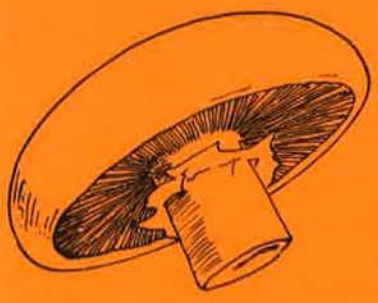
October 1978 Number 70

The Mushroom Journal



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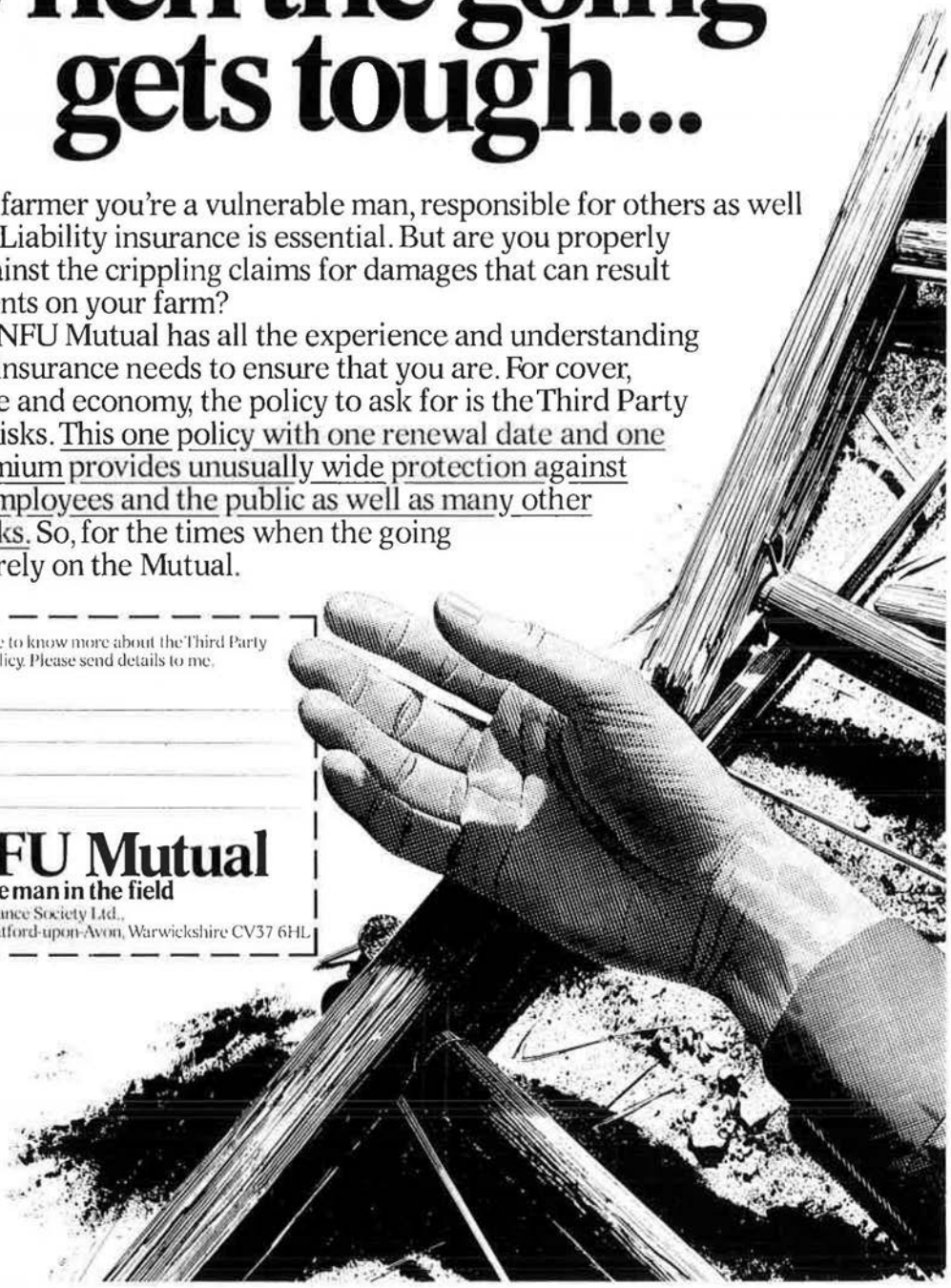

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THE MUSHROOM JOURNAL No. 70 OCTOBER 1978

Editorial . . .

