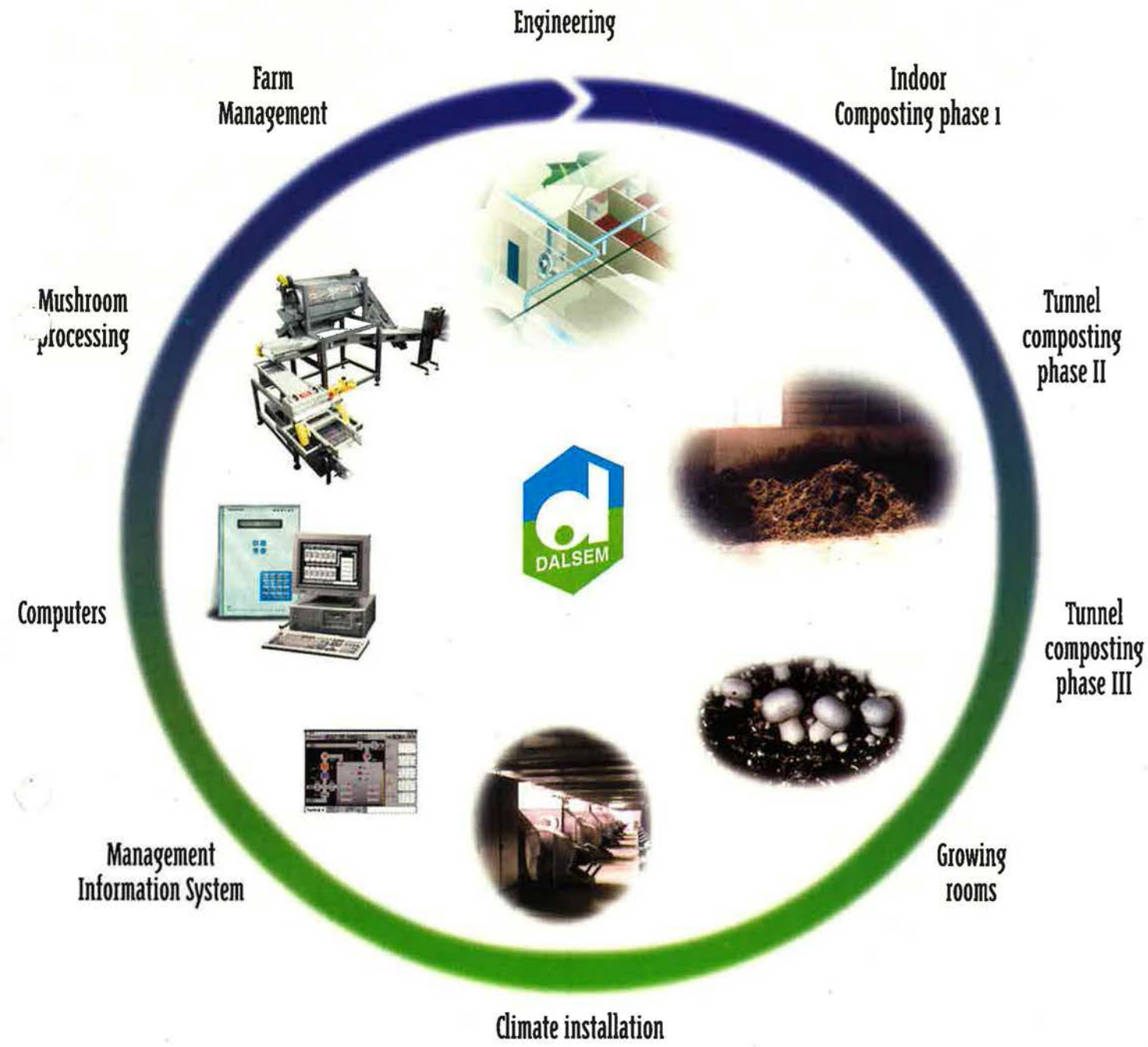

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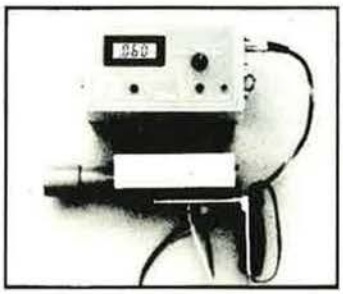

