

# THE *Mushroom*

OFFICIAL JOURNAL OF THE MUSHROOM GROWERS' ASSOCIATION  
MAY 1995 NUMBER 545 ISSN 0144-0551

## JOURNAL

Sylvan - Quality Production

**INSIDE** HARVESTING SPECIAL FEATURE ■ LET'S  
KEEP IT SIMPLE ■ GROWING PAINS

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*From a series of drawings by Anatoly Dverin*



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Articles for consideration are welcome; also letters for publication which should make a point strongly and as briefly as possible. They may be faxed or posted and should be addressed to the editor.

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# THE Mushroom JOURNAL

May 1995

No 545

## EDITORIAL

### Forward challenging progress!

One reason for the success of our industry is that we have always had to remain under extreme pressure from almost every aspect of the work involved. This has resulted in our being forward-looking, alert to every possibility and willing to apply the latest in technology and machinery when so much of UK industry either soldiered on or stagnated.

This issue of the Journal illustrates this alert attitude very well. We are at present in the forefront of the international scene with the forthcoming conference bookings for which reveal just how much the world wishes to come to our event in Oxford. This gives it already the cachet of success which all of us are doing our damndest to ensure.

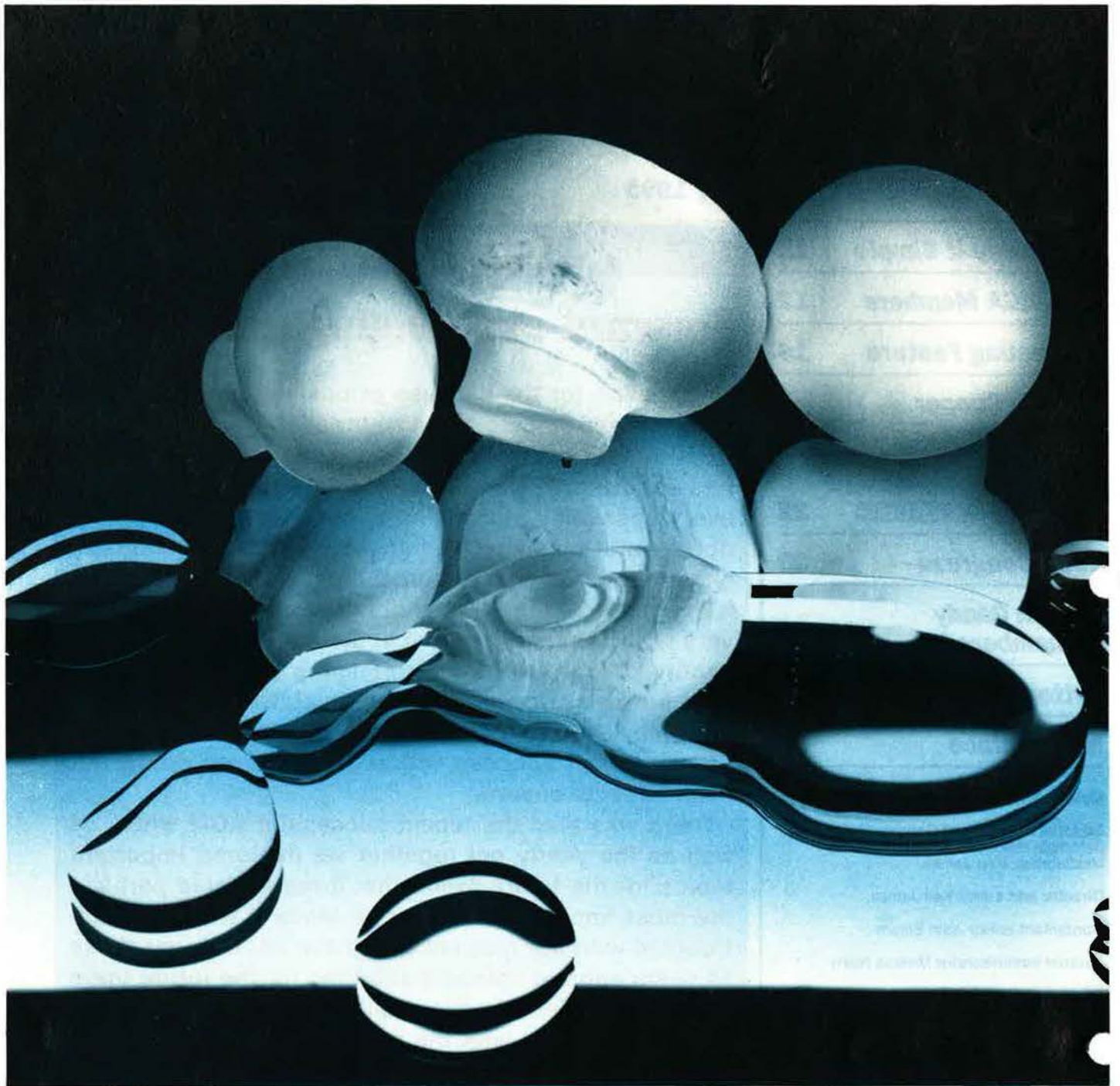
There was also the recent successful AGM when, as well as the yearly get together we explored important topics for the future aware that it represented perhaps the most important event of all since it was our 50th. Coupled with the resilience we have shown over those 50 years and the splendid auguries for the future there is plenty to celebrate. We shall not, of course, have any event to compare with the recent Hyde Park gathering but in our own way the Oxford conference allied to our own golden event could be equally important.

This month's Journal catches the theme of forward challenging progress and looks at harvesting hygiene and other topical subjects in the hope that these will influence the consumers to purchase our superior product.

We are starting a problem page hoping it will be of assistance to everyone.

The editorial board have even caught the 'progress' bug and decided to look at revamping the Journal itself. All in all a pleasing prospect.

Perhaps we may be wrong but we thought that this month even Geoff Ganney's growing pains were hurting a bit less. Now that really is something!



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## Gerard Derks informs:

"With regret we have learnt that on 24 March 1995, Mr Bruno Sartor (aged 85) passed away. He was President of the "Funghi del Montello" enterprises in Italy.

Together with his brother, Angelo, Bruno started growing mushrooms in 1956 and in less than 10 years they became the biggest, most modern and well-known farm in Italy. Mr Bruno Sartor had "the art" of growing mushrooms in his veins and up until three months before his death, he visited the farms daily.

A funeral was held in his village parish church on 26 March, and was attended by a crowd of colleagues and friends. Many growers from the UK met Mr Sartor on the numerous visits to "Funghi del Montello".

Italy has lost a highly appreciated pioneer of the industry."

**T**he South East I & II area farm walk at Blue Prince Mushrooms, Horley will take place on Wednesday, 7 June 1995. Invitations have already been issued. If you are in that area, would like to attend but have not received an invitation, please contact Mel at the MGA office as soon as possible. (Numbers will be limited).

*Our thanks to all those members who attended the Annual General Meeting on 26 April 1995. A full report and photographs will appear in the June issue.*

### There are some sponsorship opportunities still available for various events and items for the 1995 Oxford Congress.

If you would like details of what is still available and the approximate cost please contact Mel at the MGA office on 01780 66888 or fax 01780 66558. (All sponsorship will be acknowledged in the Congress guide book – in the Congress programme and on the sponsorship board throughout the whole event. Other ways as appropriate will be considered, and hopefully agreed).

**Call us now!!!**

## We are pleased to announce an **MGA/Congress Golf Competition**

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# Director's Notes

## "Thanks Robert"

A short but very sincere tribute, by among others, the incoming Chairman, Jim Rothwell, to Robert Brown. Robert is the smallest grower in scale, to have taken on Chairmanship of the Association. In his tribute, Jim reminded members that Robert's contribution during the year has been important, but when the level of commitment, compared to his own farm resources, is taken account of, that contribution assumes massive proportions. "He is an example to all growers," said Jim. And so say all of us.



### The 50th AGM

Nobody could remember when we last had a Government Minister to speak at an AGM, but the Minister of State, Michael Jack gave members present good value in a lively question session.

His announcement of proposals for a horticultural LINK programme, could have interesting implications for research and development based more clearly on commercial needs. As always it will require a strong input from the industry if full value is to be obtained. He encouraged the industry and HRI, in a meeting to be held shortly, to ensure that growers and scientists do work positively together.

For his part, he offered Government support "to underpin and support mushrooms."

His previous commercial involvement and interest in the horticultural industry, was clear in his advocacy of training for a critical crop and sales into the Single Market. He urges members to attend a Food From Britain seminar on 27 June, aimed at stimulating exports. To that end, Michael Jack committed the Government to continuing vigilance over any illegal aids to member states.

The Minister left the AGM in no doubt about the strength of feeling on the issue of the negative impact that the Agricultural Wages Board has on our industry. A later resolution committed the Association to further action to meet the challenge presented by AWB provisions which have a damaging impact on employment in the industry.

Prof Chris Payne, Chief Executive of HRI, reported on the progress at Wellesbourne and looked forward to a positive meeting with the industry, to seek ways of making good use of HRI and the Government initiatives within the industry.

The resolution on marketing advice and information was accepted after modification and an understanding that members could use the vehicle of the MGA for discussion on non divisive issues.

Bryan Dyer drew the attention of members to the Director's report on work within the European Mushroom Group. He stressed that the work to maintain "the ring fence" - of quotas and tariffs, was some of the most important. Pressures on the Commission from third countries seeking to obtain, or strengthen, a foothold in the EU, could seriously undermine our own market. The Director confirmed the Groupement's commitment to this issue.

At the AGM luncheon, incoming Chairman Jim Rothwell performed his first and very pleasant task, of confirming Life Honorary Membership of the Association on Sylvia and Ferd Hensby. He commented that this was particularly appropriate in this their own 30th anniversary year in the industry.

### Oxford Congress September 1995

Bookings are coming in at a very high level. We have had to take more hotel accommodation, but more importantly, I have been able to negotiate for twin accommodation to be added at Christ Church. For many delegates, this provides a wonderful opportunity to experience the atmosphere, the dining grandeur and excellence, and the inexpensive convenience of Christ Church. It is only five minutes walk from the Congress venue. Book now to avoid disappointment.