Editors come and go

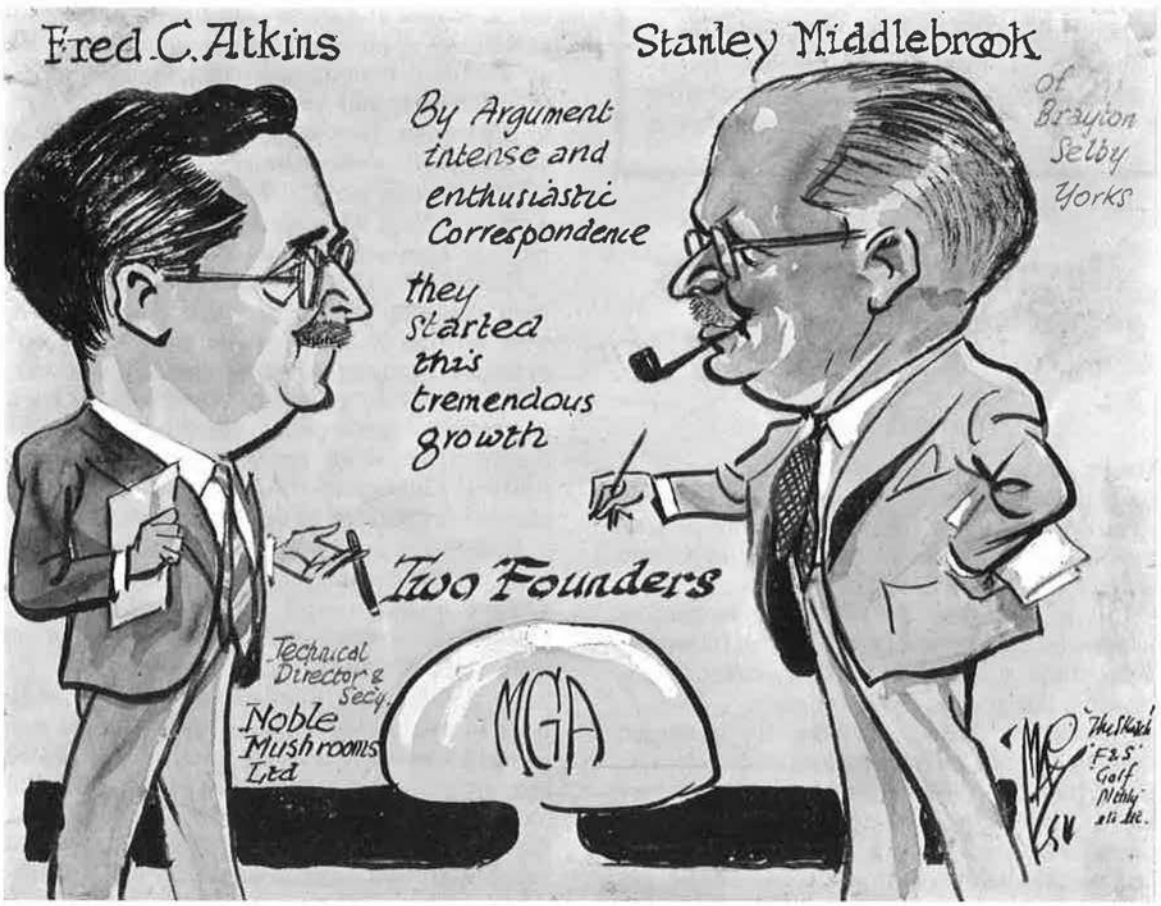
The Mushroom Journal first appeared in 1945 in the guise of a quarterly *MGA Bulletin* under the editorship of the late Stanley Middlebrook.

Angus Watson, the Association's first full-time secretary, took over in 1947, guided by me, and from 1951 until 1953 I was in the editorial chair. We were by then appearing monthly.