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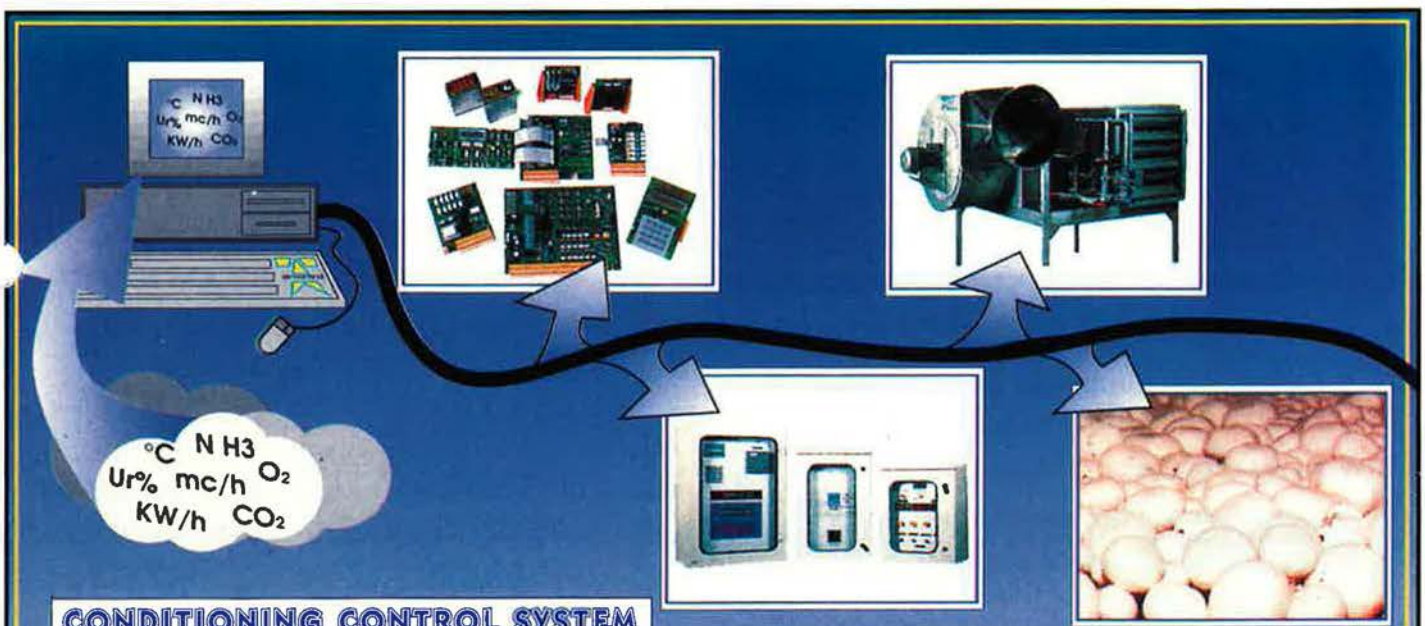

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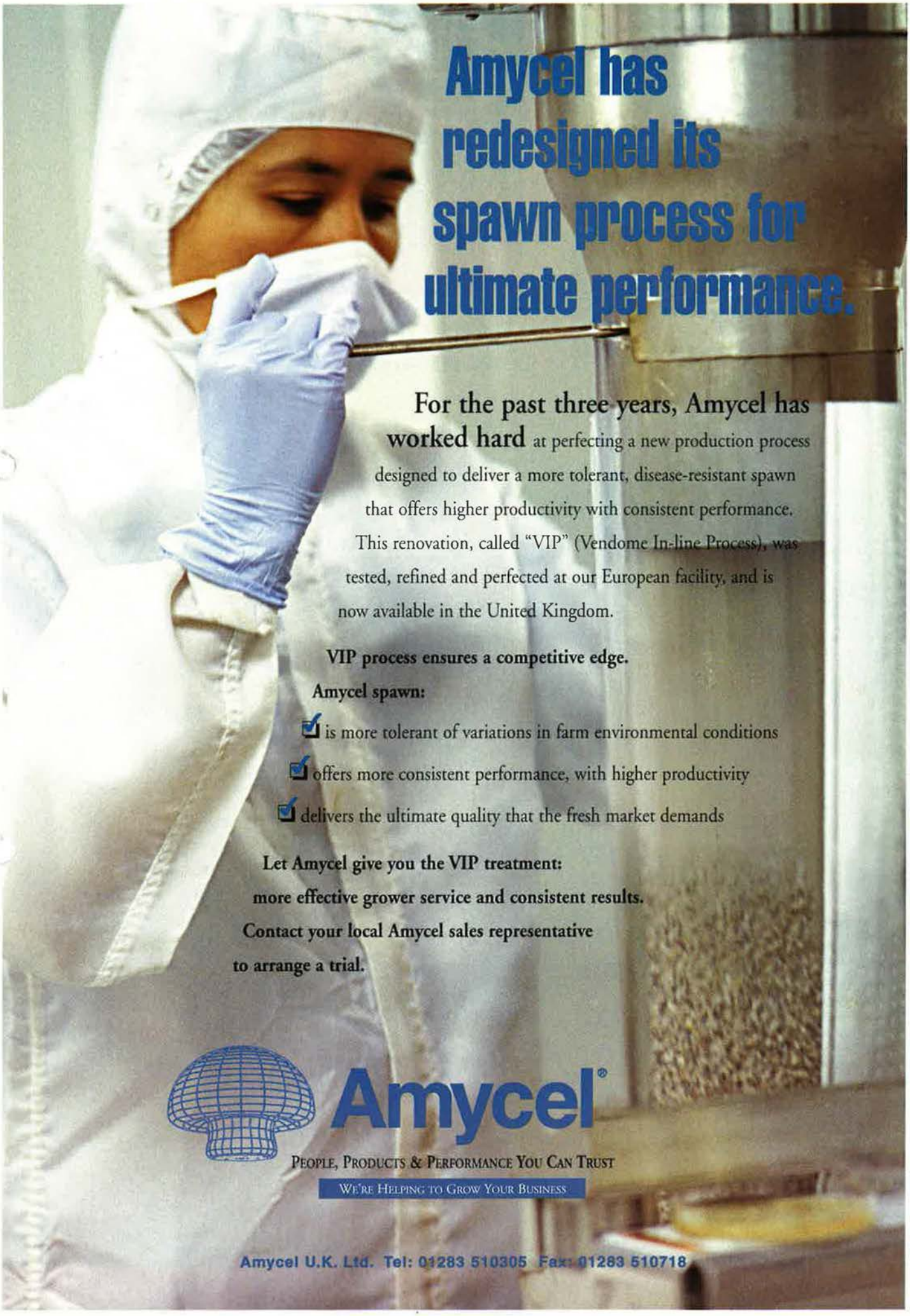