Ken James

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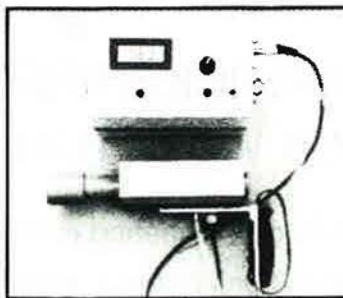
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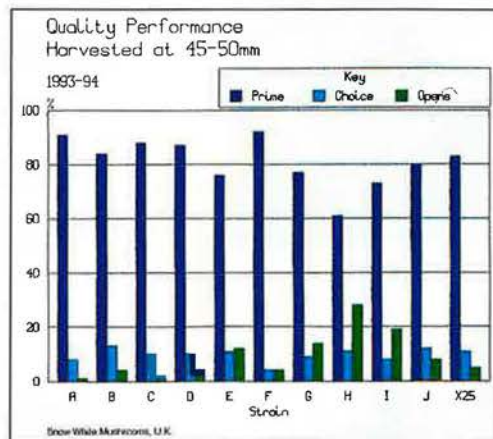
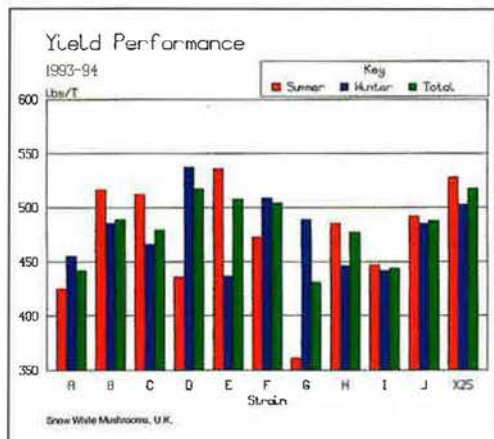
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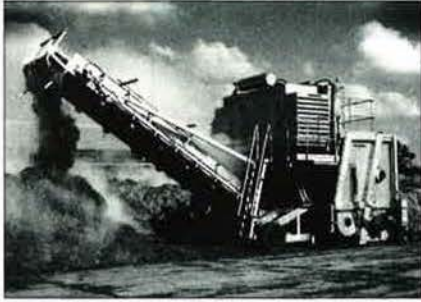


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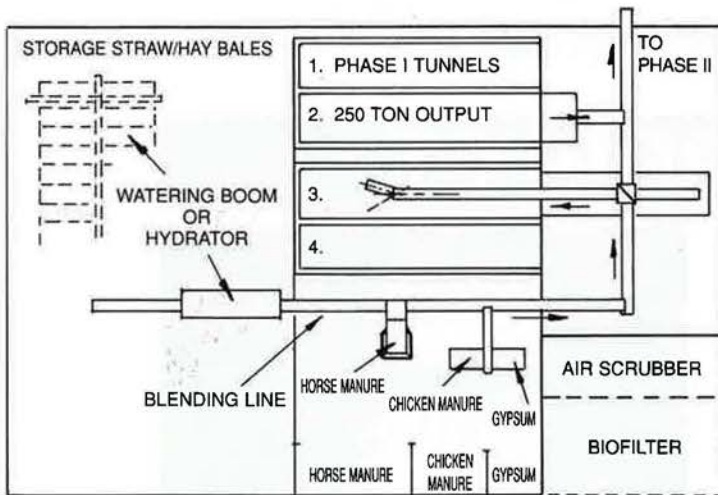
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### 1 March

It sounded like 'spring growth' but turned out to be a faulty heating valve!! What exactly is spring growth? Can mushrooms be affected by lengthening days and increased light intensity? More likely a softening of the air and higher temperatures. I looked in the Glossary of Mushroom Terms by Bels-Koning and found "Spring". This referred me to section 1143. Here "Spring" was replaced by "a well", which to me summarises the problem...

### 2 March

Packaging costs have gone crazy and surely we need some rationality in the business of presenting our product. You go to a large supermarket and look at the fresh produce delivery area, and there are piles of expensive plastic or heavy cardboard packs. Is there not a returnable system? How many millions are wasted annually?

### 3 March

New tray timbers full of blue/green mould giving rise to what we simply term *Trichoderma* spotting! Must check the cook-out temperatures again. In fact, we need a double valve control to eliminate irregularities. Last delivery was Scottish Pine tray sets, and an extremely good sample.

### 6 March

ADAS Energy Audit has given us nightmares on what needs to be spent to put everything in order. We have been through this before!?

### 8 March

I am told there is no shortage of mushroom flies around the industry!!

Following such a mild winter and the increased movement of prepared compost, it is not really surprising. Perhaps re-evaluation of the habits of a mushroom pest requires re-examination following major changes in cultural systems. We will gradually (may be not so gradual!) be pushed into tighter, shorter production systems in order to withstand pest and pathogen attacks. Reliance on chemicals is environmentally and economically unthinkable. Reliance on so-called biological control must raise a fresh debate on the whole issue of its commercial practice and scientific development.

### 10 March

I suppose the straw will last until the next harvest. It is breaking down much quicker and holding a good length with a firm structure is not easy. Probably won't be too important in years to come as controlled phase I methodology develops. There seems to be little doubt phase III will provide dry matter fill control and will be the ideal way of securing good quality mushrooms at high yields. Probably cost far more. Won't be too good if pathogens and pests dictate

two-flush cropping. What is this idiot talking about...?

### 11 March

The annual seminar was well supported and was, to me, a rewarding day. Where can you have a series of practical mushroom papers superbly chaired by Ron Jones, the opportunity to meet suppliers, and spend time talking to mushroom growers all for £50!! The old style annual conference is likely to take place perhaps every three years, and extra seminars held in non-conference years. Well, it's just a thought!

### 13 March

Growers caught out with watering patterns. Change to rapid drying conditions have resulted in beds being far too dry so producing light mushrooms. How can we make such a mistake so many times, and not learn from such mistakes. 'Mundanity'.

### 14 March

*Dactylium* is becoming (or already is!) a major factor in current mushroom nature of the pathogen. It's upsurge in the past two years leaves one wondering how this has come about? Changes in market requirements, volumes of mushrooms

moved around the country, cultural or bad hygiene practices. Quite a list to work through, and no doubt a total priority for the HDC hit list. But there is no money left? How do you prioritise immediate problems? Or is it being able to see further down the production road as to what will become major commercial problems?

### 15 March

Don't understand why we have such high nitrogen levels at spawning – up to 2.8? Adrian Hearne has no real answer and our computation figures are only slightly high. Must be the straw! Re-check sampling system to ensure the master sample is taken as representatively as possible before selecting the analysed sub-sample.

Made note to watch spawn growing temperatures very carefully at all stages of development during the coming weeks.

### 16 March

Another council meeting with an agenda that should take us to Saturday! Bound to take all morning discussing this ill-based, commercially suicidal Agricultural Wages Board. Next Wednesday's first meeting prompts us to write to PM's, MP's, WB

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Chairman, NFU and anyone else we can make a case too. **'To what effect'**. But we must try. Only I do wish every time we take this action, that it was better planned and not left to the last few days.

## 17 March

Production down from forecasting levels and it is not totally clear why this is. Certainly our phase II has been **marginal in it's execution**, or to put it another way, bloody rough. Must work on this with introduction of more standard checks and

## 18 March

Trip to Twickenham re-charged the batteries but reduced the brain function! As Jim Gooding said: "We've been doing this for a good few years, we should know better!"

## 20 March

**'Many people dream of success. To me, success can only be achieved through repeated failure and introspection. In fact, success represents the one per cent of your work which results only from the 99% that is called failure'**.

(Soichiro Honda, founder of Honda Motors, reflecting on mushroom growing!!)

## ?1 March

Even more convinced that the **cost, availability and sociological problems** associated with mushroom harvesting will control production in the UK and other countries.

## 22 March

Sugar beet lime is very tacky this week and presenting us with lumpy, sticky casing mix. Perhaps that would be alright if we were ruffling, but it isn't doing us any favours in mixing in casing mycelial additives. Variations in the base material is enough, without casing materials as well.

## 23 March

We used to have a growing shed cleaned, frosted, and dry before re-filling.

Nowadays it is emptied by 10am and re-filled by noon!!

## 24 March

MGA letter tells me wage award discussions centred around a 3% increase. But what about the add ons or cut offs? Without increases in prices this can not be afforded, and a clear statement on MGA policy will be required at the AGM with instructions to members on how to lobby against the AWB. The reality of comparing an intense commercial mushroom unit with an arable farm defies description, but it has gone on for generations.

## 26 March

Areas of hardgill and a dark annular ring giving cause for concern. Only at present seen in isolated trays which makes us give careful consideration of **'iffy' compost**. Recent virus tests have all been negative, but maybe we should sample again. No good taking odd ball mushrooms, we need a random clean sample from normal looking crops. If it was a virus, I am not sure what we could do to combat the problem. Back in the late 1960s, it always appeared to me that a latent form of mushroom virus could be triggered into crop loss by compost conditions. Crop loss with compost condition is immediate, as is apparently virus. How do you monitor the difference?

## 27 March

Rasmussen's shake up of spawning in the late 50s gave startling results, albeit variable. No doubt, super filtered preparation of phase III compost relates to similar results under **controlled conditions**. Variations in such conditions will no doubt lead to just that: **variations**.

## 28 March

Are we in the realms of having to consider pasteurising our casing materials with what? Methyl bromide? Can it still be used? Past experience gave good results, I think? To use

steam air mixtures with the volumes of wet peat and sugar beat lime would be impossible.

Preparation of material specifications is underway in order to minimise variations. 'Not possible in mushroom growing'. No, compare the preparation of a quality product for supermarket acceptance at depot level with 10 years ago! **Needs must**.

## 29 March

Convinced for many years that the simple art of weighing, in the crop preparation area, was as important as any part of mushroom production. A basic, often given insufficient importance.

## 30 March

**'Please make sure we have some stalk length on the mushrooms'**.

## 31 March

Those who knew and loved Fred Atkins will appreciate this from his **Newsletter** of the 3rd June 1960. Those who never had the pleasure of meeting such a gentle man will also appreciate that this is mushroom growing.