At the end of 1953 Winston Alderton was appointed secretary, and in 1954 became the new editor. He retired as secretary five years ago and now bows out after completing almost a quarter of a century as editor — a magnificent record of service.

As from 1st October, I am again editing the *Mushroom Journal*. I shall do my best, but please tell me when I fail you, and advise me how I can improve the publication. And forgive Mac's ancient but nostalgic cartoon!

FRED. C. ATKINS



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WHERE ARE WE GOING?

Among the many excitements at the Tenth International Congress I reacted sharply to unusual tensions, and felt it would be useful to attempt to obtain broad views on what is happening and may lie ahead.

The first article in this series has been written for *The Mushroom Journal* by **Donald O. Cunnion** of Harleysville, Pennsylvania. Donald was formerly an editor of *Country Gentleman* and *Farm Journal* magazines. Subsequently he was chief of marketing services for the Pennsylvania Department of Agriculture, where he worked closely with the mushroom industry, among other agricultural enterprises, on marketing problems. He is now a free-lance journalist and marketing consultant.

FCA

Mushroom Marketing in USA

by

Donald O. Cunnion

Mushroom marketing in the US is changing — and changing rapidly. Fresh sales, which ten years ago accounted for only a quarter of total production, now account for about half. And the end is nowhere in sight.

This is good news for American mushroom growers because imports are taking an increasing share of the canned market. This market, too, is growing, but at a much slower pace.

Mushrooms grown for the fresh market amounted to 42 million pounds a decade ago. The figure for 1977–78 should be somewhere near 175 million pounds, according to **Tim King,** executive director for the **American Mushroom Institute,** the industry's trade organization. But the per capita consumption of fresh still is less than one pound, leaving plenty of room for growth. Some see a billion pound annual market as a reasonable possibility, figuring a 4–5 pound per person potential.

What has brought about this dramatic increase in fresh consumption? A couple of minor reasons appear to be: more sophisticated eating habits on the part of more affluent consumers, and the discovery of mushrooms by newspaper and magazine food editors. But the principal reason is the appearance in the industry of large, well-heeled food corporations that have set up modern, mass-production operations.

Ralston-Purina, a nationwide processor of both human food and animal feeds, was the first of the giant corporations to get into mushrooms when it pioneered with a large facility in Florida in 1973. Now it operates mushroom farms (if they still can be called farms) in six locations, all near metropolitan markets. Later the same year saw the entry of **Castle & Cooke, Inc.**, a grower and worldwide distributor of such perishables as pineapples, bananas and coconuts, as well as a manufacturer of processed foods. C & C bought out an existing mushroom farm to get started. Now it has seven in operation in various parts of the country.

One of the latest firms to get involved is **Amfac**, a large Hawaiian sugar producer that recently converted a California poultry ranch.

Historically, the US mushroom industry has been made up mostly of small growers, some with as little as 8,000 square feet. A majority of these are located in Pennsylvania and normally sell most of their output to canners. With a few exceptions, mushrooms reaching the fresh market from small growers are sold through brokers. On top of this, most of the old-line growers are located in the North-east.

Now things are changing. The newcomers have located their sizeable facilities (some in the 10–11 million pound range) at strategic locations around the country and are concentrating on fresh sales directly to wholesale buyers.

To develop new markets, as well as expand sales in established markets, both **Ralston** and **Castle & Cooke** are bringing to bear sophisticated promotion and merchandizing techniques that have proven effective with their other food lines. Almost for the first time, fresh mushrooms are being 'marketed' instead of merely being 'sold'.

'At Castle & Cooke we have made a total commitment to the job that must be done with consumers and with handlers all along the distribution line,' says **William J. Crum**, vice-president and general sales manager for fresh

marketing. 'For instance, we have twenty-five merchandizing specialists at the retail end alone. They instruct produce managers on how to care for and display mushrooms. They set up point-of-sale promotions and arrange in-store demonstrations.