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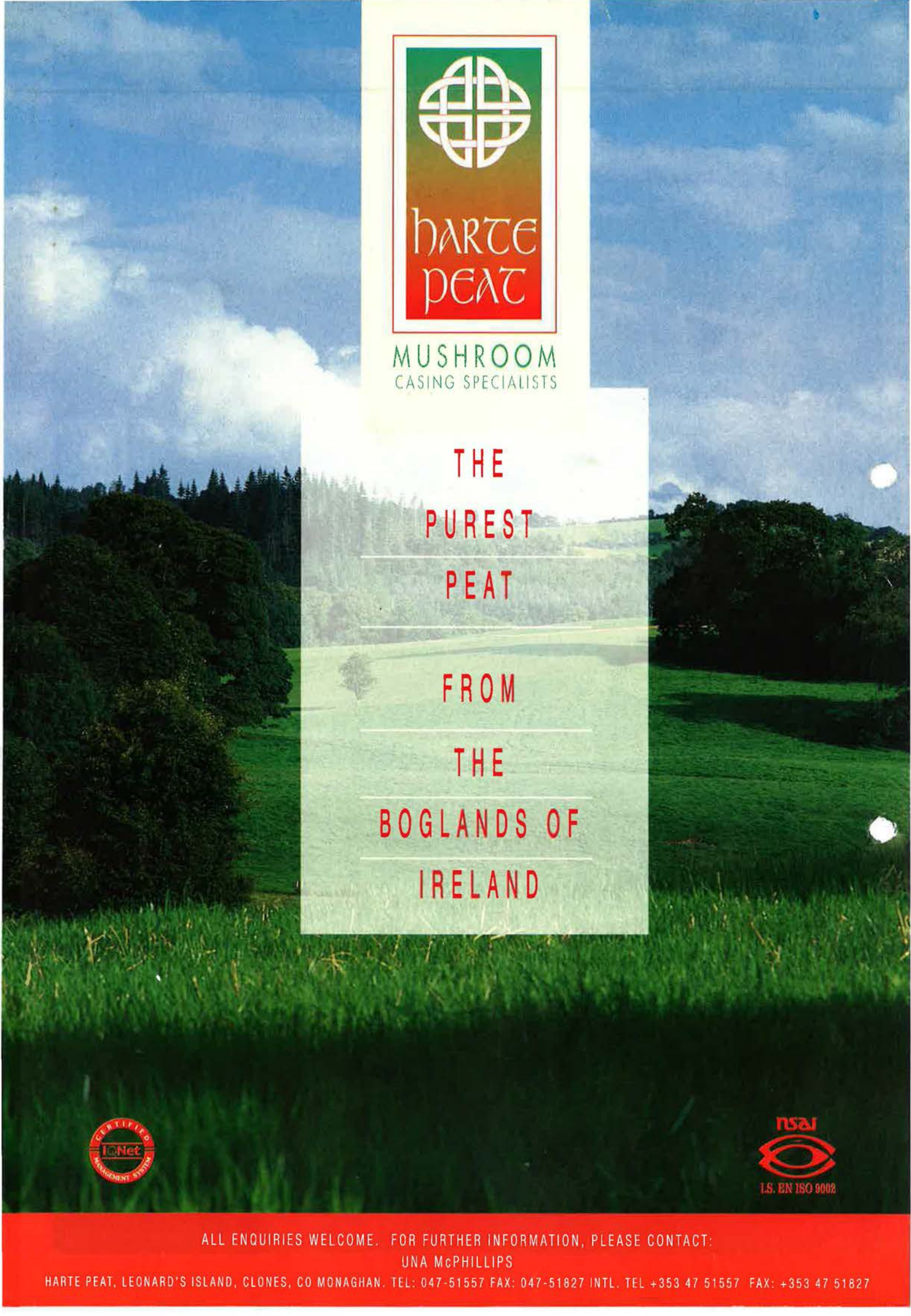

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