'I have suffered bitter criticisms for some of my remarks in past Newsletters. Perhaps I should emphasise here that if I say what I think, it is because I feel it could be useful to my readers and not, heaven forbid, in order to denigrate anybody. I want to keep my friends in the mushroom world. I reject Shakespeare's advice;

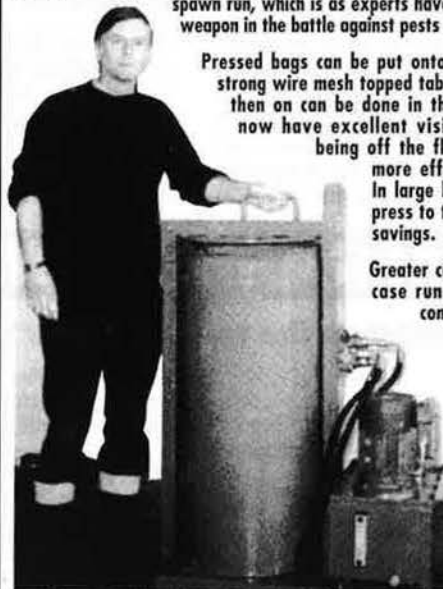
**'Give thy thought no tongue'**, but agree with this above all;  
**"To thine own self be true, And it must follow, as the night the day, Thou canst not then be false to any man."**

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## Compost selectivity and indicator moulds

By Peter Flegg

There is no doubt about it that one of the best tests of compost quality is how well the mushroom will grow in it. I gave some simple tests of compost quality a year or two back (Journal 514, October 1992) but the 'mushroom test' remains the surest. No analytical test can compete.

### Selectivity

A compost in which the mushroom grows well is called 'selective'. That is to say, the conditions prevailing in the compost are selective towards the mushroom. They encourage the mushroom to develop and discourage the growth of other fungi. It is not easy to state exactly what those conditions are, partly because they are the result of the composting process which involves the activity of a range of microbes acting on the compost raw materials (which are variable) although under fairly specific conditions. The result is a more or less dynamic, biological equilibrium. This state of selectivity, so carefully worked towards by the mushroom composteer, can very easily be upset.

The early part of the composting process involves vigorous microbial activity during which readily available nutrients are used up. Microbes grow and multiply very rapidly. A lot of heat is generated so it is mainly only those microbes which can grow well at high temperatures, such as 45-55°C (thermophilic microbes) which will be active. Eventually their food is used up so microbial activity slows down, ammonia production ceases and temperatures fall.

At this stage of the compost preparation, the mushroom, which is killed by high temperatures and the presence of ammonia, and is, compared with many other microbes, a fairly slow grower, can gain a foothold. Even then, for success, it needs a fairly massive initial level of

inoculum, as spawn. The mushroom has the enzymes which enable it to break down the less digestible components in the compost whereas the existing population, generally, does not. The previously very active composting microbes are by no means dead. Some may be, but, because there is no food left for them, they become inactive – alive but dormant.

### Destroying selectivity

Provided that conditions of low temperature are maintained the mushroom can continue to develop and even to digest some of the dormant microbial population. However, should the temperature rise to over 60°C, even in a small part of the compost, say, through carelessness over compost temperatures during spawn running, the whole composting cycle can begin again. The excessively high temperatures will kill some microbes. Their cell contents will be released and other microbes will be able to make use of them as food and begin to multiply and produce heat and ammonia.

In the early days of compost supplementation compost overheating was a serious problem. Many of the materials used to supplement composts contained significant quantities of readily available nutrients which encouraged the dormant thermophilic microbes to become active again. It took a lot of research to overcome the problem of the overheating which resulted from the use of compost supplements which upset compost selectivity.

### Indications of composting problems?

Sometimes the composting process does not go exactly according to plan. The compost may be slightly too wet, perhaps only in parts, or too dry. Perhaps the initial supply of certain important elements, nitrogen in particular, may have been faulty. A consequence is often that the compost selec-

tivity may suffer. Organisms, which, if things had gone well, would have had little chance of making their presence felt are able to develop. They can become an indication that all is not well in the compost. In a 'field' of mushrooms, they are weeds, weed mould, or because they may indicate a certain compost condition, indicator moulds.

Standards of compost preparation these days are high and the occurrence of weed moulds is probably much less than in the past. However, things can and do go wrong and because fewer growers are involved in compost preparation these days there may be a tendency for the tell-tale signs given by indicator moulds to be overlooked or the significance of their presence just not appreciated. It is true that quite often there is little which can be done to put right a problem in an infected crop. Good hygiene, though, should help to prevent moulds, especially their spores, and the mites which feed on weed moulds (see Journal 535, July 1994) from spreading to other vulnerable crops.

The presence of strange moulds should not be ignored even if they seem to be causing no particular problem. The nature of the mould, where it is growing, its colour and mode of growth should be noted. If it persists in successive crops an identification should be sought and, if a compost problem is suspected, the details reported to the composteer. Do bear in mind that not all extraneous moulds indicate a compost problem. Sometimes, action may be needed by the grower.

Weed or indicator moulds are often identified by their colour, usually of their spores. They come in a variety of hues, red, white and, yes, even blue, but more usually they are of varying shades of brown or black. I will be writing in more detail of these multi-coloured moulds on another occasion.

## NEW MGA MEMBERS

The MGA welcomes the following new members:

### GROWER MEMBERS

**MR IAN NICHOLAS**  
3 Stirchley Village,  
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TF3 1DY  
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**FOREST WOOD FOODS LIMITED**  
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Margate,  
Kent  
CT9 4LT  
Tel: 01843 823463

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West Sussex  
RH20 3ED  
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Reykjavik, Iceland  
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## Technical Manager – Fenton Barns

Middlebrook Mushrooms Ltd has a vacancy for an experienced mushroom grower to be appointed Technical Manager at Fenton Barns, located in the Scottish Borders. Fenton Barns is a Phase 2 and Phase 3 bag farm, currently producing 50,000 lbs per week of fresh mushrooms for the major Scottish supermarkets.

Reporting to the Farm Manager, the Technical Manager is expected to contribute fully to the wider aspects of managing the farm, including deputising for the farm manager and acceptance of budget responsibilities. There are good prospects for personal development and promotion into general farm management.

All applicants must have experience as a successful grower on a tray, shelf or bag farm. Personal drive and ambition are essential and we shall be looking for planning, organising and communicating skills as evidence of ability to motivate and lead others within a well structured organisation. Formal training in agriculture would be an advantage but is not essential.



Terms will be tailored to attract the best applicant and financial assistance will be given if relocation is necessary.

Applications, in writing only by Monday 12th June 1995, giving full personal and career details should be addressed to

THE PERSONNEL OFFICER,  
MIDDLEBROOK MUSHROOMS  
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AVON, BS18 7ES.

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# Harvesting

## Hygiene and Air contamination

We thought we could not do better than reproduce the first part of a comprehensive survey made at the 1984 Conference by Brian Purkiss of BDH Chemicals. It appeared first in the 1985 Journal.

# Cleaning up in the mushroom market

### A profit and loss account

The science of environmental hygiene has only risen gradually to its present level of understanding, having its natural foundations in the work of Louis Pasteur, a century or more ago: his work introduced the idea that infection could be transmitted by air currents. Pasteur's original work concerns what we have come to call industrial biodeterioration, but was rapidly exploited by the medical profession of his time. This early medical emphasis had the effect of delaying the fullest appreciation of the true industrial implications of Pasteur's discovery. But industry is now realising the economic importance of environmental hygiene: as is so often the case, farmers and growers are well in the forefront of the advance.

I am a practitioner in industrial environmental hygiene procedures, rather than an actual producer of mushrooms. I hope today to be able to remove from the subject of environmental hygiene a good deal of the pseudo-medical mumbo-jumbo with which it has become associated during the last few years. The main problem in this type of situation is that practical laymen, without any specialised medical training, have been conditioned to believe that the subject of hygiene is an area of operation restricted to the medical profession and, even supposing he could understand it, the farmer and grower is led to believe he would stand little chance of making any good use of it. In fact this is very far from the truth since, once the subject has been completely understood, the multitude of routine procedures which arise from its application make a good deal more sense.

It will come as news to nobody that the air around us is always heavily loaded with bacteria, yeasts, and fungi, in the form of cells, spores, and viable fragments; this characteristic of omnipresence is at the root of all environmental infection problems.

### Airborne counts

In an extended series of field tests the following microbial fall-out was observed after one hour's exposure to air of a solid culture medium in Petri dishes. The samples were incubated for 18 hours at 35°C before counting.

### Airborne fall out/hour

Location	No. of colonies/m <sup>2</sup> (extrapolated)
1 Railway Station at 10.00am (men sweeping with broom)	12,065
2 Cafeteria at 12.00 noon	11,430
3 Typing room at 10.00 a.m.	3,302
4 Town Hall, corridor	
2.00am	2,667
11.00am	8,255
Noon	11,049
5 City, Main Street	7,874
6 Open country, after snowfall	127
7 Underground Station at 5.00pm	16,764
8 Mushroom Sheds (mean result)	31,750
(Standard deviation ±15,000)	
9 Municipal rubbish dump	40,260
10 Hospital operating theatre	508

**Note:** These colonies rarely arise from just one cell but usually from multiple clusters of cells, on separate dust particles.

### Consideration of fall-out

- 1 The fall-out in any area will be characteristic of the surroundings.
- 2 The microbial population in a given 'region' will, in general, be organisms which find it convenient to be there (i.e. adapted or selected types). Therefore the microbes have found something there that they like.
- 3 They will, thus, be parasitising the crop or materials associated with the crop. If the host cannot tolerate them one then has a disease.
- 4 'Disease' = a superfluity of organisms able to parasitise the host – to the point where the host's defenses are swamped.
- 5 No two species of plants ever have precisely the same immune-response. The relatively tolerant plant (mushroom) is the one which develops the mutated species (variant) of micro-organism which eventually kills other less tolerant plants.

This law is manifested in the infantile cold infection situation. Dad picks up a mild infection and passes it to mum who suffers rather more. She passes it to junior who reacts fairly vigorously. After dad's mild cold is forgotten he is then reinfected by the now very much altered version from junior and experiences a very severe reaction. Dad is still suffering long after junior has recovered.

### What is infection?

All living matter is continually exposed to a fall-out of micro-organisms which may

or may not be antagonistic to it: this antagonism is called disease. Every living organism has acquired an innate ability to resist infection, known as its 'immune-system'.