'We also do extensive advertising on radio and in newspapers and trade journals. We run 'cents-off' specials. We do tie-ins with store meat departments. We co-operate with salad dressing makers to encourage use of raw mushrooms in salads. Beyond all this, we conduct educational programmes involving school-children and home economics teachers. We promote mushrooms at local and county fairs. In short, we do just about everything possible to make people aware of the virtues of mushrooms. We want occasional users to become regular users. At the same time, we want to make sure consumers are able to get mushrooms whenever they want them and get them in prime condition.'

In the East and Midwest most Castle & Cooke mushrooms are sold in 8-, 12- and 16-ounce over-wrap trays. On the West Coast there's a preference for loose mushrooms, usually sold from 10-pound containers. C & C sells its mushrooms under its well-established 'Dole' brand. All are sold unwashed and labelled 'natural' to indicate the absence of additives normally used in the washing process.

The firm's newest plant at East Windsor, Conn., near Hartford, began producing mushrooms this summer for the Boston and New York City metropolitan markets. By the end of 1978, total production for the company will amount to '50 to 60 million pounds on an annualized basis', Crum says. To make sure this output finds a market, 130 Dole salespeople from thirty district offices are out calling on the trade.

Much the same all-out marketing effort is being made by Ralston. Each growing facility has an attachment of field salesmen who work both the wholesale and retail levels. They also teach approved handling methods and merchandizing techniques.

Ralston features prepackaged mushrooms in retail sizes and promotes them under the brand name of 'Country Stand'. It also sells in bulk to the food service trade. Ralston, like Castle, has launched a new farm in Connecticut to serve the New York City and Boston markets. It inaugurated the facility with a hard-hitting promotional campaign including local newspaper advertising, coupons and promotion allowances.

Rick Pearce, product manager for Ralston's mushroom division, was quoted by *The Packer*, US produce journal, as saying:

'Ralston is a marketing company, and marketing is what we're helping bring to the produce industry. We recognized an exciting opportunity in the mushroom industry in production, marketing and promotion. There was prior demand we felt could be heightened with proper promotional support, and even with the additional capacity of the industry, we believe market expansion will continue because the consumer demand is so strong. We still believe the fresh market is ripe for continued growth'.

With the opening of the Connecticut plant in June, Ralston now has a production capacity of over 70 million pounds annually. This clearly puts it in the No. 1 position for the country.

When you add Ralston's 70 million pounds to Castle's 50–60 million you come up with about 130 million pounds by these two firms alone. That nearly equals total fresh production in the US only four years ago.

What's the attitude of the old-line growers toward the giant newcomers? At this time it appears ambivalent. It is agreed that the big corporations are expanding the market as never before and everyone is benefiting. However, some are looking down the road and wondering if they will be able to compete once saturation or near-saturation is reached. Pennsylvania growers at least, are conservative as a group and slow to adjust to change. Some aren't sure they like what they see. The more progressive, however, are getting on the bandwagon and pushing fresh sales.

Butler County Mushroom Farm, Inc., in western Pennsylvania, the largest producer in the US up to this year, continues to be the leader among the old-line firms when it comes to marketing fresh mushrooms.

In business since 1937 when it began to utilize the ideal conditions of abandoned limestone mines, privately-held Butler always has stressed the fresh market. It sells directly to chains and services independent retailers through local distributors in fifteen major cities in the East and Midwest. Currently, 70 per cent of its total

production — estimated at over 40 million pounds — is going to the fresh market.

'Our fresh sales have increased substantially over the last five years', says **Bill Lane,** vice-president in charge of sales. 'There is tremendous growth in the retail market, but we are noticing that sales to hotels and restaurants are also increasing rapidly'.

Butler promotional efforts are concentrated in two main areas, according to Lane. One is the promotion of the brand name 'Moonlight Mushrooms' through co-operative newspaper advertising at the local level. The other is a 32-page, four-colour recipe booklet offered free via a label on each over-wrap tray. Requests for the booklet are averaging 12,000 a month. This recipe programme has been in effect for six years and follows an earlier one in which much smaller booklets were packed right in the trays. Butler also provides point-of-sale material stressing mushrooms for conventional cooking, for eating raw and for French frying. Butler does in-store demonstrations and conducts educational seminars for store personnel.