#### The stress situation

The nutritional and environmental requirements of a plant are usually highly specific, but the highly evolved plant also does have a limited but finite ability to discriminate between the available nutrients. Given an adequate store of nutrients it will choose what it needs to cope with the situations in which it may find itself, when the appropriate nutrient or ambient condition is not immediately available, a living organism is brought under stress, which then predisposes it to disease.

**'A living organism is brought under stress, which then predisposes it to disease'**

### Components of stress

- 1 Incomplete nutrition (starvation, sequestration).
- 2 Adverse ambient situations:
  - a Water Tension
  - b Heat
  - c Oxygen/Carbon dioxide
  - d Trace Elements
  - e Sub-toxic agents
  - f pH
- 3 Inherent genetic deficiencies.
- 4 Parasite attack:
  - i Insect
  - ii Fungi
  - iii Bacteria
  - iv Antagonistic species

#### The sequence of infection

A contamination which could usually be handled by the plant, may, from time to time, develop into an infection, or pathogenic condition, where the well-being of the host plant is actually under threat. What causes a 'contamination' to change to an infective situation?

### The anatomy of an infection

Stage	Apparent effect on plant
a Contamination	Healthy
b Proliferation	Healthy
c Colonisation	Healthy?
d Coexistence	Healthy, but with alteration
e Moribundity	Unhealthy
f Mortification	Obvious ill health
g Decomposition	Finis

We can examine these stages in more detail:

a This can be mitigated by the correct attention to basic hygiene, but it is dubious whether it could ever be

absolutely eliminated. It is always the ever present initiator of infection.

b The fall-out has begun to consolidate its bridgehead on the host-plant, but is still using its own nutrient-sources.

c The parasite has now consolidated its hold on the host, but has not yet become dependent on it.

d Symbiosis of a transient or permanent nature has now developed. Both the host and the parasite may be finding benefits to their mutual advantage.

The immune-system of the host may be actively rejecting the parasite.

e The parasite is now taking more from the partnership than the host can easily give. The host is now under stress.

f The life of the host is now under direct threat and is suffering actual physical harm.

g Partial or gradual death of the host is well under way. Certain other 'scavenging' organisms (saprophytes) are now at work on the host. After a while the saprophytes will have the decay process well in hand.

**NB** 'Saprophytes' are organisms which obtain their nutrients from dead or decaying material.

In sections a, b, c, and d the host may still emerge undamaged and saleable, but after this, it is increasingly less likely to be so. Up to this moment we have been dealing only with random contamination of a statistical nature. The typical mushroom shed has of course certain important differences:

- 1 The potential hosts are very closely interrelated and they may often be clones. This will give the pathogens a consistent target to adapt themselves to.
- 2 The growing environment is rigidly consistent (for optimum cropping).
- 3 The same environment is inherited by a succession of crops of the host. This permits highly-adapted potential parasites to develop on walls floors, etc. The concentration of parasites/plant tends to increase with time and, with it, a probability of infection.

In case it should seem that these arguments are aimed at mushroom growers in isolation, I must point out that this is not so, for precisely the same situation exists in hospitals, medical centres, and many other common environments.

### The origins of fall-out

In order to permit the design of valid environmental hygiene operations it is

vital that there should be a clear understanding of the principles which underlie the phenomena associated with the existence of such suspended matter and its eventual sedimentation. With a clear conception of the situation which governs the formation and behaviour of fall-out matter one is better able to optimise the conditions of treatment, to obtain the maximum economic effect.

The sources of airborne fall-out are manifold and would have been different in each of the foregoing examples, we must, however, address our attention to the results obtained in the mushroom sheds. In this context we will find that the microbial fall-out in the growing area arises from a number of sources among which are:

- a The compost/casing
- b The crop
- c The building
- d The equipment
- e The workers
- f The exterior environment

There seems to be little doubt that, of the above, a and b are quantitatively the most important; with the exception of f, the other 'sources' are merely regions where a and b have accumulated with time.

#### The compost

Almost by definition, the damp compost is a thriving ecology of micro-organisms and it is by no means uncommon for it to contain as many as 2 billion ( $2 \times 10^9$ ) organisms per gramme: several times more than this on a dry-weight basis. In general, these organisms are a benign part of the cultivation process but, occasionally, villains will appear and flourish.

#### The crop

This contributor to the eventual fall-out produces spores and hyphal fragments, from time to time it must be expected to contribute actual disease organisms.

#### 'Dust'

This clearly covers an almost infinite range of materials but is most easily defined in terms of particle-size alone: a pebble ceases to be a pebble when its diameter (thus, mass) permits it to become suspended in air currents. In this region of physics the unit of measurement is the micrometre or 'micron' ( $\mu\text{m}$ ) which is one millionth of a metre, i.e. 0.0001cm (0.001mm). Whether a particle suspends or not will be determined by its density and diameter and the movement, temperature, and humidity of the air around it, the same parameters, of course, will also govern its rate of sedimentation. Such particles will often acquire a surface charge of static electricity.

Particles greater than 200 $\mu\text{m}$  may require a considerable degree of air-turbulence before they become mobilised (say, a light breeze) and will settle a few minutes after the air movement has subsided. Particles in the 10 $\mu\text{m}$  to 100 $\mu\text{m}$  range will suspend in convection cur-

rents and may take an hour or so to settle; whereas in the 2µm to 81µm range they may remain suspended for some hours. It will be recalled that the fall-out rate in the Town Hall corridor became greater as more people caused greater agitation of the air around them.

The presence of the suspended particles is clearly visible when an oblique ray of sunlight illuminates them (Tyndall Effect); a principle which is used in the Coulter Counter, for testing 'clean rooms'.

A bacterial cell or fungal fragment could be expected to have a diameter of the order of 1-2µm, so that 200 of them might easily be accommodated on the surface of a 10µ diameter particle of inorganic or organic matter: a 100µ particle could provide space for a hundred times as many. However it is unlikely that these extreme 'standing room only' conditions would occur very frequently but even low levels of microbial contamination might give trouble for the grower.

We then, have a situation where there is a virtual commuter population of microbes – good, bad and indifferent – which will experience a number of peaks of intensity during the course of a day. Sooner or later a pathogen is bound to come into contact with a mushroom which is experiencing a stress situation.

**Sedimentation**

In the course of time most of the larger or denser suspended particles will settle under the effect of gravity, coming to rest upon a variety of horizontal surfaces – as well as certain vertical surfaces which may offer an electrostatic attraction. This sedimented fall-out obviously represents an enormous concentration of microbiological matter, a proportion of which is bound to be antagonistic towards the crop. This settled 'dust' represents a reservoir of latent infection for the region in which it falls: it will obviously resuspend as and when appropriate conditions of turbulence arise.

Being the largest horizontal area available, the floor is certain to receive the largest amount of fall-out but, with reasonably good housekeeping, this tends not to reach a 'great' depth—perhaps a millimetre or so per day. Bear in mind that a layer of compost dust 1mm thick over an area 10 metres by 10 metres would weigh about 200g; this could, as has previously been shown, represent  $200 \times (2 \times 10^9) = 4 \times 10$  micro-organisms.

Horizontal surfaces which are not cleaned as frequently as are the floors, will obviously accumulate much heavier depositions per square metre.

**Continuing our theme we have the ideas of Mariet Vedder, the consultant of Georgia, USA, by kind permission of Mushroom World**

# Pre-harvest, harvest and post-harvest

**When we get to harvesting everyone backs off**

*Mariet Vedder thought it appropriate that the following letter to Geoff Ganney which was published twice in The Mushroom Journal be used as a lead-in to her paper on harvesting.*



*"Dear Geoff,*

After reading your 'Growing Pains' in the May issue of The Mushroom Journal, I would like to respond to what you wrote about your experience of April the fifth; your philosophy about a picker's knife.

Indeed, I have studied the most important tool a mushroom picker has, perhaps little closer than most of your readers.

First of all, I would like to explain why I'm so interested in what you wrote about harvesting in general and the cheap, but nevertheless very important, tool: the knife.

As a teenager, in my spare time after school hours, I helped my friend's parents to get the mushrooms off.

They had a small size mushroom farm. Little did I know then how it would effect my later life... Although I studied fashion, for several reasons I ended up in the mushroom business.

Working first for the Mushroom

Training Centre in Horst as a harvest supervisor and later doing training for harvesters on farms all over the globe. Introducing new harvesting techniques and methods to improve the efficiency and also the quality of the product. We all know that mushroom growing is not that easy and more and more developing into a science. To improve the business we organise conferences and courses, we

write books and magazines and sometimes we have open house to show off some good first breaks. There even is a kind of mushroom doctor: Geoff Ganney, specialised in growing headaches.

Amazing for me is that at these conferences or in these books or magazines, famous experts are talking or writing about compost, supplementing, cack'ing, deep scratching and the use of chlorine and the ideal CO<sub>2</sub> concentration and hybrids and virus and marketing, but so far... I have always missed harvesting.

It seems that when we get to this, in my opinion, most delicate and important part of the mushroom business, almost everybody is backing off, having no interest. Do the owners/managers of a mushroom farm forget that the pickers are eating away almost 60-70% of the (labour) pie?

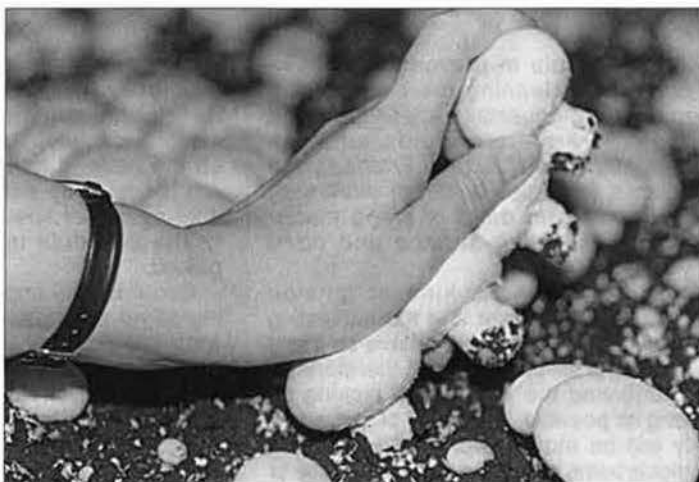
Don't they realise that a harvester can influence the quality of the product more than any other growing factor?

We send our growers, area managers, compost guys, etc. to courses and meetings, sometimes even overseas.

**'A picker can influence the quality of the product more than any other growing factor'**



Showing a handful of four mushrooms picked according to the "One Touch Technique." All mushrooms are lined up straight, held gently against stretched side of thumb, ready for easy cutting. This way there is no bruising or soiling of the mushrooms, the palm of the hand stays clean all the time.



**The "One Touch Technique" not only solves the problem of soiling and bruising the mushrooms, but gives higher efficiency too. Once they are lined up this way it makes cutting easy and we start from the little finger and then up. This sequence of cutting allows us to move quickly while making a straight clean cut. Mushrooms are kept clean without bruising.**

Do we have any serious training program for the biggest work force, the harvester? Are the mushroom growers dozing off?

They mechanised and computerised to the fullest, but most of them overlooked in my opinion one of the most important (and also expensive) areas.

It seems to be below the level of the designer-owner of a farm to discuss with the pickers how to create the best harvesting conditions. We do the utmost to get the mushrooms on the beds and very little to get them off properly. May I offer your readers a suggestion, Geoff...?

The best way to recognise the daily problems in the harvesting area is: let the boss/manager pick mushrooms himself for half a day or more. Then he will figure out that indeed it's very unpleasant to constantly get a wet shoulder from that dripping plastic airduct, or a stiff neck as the result of the high air velocity in the aisle.

He never before realised that it isn't that much fun to sit on your knees on a catwalk for hours to collect the white gold. That indeed the distance between the two beds was that little and the lowest bed so close to the floor. How frustrating it can be to pick just 12kg an

hour with hard work, because of mushrooms with a piece weight of 160 in a kilogram and most of them almost open already, and somebody is asking if that room ever will be finished.

The boss then will figure out that there's actually more light in his toilet than in the growing rooms where 15 or 24 people are working for so many hours.

A king-size bed may be wonderful during the night time but for picking the mushrooms at the centre of a bed, one should know that the maximum width should not exceed 140-145cm. By picking himself, he too will realise how unpleasant and itchy it is to have compost in your hair and neck because of poor construction of the sideboards or sloppy filling. Perhaps he never before realised that there are that many spots in the room with puddles of water on the floor. Not good for controlling blotch but very unpleasant to stay in too!

He will figure out that his stepladder is not as handy as he thought it was; that the space on the platform of the lorry is indeed very limited and that climbing the trays goes far beyond his physical capability.

After that half day of picking he perhaps will understand much better why

many harvesters are constantly looking for other jobs.

Sorry Geoff, I almost forgot to tell you more about the knife. In my opinion and I've quite a bit of experience, the best mushroom picker's knife is made by:

Diogenes-Werk Herder & Sohn  
P.O. Box 110227  
D-42662 Solingen  
Germany  
Fax: (02 12) 7 12 89

Order No. 4602 for mushroom knife, colour orange; loose in paper DM 1.60 each (unit pc. 10, cont. pc. 200).

If the mushroom growers in the more developed countries want to continue their business in the future, they'll have to pay much more attention and have to spend quite a bit of money to improve the harvesting situation. Although the Dutch developed a system for mechanised harvesting, we all know that for a high quality, fresh market product we still need human hands and eyes. For as little as one US \$ we at least can put a good picker's knife into those hands."

*Mariet Van den Munckhof-Vedder*

It is well known in marketing that for a buyer of a product, the most important factors which will influence his choice are: a consistent quality and price, along with reliability, correct delivery, etc. Especially in the market for fresh mushrooms, high quality and thus a longer shelf-life, is a key factor.

In such a competitive marketplace, what kind of possibilities does a grower have to make his product more attractive for the potential buyers?

He could try to produce cheaper, more efficiently and offer his product at a lower price than the competitors. If he does have a hard time to compete price-wise, perhaps he could try to do better in other very important areas, namely quality, service, reliability and presentation.

The biggest problem today for most American and European mushroom growers trying to produce a first grade quality product, is high harvesting costs (which often make up more than 60% of all labour costs). In spite of the high wages, it becomes more and more of a problem for them to get enough people willing to do that kind of work. Picking mushrooms is not an appealing job. It has a low image. Therefore growers increasingly have to compromise between quality and efficiency or come up with mechanical harvesting. Profitable mechanical harvesting, however, is only useful so far for lower quality, sliced, canned product. In the end, quality will always be the winner. Here is a good chance to excel. A grower should train and motivate his people to pick first quality mushrooms. If they work efficient-

ly he can pay them a good salary and still make some profit. He just has to organise his work force properly, giving them good training, the best tools and equipment, the right instructions and the necessary follow-up. Motivation and involvement are the keywords. If someone can motivate his workers and keep them involved in what they are doing, most of them will do the utmost to do a quality job.

To lift up the poor image of this most important job we better look into the techniques and all the little tricks and details involved. Based on the results of studies in the field of harvesting mushrooms, I like to describe what, to my knowledge, at the moment is the best hand-harvesting technique, regarding ergonomic factors, efficiency and product quality. The proper harvesting technique is not only a question of efficiency and cost savings but it also is the key to quality. And quality is the key to success in the mushroom business.

The potential for first quality on the beds most times is at least 70-80% but we often end up with less than 50-60% in the packaging or cannery.

A beautiful product on the beds can be ruined if the harvesters do a poor job. This can be due to lack of interest, too little discipline, a lack of training, not having the proper tools and equipment, or working in a poor environment.

On the other hand, even the most skilled and dedicated picker cannot collect a first quality product if the mushrooms show up in big clusters or are formed too deep in the casing soil. It also will be very difficult when the mushrooms are wet and sticky as the result of the poor watering technique or an inadequate ventilation-circulation system. That kind of damp mushroom is much more sensitive to bacterial blotch or discolouration after bruising during harvesting and transport.

A picker cannot do much if there are mushrooms on the beds with bacterial blotch, green moulds or mites. These are mainly growing problems. What a picker can do is keep the beds clean and help to keep the infection level on the farm as low as possible.

There has to be a good cooperation between grower and harvester. They can help each other a lot. The pickers see every square metre of the beds and can tell the grower where the wet or dry spots in a room are, or on which bed there are some funny looking mushrooms or the first mould spot. The harvesting crew also plays an

important role in preventive disease control by cleaning the beds during harvesting, especially after finishing a break. Parasitic moulds such as *Dactylium* and certain *Trichoderma* species (and also bacteria) often start developing on dead or dying mushroom tissue like stumps and dead young fruit bodies.

There can be a kind of tension between the grower and the harvesting crew. The grower likes to have as many kilograms as possible and therefore he is delaying the moment of picking as long as possible. The result of this usually will be more weight but with some mushrooms oversized, almost square or even open, with much lower market value.

Mushrooms normally don't show up on the beds as oversized or second quality; we let them grow that way, mainly because we don't pick them on time. One of the reasons for this is that a number of staff people at our farms are too quantity driven and they are just thinking in kilograms. The more, the better, but they forget the most important thing: the quality, and so the market value of the product.

Often we are wrongly promoting this concept by paying the growing supervisors an incentive, mainly based on quality. This way we might not expect too much cooperation from them for achieving a quality product, if that could mean a little lower yield (and therefore less money in their pocket).

It is a misunderstanding, however, that the total yield will be much higher if we let mature mushrooms grow bigger by leaving them on the beds for one more day. We have to understand that there is only a certain amount of nutrients and water available in the compost and that will be the most important limiting factor.

It is not always easy to judge the right moment of picking, especially because the cap-size is not a good indicator of maturity. We have to realise that mushrooms are growing fast and that a good looking first or second break at 6 in the morning is perhaps not finished picking before early afternoon. At that time a part is already turned into second quality.

We know by experience, and we have shown this on several farms, that we can increase the percentage of first quality product drastically if we pick the mushrooms off the beds on time. Picking time starts as soon as there are a few mushrooms maturing (the

fore-runners) before the real first break develops. To speed up the development of the coming break and create more uniformity, we better pick them off the beds. If first break mushrooms are ready to be picked, whatever day after casing or spawning, and whatever the schedule is, they have to be picked.

Also it is very important to start picking some mushrooms out of a cluster (pruning) in a very early stage. Clusters will often develop, especially in a first break, most likely as the result of non-uniform casing and/or poor deep-scratching. Making openings by picking some mushrooms out of a cluster gives the remaining fruitbodies more space to develop. It also avoids higher temperature and CO<sub>2</sub> concentrations between the caps (resulting in fast quality deterioration) and it makes drying after watering easier.

The faster we finish, eg the first break, the sooner the next, second break will be ready. We can speed up the development somewhat by picking the mushrooms off the beds completely after 4-5 days of selective picking. This means: not waiting for the last ones to grow out completely. We should try to have empty beds for at least one or, even better, two days. Leaving some mushrooms on the beds can delay the next break and makes watering, temperature control, etc. more difficult and the application of pesticides more risky (residue).

From the foregoing it also will be questionable if we should opt for an "in-between-break", which means: waiting for some left-over pins after a break to mature, before the next break is ready. Besides the aforementioned negative effects, the quality of those mushrooms is often reduced and any gain in total yield is questionable.

To have any open mushrooms is not only dangerous from a virus infection standpoint, but they also have a low market value. Leaving them on the beds will further delay the uniform development of the maturing fruit-bodies from the upcoming break, and use up food and water.

It also is, of course, very inefficient to send an entire crew into a room to pick only a few fore-runners or some left-overs after a break. The fore-runners can be picked by the waterers, first thing in the morning and the pickers should clean the beds completely on the last day of the break, so that there are no left-overs.

Whatever picking has to be done at any given day, the entire room has to look uniform after the harvesters leave the room. Starting early in the morning one has to pick slightly tighter than around noon, because mushrooms grow

**'If first break mushrooms are ready to be picked...they have to be picked'**

per hour. Its the task of a harvest supervisor to make sure that everybody matches this uniformity, whether selective daily picking or the final day of cleaning the beds at the end of a break. It should never look patchy.

## Organisation

To reach the goals of best quality, highest efficiency, lowest costs and happy people, a good organisation of the harvesting is very important.

Most farm managers are still more concerned about getting the mushrooms on the beds than about how to get them off on time. Its a common misconception that harvesting mushrooms is one of the most simple jobs in the world. Picking a few mushrooms indeed is rather simple but doing it 6-8 hours a day, fast and well, while leaving the beds in good condition, is not an easy job at all and it takes quite a bit of training and daily experience to make a good picker. One has to realise that playing organ, piano or typing with ten fingers, can be compared with picking mushrooms! There are after all not that many jobs which require the full and individual use of all fingers from our left hand. This takes a lot of practice and dedication to do it right and for a beginner it takes at least two weeks before they pick up on speed.