The company was a pioneer in over-wrap trays, helping to develop the use of 'breathing' plastic film, Lane reports. He also says it is the only firm in the US that vacuum-cools its mushrooms as soon as they are picked. 'This helps extend shelf-life', Lane explains. 'We bring the mushrooms down to 35 degrees F. in 15 minutes. Then we maintain that temperature all the way to the store warehouses'. One of the problems is convincing handlers at the warehouse and retail levels to maintain this ideal temperature.

Butler is planning to expand its production, but does not contemplate entering any new market areas, at least at this time, according to Lane. He says additional output is needed just to supply the fast-growing demand in the company's present outlets.

Phillips Mushroom Farm is one of the few in the Kennett Square area of Pennsylvania — still the heart of the US mushroom industry — that specializes in selling direct to retail outlets or through produce wholesalers. **Donald Phillips** grows only two million pounds a year, but sells an additional four million acquired from other growers in the area.

Despite its relatively small size, Phillips has been a forward-thinking, aggressive marketer over the years. It began marketing capped and over-wrapped trays as early as 1962 and today some 80 per cent of its sales are in 8-, 12- and 16-ounce sizes, according to Donnie Phillips, a co-owner. All Phillips mushrooms are picked 'slightly immature' and are washed.

Phillips does no promotion in its market areas, but has played a leading role helping to develop Kennett Square as a tourist attraction. It operates a mushroom museum and markets mushrooms direct to tourists in its gift shop, which features items with a mushroom motif. The mushrooms, which include both whites and 'goldens', are sold from refrigerated vertical cases with glass doors. A small restaurant features a wide variety of mushroom dishes.

The aggressive marketing tactics of the newcomers have been a shot in the arm to the non-brand publicity efforts carried out by the American Mushroom Institute for many years. Up until now the AMI programme, conducted by a professional public relations firm, has been almost a lone voice crying in the wilderness. Its promotional budget has averaged only about $50,000 a year — a miniscule amount compared with multi-million dollar expenditures to promote such delicacies as avocado pears. AMI always has gotten a lot of bang for its promotional dollar, but the total has hardly been enough to make any appreciable impact. And, of course, the promotions have been neatly balanced between fresh and canned mushrooms.

Now, AMI's small umbrella-type promotional programme is being backed up by the brand promotions and educational work being done at the local level by the big newcomers. 'The overall impact now is terrific,' says Tim King. The newcomers also have brought a tremendous increase to the AMI's overall income, which is based on a dues structure of one cent per square foot of bed space. The larger income has resulted in AMI's promotion budget being boosted to about $75,000.

The AMI programme currently is featuring seasonal themes, each of three months' duration. Members are supplied with details about each theme so they may tie in their own promotional efforts. To encourage greater use of mushrooms by the food service, AMI has issued a 'food service guide' containing quantity recipes and tips on menu planning.

As the sale of fresh mushrooms climbs

rapidly, several basic changes are taking place in marketing methods.

There is a trend away from washing. This saves on handling costs and is said to extend shelf-life. It also helps meet growing antagonism in the US toward food additives or preservatives. The conventional additive for washed mushrooms is sodium bisulphite.

There is a definite trend toward over-wrap trays, although the majority of mushrooms sold on the West Coast still are from bulk containers.

There are shifts in strains. Snow or paper whites long have been the preferred strains in the East and still command top prices. However, creams and off-whites are gaining ground. These are said by some to be hardier and more productive than whites. There are claims, too, that they have longer shelf-life. Although the wholesale price of the darker types remains below whites in the East, a number of enterprizing retailers are promoting them as 'gourmet' mushrooms and charging a premium price. They tout them as tastier and crisper.

Most packers do their own grading. In the East, No. 2's go to the canners, but in the West both No. 1 and No. 2 types are sold in the fresh market. No official US grades are being used at this time, but some packers are reported looking into the idea as competition heats up. There is little fresh market in the US for other than closed veils.

Meanwhile, what about the canners, most of whom are growers as well? How are they managing to stay in business in the face of the flood of low-cost imports from the Orient? Such imports are taking an increasingly large share of the US canned market — more than 55 per cent in 1978. While the canned market has grown 50 per cent since 1969 most of the increase has gone to the imports.