The farm manager has to be aware of the importance of what the harvesters are doing and he has to be very supportive in that area. He should try to find a harvesting area manager/coordinator with long years of experience in this field who already knows most of the tricks and is very knowledgeable about everyday problems. The manager should have a harvest supervisor for each 50-60 pickers. The pickers should be divided in crews of 10-15 people. The most logical and best way is to recruit a harvest supervisor out of a group of crew leaders. It is almost impossible for somebody to manage such a job without quite a bit of practical experience, even if that person may have a certain education level. Nobody would accept a driving instructor who is not able to drive a car himself

Each crew should have a crew-leader, preferably recruited out of the best harvesters. In case the growing rooms are rather big, we could consider additional runners, serving the harvesters for a smooth flow of empty and full trays and exchange of waste buckets.

## Harvesting coordinator

The harvesting coordinator is the liaison between the farm manager and the entire harvesting crew. It is very important that the coordinator must have a

good feeling for teamwork and the ability to work with people while handling stressful situations.

The harvesting coordinator has to work in close cooperation with the production manager (head grower) and the packaging or cannery manager. He or she is responsible for the instruction of what kind of product we need at a given moment, for the quality of that product within the given specifications, as well as for the harvesting costs (efficiency).

The harvesting coordinator can supervise the work of two to four harvesting supervisors and keeps the manager informed about the status of the total harvesting group: attendance, shortage, vacation, efficiency and termination. He or she also has to prepare daily and weekly picking estimates, independent from those of the harvesting supervisors.

Together with the farm manager, the harvesting coordinator has to work out training programmes, proposals for improvements, incentive programmes and so on. He or she also has to study the QA reports, results of piece counts (a daily random sample of each room) and collect quality and efficiency data as well as work out proposals for improvements within the total harvesting area.

The harvesting coordinator should spend at least 50% of the time on the farm, in the growing rooms, where the action is.

## Harvesting supervisor

With the full support and guidance of the harvest coordinator, the harvest supervisors are responsible for the following

- 1 The supervision of 4-6 crew leaders with their 50-60 pickers and eventual runners.
- 2 The correct picking method, including quality grading, efficiency and hygiene.
- 3 Room assignments for each crew, in good cooperation with the crew leaders (make sure that fore-runners be picked off on time).
- 4 Keeping track of total picking weights, quality and piece weight per room.
- 5 Keeping track of performance level of each crew, motivating and correcting as necessary.
- 6 The preparation of a daily and weekly harvest estimate (independent).
- 7 The preparation of trays for next day, based on estimate. Also make sure that enough waste bags and buckets are ready inside the rooms for next

day.

- 8 Training of new pickers and an ongoing training programme for minimum pickers who don't meet the standard of eg 10 kg (22lb) per hour.
- 9 Hold occasional meetings with the crew leaders to discuss their job and any problems.

To be able to do a proper judgement of what, when and how much can be picked, a harvest supervisor has to pick regularly. He or she should preferably be recruited out of the group of crew leaders.

## Harvest crew leader

Normally the best and most experienced out of a group of pickers will get the function of crew leader. For a crew leader, as well as for a harvest supervisor, it is not enough to just watch what other people are doing. To get the feeling of how well or poorly that particular room can be picked, how the mushrooms are (sticky, weak, firm), how the work environment is, they have to be picking themselves every day. How can they train, guide or correct people in their work (with some authority) if they can't master all the fine tricks themselves? A crew leader normally supervises the work of 10-15 pickers and perhaps a runner. The main responsibilities for a crew leader, in close cooperation with the harvest supervisor, are:

- 1 The proper harvesting technique following the "One Touch System" including quality grading, simultaneously cleaning the beds, efficiency and hygiene of each crew member.
- 2 The discipline of the crew in the room also regarding clothes (sleeves), hair, hands (nails), etc.
- 3 The proper positioning of the crew in the room.
- 4 Keeping track of the performance of each member of the crew.
- 5 Giving feedback to the supervisor regarding wet or dry spots, the presence of pests and diseases, broken lights, etc.

These are but a few important aspects of harvesting good quality mushrooms. It's nearly impossible to cover the entire technique detailed in one article. Nevertheless it might be food for reflection and even give an indication for improvement. Harvesting, in my opinion, has been neglected far too long.

'Harvesting, in my opinion, has been neglected far too long'

And here, finally, is advice from our own John T Fletcher

# Harvesting hygiene

Managing harvesting is never easy and the more people involved the greater the need for a well regulated system. Without a well defined routine essential harvesting hygiene is difficult to implement.

## (How important is hygiene at this critical time of crop production?)

To appreciate its significance it is important to have an understanding of the biology of the organisms that cause the problems. Some are very effectively spread by air movement alone whilst others move in water.

The recent epidemics of cobweb show how effective air-borne transfer can be and *Mycogone* patches proliferate at great speed if diseased mushrooms are watered. Spread on hands, clothes and tools is one of the main means of dissemination for *Verticillium* and many fungi whether pathogens or weed moulds are spread to some extent in this way.

Handling disease is therefore a very risky practice.

Harvesting is the one process in cropping where a large proportion of the crop and the casing surface may be touched by hand. Although harvesting hygiene is only a part of the farm hygiene programme it is a critical part. One absolute essential is the removal of disease before harvesting begins.

## Pre-harvesting hygiene

There are three components:

- knowing what to look for
- Seeing what there is
- the effective removal of disease

Education is the key to recognition and every farm should have a training programme which keeps staff up-to-date and educates new staff. The cost of training is small compared with the damage that can be done by the inadvertent handling of diseases. It is not essential for pickers to know the detailed biology of pathogens and pests but they must know what is abnormal and that abnormal mushrooms must not be handled. Of course it adds to interest and commitment of staff do know something about the principals and reasons for hygiene. Such information is necessary for management but the pickers need have little more than the basics.

It makes sense to have the beds so well illuminated that abnormalities are immediately seen. This ideal is not so easily achieved and there are many cropping houses with dark corners.

Good fluorescent lighting is an essential but often needs to be supplemented with high intensity torches especially for 'disease' gangs.

Finding disease can be a problem when cropping is heavy and this makes it even more important to have well informed pickers as they may be the first to spot a problem.

The effective treatment of disease is the final stage in hygiene at harvesting. There are two options:

- *in situ* treatment
- removal.

Both have their merits.

## *In situ* treatments

*In situ* treatment does not involve the handling of the affected mushrooms. But it must be done carefully otherwise it is a waste of time and money. Most pathogens spread beyond the recognisable area so the treatment must be over and beyond that which is visually affected. Salt is the most frequently used treatment. The finely crystalline product is better than chunky crystals. It is useless to cover the casing and leave large untreated mushrooms projecting above the salt. Red pepper mites move well through large crystals and are not always suppressed by the first application of the finer product.

Localised application of disinfectants has been used in the past but pesticide regulations may not allow such practice to continue.

## Removal

Removal requires the very careful handling of disease and the frequent use of disinfectant to avoid the accidental spread of spores.

So pre-harvest hygiene includes education, perhaps a well trained disease gang and effective removal. This should all happen before the pickers move in.

## Picker hygiene

Once hands or gloves become contaminated spread of spores can continue for a long time. It has been shown experimentally that *Verticillium* spores can be transferred at least 400 times after once handling a source. This means that a picker who touches a *Verticillium* dis-

eased mushroom is likely to spread the spores some distance along the bed or even to another house. Also baskets, hangers, steps, buckets, switches, taps,

radios, even toilets may all become contaminated and be a secondary source. Spore spread is not immediately apparent because it may be a week or more before the next diseased mushrooms appear. Imagine the possible routes for spores to travel around a farm! From an affected mushroom in a third flush to the canteen and back the next day to a first flush is a real possibility. Pickers over-

alls must be clean every day and it should be absolutely clear whose responsibility it is to wash them. Just 20 minutes in a tumble drier set at a maximum temperature is all that is needed to kill pathogens if there is any doubt about washing.

## Pickers' paraphernalia

As important as overall cleaning is the hygiene of all the bits and pieces that go with picking. Look at this equipment at the end of the day and see if it is clean. Only too often hangers become encrusted, steps dirty and knives are poorly cleaned. It is no use making a gesture by showing these pieces to a disinfectant. Most disinfectants are not effective in the presence of large quantities of organic material so it is essential to remove all crud first. Once free from such material a short dip treatment is much more likely to work.

## Returned boxes

Getting other people's containers from the market can be very hazardous. They may be contaminated with spores of pathogens and this is one sure way that long distance spread can occur. The spread of fungicide resistant cobweb could easily have occurred in this way. There is also the additional danger of getting someone else's mushroom spores and with them the risk of virus. Re-using containers can save money but it is essential to have an adequate cleaning programme for trays in order to avoid disaster.

Harvesting hygiene is all about attention to detail and the discipline of checking. When it is lax problems follow.



# Norman R Cooper

## Shadowlawn Mushrooms

By Peter W Munns

Norman Cooper was Chairman of the MGA for the year 1963-64.

He started to grow mushrooms at Kimcote in Leicestershire in 1948.

When I first met him, in company with the late Fred C Atkins, it was early in 1974. He had recently completed a substantial expansion on his farm, virtually single-handed and having laid 33,000 bricks in the process. In later years I was to ask him – "How did you manage to lay so many bricks?" His reply was typical of the man; "I just laid the first one and then kept going until I finished".

Such was his outlook on life. Norman was a perfectionist who strove to achieve what he wanted to do. He was a talented artisan and desired to acquire, and to then use the latest in machine tools and gadgets. He had played golf until the development of Parkinson's disease made him stop. He was, for many years, a Rotarian. He learned to play the piano, starting to do so in his 56th year.