The few grower-canners who have been forced out of the canning business have turned to the fresh market, selling most of their output through brokers — at least for now. Some of those still canning say they depend on their growing operations to stay alive.

Oxford Royal Mushroom Products of Pennsylvania stays in business through careful planning, efficient production methods and hard selling and promotion, according to **Joseph Tercha, Jr.,** vice-president. The firm is one of the largest mushroom canners in the US.

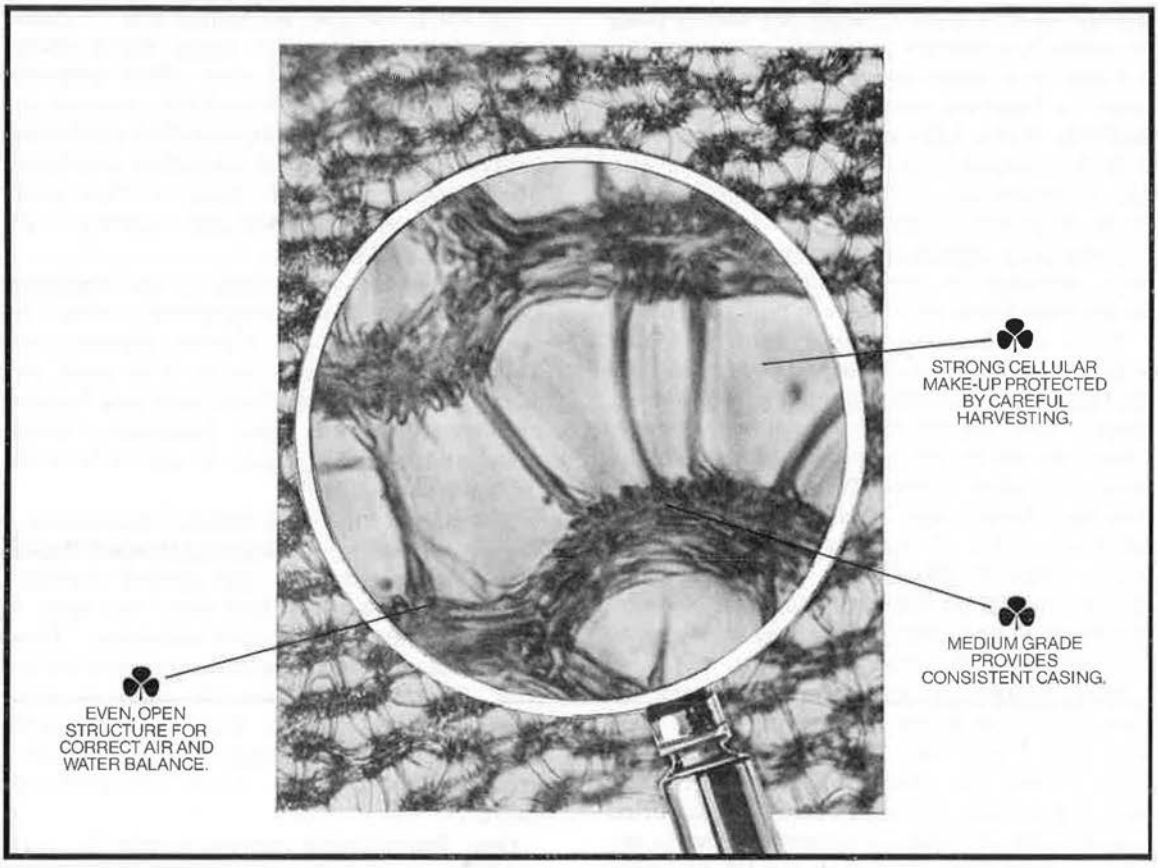
Oxford Royal does newspaper and TV brand advertising in its market areas, which extend from coast to coast. It also offers 'cents-off' coupons and does point-of-sale promotions. Tercha notes that recently-installed continuous cookers help hold down operating overheads. The company sells both direct to chain stores and through grocery wholesalers catering to the independent retailers.

Diversification is the word at the **Mushroom Co-op Canning Co.,** co-operatively owned by several growers in the Kennett Square area. This co-operative, now in its 49th year, still cans, but it also freezes both plain and breaded mushrooms for the hotel, restaurant, institutional and industrial trade. It also sells to the fresh market.

The market for frozen breaded mushrooms is steadily expanding, according to **Howard Malick,** executive vice-president and general manager. Eating establishments find they are easy to handle and are popular with customers. 'These breaded mushrooms are as easy to serve as French fries', Malick says. 'They are ready in about three minutes. Before freezing, the mushrooms are dipped in a batter and coated with a breading that includes spices and parmesan cheese'.

One Pennsylvania grower-canner is quite candid in stating that the firm could not stay in business if it had to buy mushrooms in the open market. The growing end sells to the canning end at the market price. Since the market price continues to hold above the cost of production, the profit in growing more than offsets the loss in canning, leaving a small overall profit. Here again, hard selling, discounts and close attention to customer demands manage to maintain the company's volume.

Whether more canners will turn to the expanding fresh market remains to be seen. Meanwhile, there are reports that other large food corporations are looking into the situation. There's no sign of over-production at the moment. And the profit margin is very satisfying. In the 1976–77 year, the fresh price to growers averaged 82.4 cents nationally — up 10.5 cents over the previous year. Production costs are rising sharply, but as recently as a year ago growers could turn out mushrooms for about 50 cents a pound. No wonder the mushroom industry is bullish.



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Effects of Compost Insecticides on Mushroom Yield

Ian J. Wyatt, *Glasshouse Crops Research Institute, Littlehampton*

For several years I have been trying to solve a worrying problem: how much crop loss is caused by incorporating insecticides in casing or compost? Whenever we at GCRI have investigated a new, promising insecticide we have tried to determine whether it was, in itself, harmful to the crop. On using the chemical at the recommended rate, we might find that there was a crop reduction of perhaps 8% in the treated plots, but, on statistical analysis, this difference would be shown to be 'not statistically significant', which means that the conclusion cannot be relied upon, as such a difference could have come about by chance. This is not the sort of answer which can be handed on to a grower, however, for the difference could well have been a real one and an 8% reduction could mean substantial loss of profits. Because of variability in mushroom cropping, it is difficult to demonstrate an 8% difference statistically, even with a very large experiment.

An entirely different approach was obviously needed. It occurred to me that it might be possible to use very high application rates, which would give readily measurable effects, and from these deduce what would happen at commercial rates. This has proved far more complicated than it sounds, for the reaction of the mushroom crop was complex. One confusing fact which eventually emerged was that the crop reacted in a different way to casing treatments than it did to compost incorporation. In the present account I will deal only with the latter, and consider casing in a future article. Detailed scientific accounts have recently been published (Wyatt, 1977, 1978).

Diazinon experiments

Six experiments were carried out using diazinon, usually as granules, incorporated in the compost at rates ranging from 5 to 2,000 ppm (active ingredient in fresh weight of compost). Because insecticides tend to delay flushes and put them 'out of step', it was necessary to analyse the yields according to flush rather than on a time basis. A 'moving average' method was devised both to do this and to define a mean date for each flush.

It was found that the highest rates delayed the first flush by about two days but low rates (in the commercial range) caused a delay of no more than half a day.

All six experiments gave very similar results and it was, therefore, possible to combine them. In the first flush, small losses were apparent even at the lowest doses, but the effect increased progressively with higher rates, halving the crop at about 1,000 ppm. In the second flush there were few signs of reductions at lower rates, in fact there seemed to be increases in some experiments. Losses were still severe, however, at high rates. In the third and fourth flushes, yields were almost consistently increased at rates up to about 500 ppm. Only with the highest applications were losses evident.

It was hoped to find mathematical relationships which would explain the effects on flush yields, but the results were so strange, and often so variable, that this proved impossible. However, it was found that, by adding one flush to the next and thus producing cumulative yields at each flush, a more explicable and less variable reaction was shown. Increases in the later flushes tended to make up for losses in the early flushes, but seldom compensated fully. Thus, for each flush, a curved response was shown resembling that of the first flush, but each was successively less severe. Logistic curves* could then readily be fitted to the results and the pattern of responses is shown in Fig. 1a. The fourth cumulative flush is the same as the total yield, and, for this, the observed yields are shown against the theoretical curve.