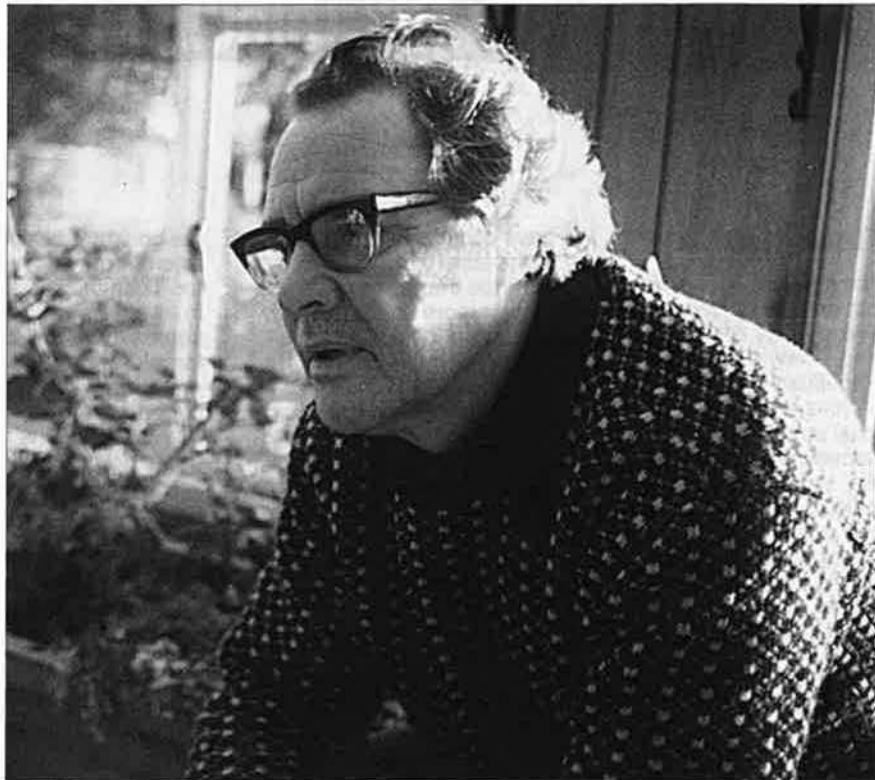
He was enthusiastic, innovative, and always active.

He and I became good friends and I have many warm memories of the hospitality and convivial times which Peggy and I enjoyed when we visited Norman and Ann, whom he had married in 1973.

Norman was born on the 22 May 1919. Having finished his schooling at Leicester Boys School he went to work for British United, in the shoe trade. He joined the army at the outbreak of the 1939-45 war and went to France, where he found his company were 'left' behind the Maginot line. They managed to make it back to England and he later became a captain and served, with several infantry battalions, in Africa, Italy and, finally, France.

He developed a love of Italy and his last holiday there was when he and Ann travelled with Peggy and me to Capri. Whilst there we met up with Raymond and Priscilla Thompson; they were on their annual visit to the island where they had spent their honeymoon. It was a wonderful evening we spent, dining *al fresco* under a clear sky in warm and memorable surroundings. Shortly after that holiday Priscilla Thompson died and Norman's disability began to become a little more pronounced.

Norman was amongst the bravest of those I have ever met. It would be an



understatement to say, merely, that he suffered his Parkinson's disease with great courage. Courage he certainly had and he undoubtedly suffered but he took hold of his deteriorating condition. He walked when he could, he rode a tricycle when his walking wasn't so good and, finally, he bought a golf buggy and drove this round the farm. When his legs 'gave way' he would lean or lie where he was until his medication began to work again. One day I found him lying on the floor of the workshop and instructing one of his men in the art of making 'tables' for his growing bags to stand upon. He refused my help. I went to the house and told Ann. "Leave him, he'll be alright, he'll be back within the hour." And so it was. The golf buggy bounced around the corner and Norman, swaying somewhat, made it back into the house and into his wheelchair. Throughout that terrible illness he was supported and encouraged by Ann, at times she seemed to bully him along but, always, it was done with love and deep caring. Hers was a positive approach.

Sadly, despite all efforts, his beloved farm failed three years before he died, he lost everything and ended his days in a nursing home. When I visited him he was still planning, still talking mush-

rooms, still mentally active but – his own words – imprisoned in a failing body.

The funeral service at Kimcote was a simple and straightforward one. It was as he would have wished it to be. Ann, his widow, and his two sons, Iain and Stewart, by his first wife Edith, were amongst the eighty or so mourners.

One final memory, one fitting tribute, a last example of the man and his zest for life. We four: Ann, Norman, Peggy and I; were at Hidcote Manor. Norman was in his wheelchair and we took it in turns in pushing him around the gardens. After almost an hour he said: "I think I can make it now". He stood up, out of the chair, and after a moment he crouched down and touched the ground and then immediately sprang upright and started, almost to run, out over the long green lawns. People around us looked as though they had seen a miracle, the expressions on their faces were a picture. In fact they had seen a miracle of sorts. One man's courage against the odds. A chance for him to prove that for the next ninety minutes or so he would be his own man, on his own two feet.

May he rest in peace, far from the cares which beset him in his final years.

# The Problem Page

## TRIALS AND TRIBULATIONS



### **?** Introduction

When growers are asked "what are your problems?" the responses are very varied. They range from "competition from those —" (this is an international journal so one has to be diplomatic) to a benign smile, slightly shrugged shoulders and the answer "none at the moment".

Possibly some of these differences arise from the personal circumstances or perhaps the optimism or otherwise of the person to whom the question is addressed. But perhaps also to perception of what is a problem. There are those, mainly human resource managers and some consultants, who maintain that problems don't exist. What **you** call a problem is really a business opportunity in disguise, a 'challenge', the meeting of which will improve your financial if not your spiritual soul. In some instances they may well have a point. The changes that

have occurred in the industry in the last 10 or 15 years illustrate that some problems can, or more correctly must, be viewed in this way. The triangle of industry, rising retailer quality control and foreign competition had to be closed and for many it was an opportunity and not a problem.

For all that, real problems do occur and the best way to confront them is to face them squarely and not hide behind management speak. The only 'opportunity' facing anyone festooned with cobweb is cure it or else... An opportunity to survive I suppose. So perhaps the man with the smile has no problem but maybe he's missing a lot of chances to improve his position.

### **!** Purpose

The purpose of this column is regularly to discuss the problems, trials, tribulations or whatever we call them, that from time to time assail us all. I shall invite others to contribute answers and solutions where it's appropriate and hope, as things progress, to receive and incorporate members' comments, both on the subjects already discussed and perhaps more importantly on those we need to discuss.

To return to the introduction, it might be worthwhile in this first, hating, instalment to fill in some of the possible gaps in the range of responses between the smile and the imponderable.

### **\*** Problems

Diseases and pests are always with us, or, when there is temporary respite

the constant anxiety of their return remains to unnerve us. Then there is rising costs in all the varied forms that seems to manifest itself, but largely labour and raw materials. New legislation concerning safety, pollution and food hygiene forever bears down on us. The awful unpredictable quality of what growers buy compared with the high quality and low margins of what they sell is a constant problem. And then, of course, the mushrooms just don't do what we'd expect them to do. There are, of course, many more and multitudes of subdivisions of this brief opening catalogue.

Problems fall into several main categories:

- The damned nearly insuperable.
- Those to which the answers are already available – somewhere else.
- Those requiring new scientific or technological information and innovation.
- Those which need 'political' resolution.

It's important to recognise with any problem which of these components apply and often aspects of all four do so.

### **?** HRI

At HRI we are primarily concerned with problems that require new scientific or technological information to take them from the insuperable to the possible. During the course of our bureau and clinic activities we can offer some of the existing solutions where they aren't known to the individual enquiring, but often learn to recognise

where new information is required and thus build it into our research and development programme.

Unfortunately today, nearly everything has a political component and we join with the MGA and HDC to improve the situation where we can, whether it be pesticide usage, pollution, health and safety or in some cases to support just claims for equitable treatment from government.

### **!** Intention

So that is the intention, and in effect this is the 'flyer' for a forum for discussion and debate on your problems. If you have any burning ones that need airing do let me know (Tel: 01789 472075 Fax: 01789 472076).

Next month I'd like to start with the current problem of Cobweb control, chemical usage and hygiene. In the meantime, if you haven't already, you might like to send us a sample of your strain of Cobweb. We will test it for resistance to currently available chemicals, **free of charge**, under the auspices of an HDC survey. The aim of this is to quickly establish the present resistance development. The address to send the samples is: Dr Helen Grogan, Horticulture Research International, Wellesbourne, Warwick CV35 9EF. The best samples are cobwebbed mushrooms, not casing, but casing will do if that's all you have.

So next month I'll start with *Dactylium*, continue with it if necessary and then introduce other subjects **as you dictate**.

**Richard Gaze**



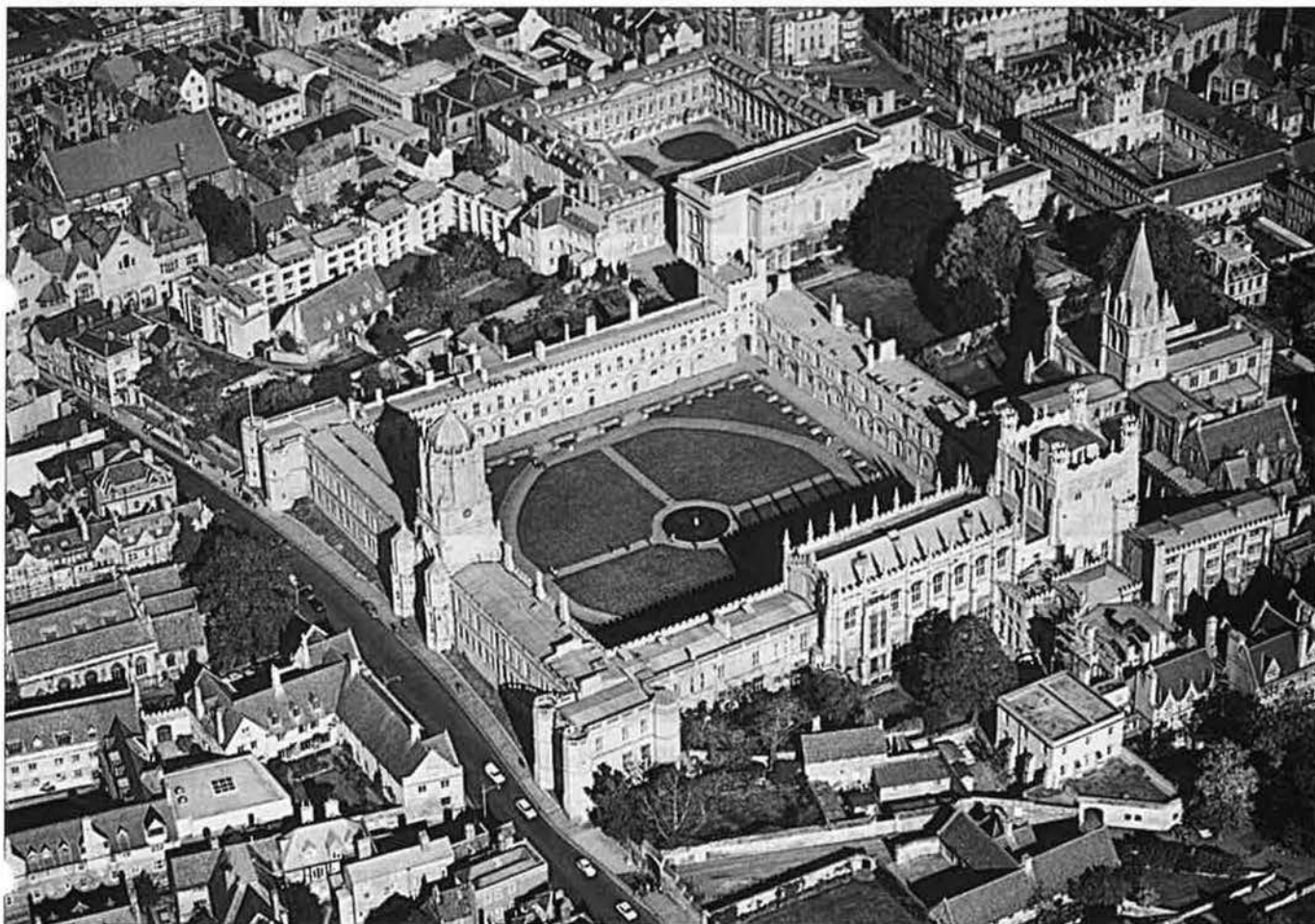
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# Doreen Gandy

It is with regret that we report the recent, sudden death of Doreen Gandy.

Doreen spent nearly all her working life concerned with diseases of the mushroom. She began her career at the Mushroom Research Station, Yaxley, in August 1951 studying a wide range of mushroom pests and diseases.

In 1955 when mushroom research work was transferred from Yaxley, she moved to GCRI, Littlehampton, with an intermediate brief stay at Wye College, .

Doreen retired from GCRI in October 1983 to spend a well-earned retirement in the nearby West Sussex village of Slindon.

Among her notable achievements during thirty or more years devoted to mushroom diseases is her determined study of a mysterious and often devastating condition of mushroom crops in the late 1950s and early 1960s known variously as 'watery stipe', 'brown disease' and 'dieback', which closed down more than a few mushroom farms. This work culminated with the discovery

(with Mike Hollings and Fred Last) of the first instance worldwide of a virus attacking a fungus. Rational control measures soon followed and nowadays crop losses arising from viral infections are very much reduced.

Mushroom growers over many years have been helped considerably in their continual battle against mushroom pathogens by her work on bacterial blotch and on *Verticillium fungicola*. She clearly demonstrated the important role of the house environment, relative humidity in particular, on the development and control of bacterial blotch.

Dry bubble, (*V. fungicola*), an intractable disease of mushroom crops also received much attention from her and she was able to give some respite to growers from the disease through her recommendations on crop hygiene and for a time, the use of fungicides.

Her work was always thorough and painstaking. She served the mushroom industry well.

**Peter Flegg**

All of us who knew and worked with her were saddened to learn of Doreen Gandy's recent death.

In my early years at GCRI, I found Doreen an unfailing source of quietly delivered, authoritative, knowledge of mushroom pathology.

Sadly, Doreen's contributions to our understanding of mushroom diseases and their control has not always been fully appreciated. She was not good at self-promotion and too honest to offer the illusion of 'quick-fix' cures when none existed. Yet in the 1960s and 70s she provided much of the fundamental knowledge of virus, bacterial and fungal diseases that we rely on today.

I was, and still am, a staunch disciple of Doreen's ideas concerning the hygiene and environmental control programmes which she developed from her epidemiological studies. They are as vital now as they were then, perhaps, as the numbers of chemicals diminish and financial margins narrow, even more so.

The industry owes a great deal to Doreen Gandy. If I needed convincing that the wisest counsellors don't always have the loudest voices, she would certainly have done so.

**Richard Gaze**  
HRI Wellesbourne

## LETTERS

Write to the Editor, Mushroom Journal, 2 St Pauls Street, Stamford, Lincolnshire PE9 2BE

## TO THE EDITOR

### Chislehurst Caves – can you help?

I am researching the history of Chislehurst Caves in connection with a proposed final reunion of World War II air raid shelters to commemorate the fiftieth anniversary of VE day. At the time of the start of the blitz on London the caves were being used for the growing of mushrooms on a commercial scale. The invasion by refugees from the air raids put a stop to this and the use has never been resumed although the company which owns the caves is still called Kent Mushrooms. I am led to believe that Kent Mushrooms was preceded in the 1920s by a company called British Mushrooms which despite its

name I suspect was French.

My reason in writing to you is to enquire whether a history of British commercial mushroom growing has been published which might throw light on the early commercial occupants of the caves and, if so, where I might gain access to it. I have consulted the RHS Lindley Library and loaned from them a copy of 'The Cultivation of Mushrooms' edited by Dr van Griensven. This is very useful in providing an oversight of the modern developments in mushroom growing but its historical content is largely confined to the Netherlands.

I should be most grateful for any information you are able to

provide or failing that, put me in touch with someone who is knowledgeable on this aspect of your activity.

#### Dr Eric Inman

BSc, PhD, C Chem, FRSC  
Local historian specialising in the London Borough of Bromley and Chislehurst Caves  
28 Downs Hill, Beckenham, Kent BR3 2HB  
Telephone 0181 650 8342

\*If any reader has any information on this matter, please do make contact with Dr Inman. It would be very much appreciated.

### IPP Prize Draw

In response to the success of the monthly IPP Prize Draws, the company will be making a single draw randomly on some months for a weekend break for two, instead of the usual prizes. A choice from one of the following areas will be available - Scotland, Peak District, Lake District, Wales, West Country and London.  
Good luck!

The winner of the February IPP Ltd Prize Draw for the weekend break is:

Mr P Littleworth of Littleworth Nurseries.

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Freehold mushroom farm in central Scotland. Extends over 8 acres with compost yard — capacity 200tpw PH1, three x 50t PH2 tunnels, 5 SRs and 17 cropping houses. Fill approx. 35tpw in trays and bags. Cooling and steam heating through modern air conditioning units. Good local raw material and skilled labour availability. Established markets nearby.

Box Number 17, Mushroom Growers' Association,  
2 St Pauls Street, Stamford, Lincs PE9 2BE, UK.

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**CHEAP SPRAYFOAM**, quality and service maintained. BE PE Insulation. Tel/Fax: 01986 895702.

## BUILDING SERVICES

### BUILDING AND CONSTRUCTION FOR MUSHROOM GROWERS

#### DIRTY WATER SYSTEMS

Settlement tanks — Storage tanks — Foul/Clean water systems  
Pump separators — Screens

#### NEW/REFURBISHMENT

Growing houses — Packhouses — Coldstores — Toilet blocks  
Restrooms

#### COMPOSTING

Composting pads — Retention walling — Concrete roadways, special construction needs

#### Nationwide coverage

#### GRAHAM ELGAR

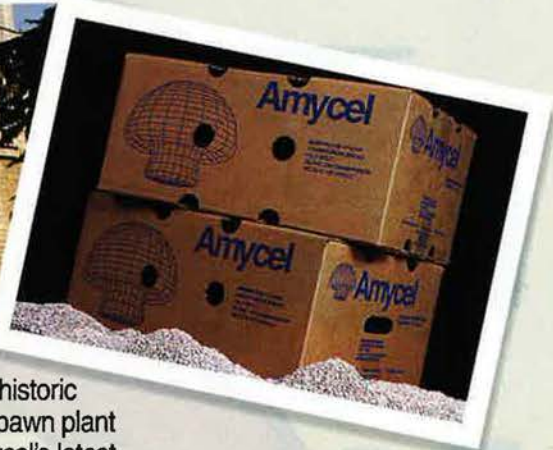
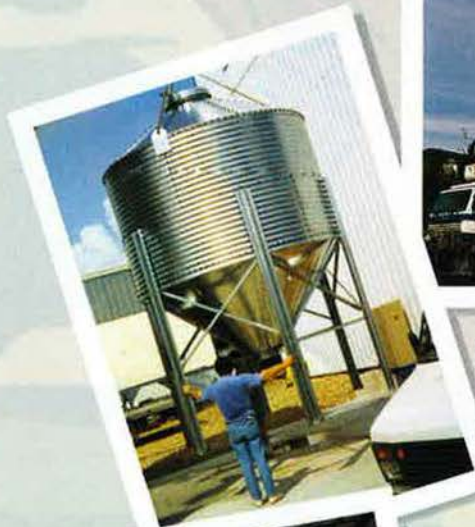
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For your classified advert  
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**Melissa on 01780 66888**

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VENDOME – REVOLUTIONISING WORLD SPAWN PRODUCTION



26th September 1994 saw the historic transformation of the Claron spawn plant in Vendome, France into Amycel's latest state-of-the-art facility.

The entire facility has been

built around hepa filter technology and designed to the industry's optimum standards. Completely new equipment has been installed including cooking vessels, autoclaves and grain towers. Amycel is now setting even higher standards for the industry to follow.

Choose the industry leader and you'll be assured of:

- consistently high performing spawn
- technical service
- prompt efficient deliveries
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Belgium  
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047 56 6225

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If we told you that there's a company which delivers a reliable, consistent, clean, disease-free mushroom casing time after time.

And that they blend specific casing material to suit individual farms and growers. You'd be forgiven for saying pigs might fly.

But if we told you that company

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At Harte Peat we became market leaders by living up to our promises.

Our new, modern production and processing facilities enable us to blend dark and light peats with either sugar beet lime or ground limestone to alter the physical properties of the casing to suit

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You'll find Harte Peat can be summed up in four words - quality, hygiene, consistency and service. Qualities that deliver volume and quality mushrooms time after time.

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