By subtracting the theoretical yields of one flush from those of the next, it was then possible to calculate the expected responses for individual flushes. These corresponded reasonably with the

---

* Cumulative yield $Y = \frac{C}{1 + e^{d(m-x)}}$

where C is control yield, x is the log. of the insecticide rate, e is 2.72 and d and m are constants.

observed yields and confirmed that increases could be expected in third and fourth flushes at all but the highest application rates. Fig. 1b shows the expected flush responses.

The size of mushrooms was almost invariably increased by diazinon treatment, the average weight being about 14% more at the highest doses. This implies that the numbers of mushrooms were decreased somewhat more than the yield. This was the case but, since numbers were more variable than yield, the mathematical fitting was applied to yield.

Thionazin experiments

Three experiments were done incorporating thionazin granules in the compost at rates from 10 to 1780 ppm. The results of two of these experiments were closely comparable and could be combined, but the other was distinctly different. In the latter, yield reduction was not marked: even 1600 ppm caused only one-third loss in the first flush and effects diminished with successive flushes. However, there was no sign of increased yields in later flushes, so cumulative and total yields were always below those of the untreated plots, though not appreciably below at low concentrations.

The other two experiments suffered very severe losses in the first flush at rates more than 100 ppm and there was no improvement in the next two flushes. However, in the fourth flush there were very large increases at rates about 400 ppm: in some cases the yield was doubled. This did little to compensate for earlier losses.

Although thionazin produced very different responses from diazinon, the method of fitting logistic curves worked equally well, even confirming the large increases in the fourth flush (Figs. 2a and 2b).

Another difference from diazinon was that thionazin tended to decrease the size of mushrooms: by about 9% at the high rates. Also, despite the severe effects on yield, the high rates of thionazin delayed the first flush by less than a day.

Explanation of effects

How, then, can we explain the diverse effects which were obtained in these experiments? We cannot be certain, but a reasonable explanation would be as follows. From spawning to first pinning, mushroom mycelium is colonizing the compost and storing nutrients in readiness for transportation to the mushrooms of the first flush. This process may be impaired by the presence of insecticides in the compost, and the expected response would follow a logistic curve, as already explained.

But insecticide may also affect the number of pinheads in a similar way. If the number of pinheads is affected more than the decrease in the amount of available nutrients, there will be more nutrient available for each mushroom and the size will increase, as happened with diazinon. If the effect on nutrients (or transportation) is the greater, the mushrooms will be smaller, as with thionazin. It is known that thionazin in the casing has extremely severe effects, so it seems that little, if any, can have moved into the casing.

Insecticides break down in compost and lose their effectiveness at varying rates according to their chemical composition. If, by the second flush, the insecticide has lost some of its potency, the mycelium will be able to extract nutrients from the compost which it had been prevented from using before, or it can transport more stored nutrients than before. Thus increases can be expected in second or later flushes, particularly with short-lived insecticides. Diazinon is not particularly persistent, and therefore allows compensation from the third flush, but thionazin is more persistent, allowing only a late increase in two experiments.

Since nutrient assimilation and storage is a continuous process, insecticide will affect the whole process up to any one flush. Therefore the expected response will be in cumulative yields, and the effect on an individual flush will be expected to be the difference between two cumulative totals.

One interesting outcome of the experiments was that, quite apart from insecticide effects, any plot which tended to produce few mushrooms in one flush would compensate this loss by producing larger ones. Also there was a tendency for a plot producing a low yield in one flush to yield more or larger mushrooms in the next. (This, of course, did not apply if there were an overriding cause for poor yield.) Thus considerably greater variability in numbers was experienced in any one flush than if yield were considered and, when flush totals were accumulated, even more consistent results were obtained, as is evident for the observed values for total yield in Fig. 1. All these observations

illustrate the remarkable resilience of a mushroom crop in compensating for temporary or permanent adverse effects. A crop must be very badly treated if the final yield is to be seriously impaired, and a poor first flush is no indication that the total crop will be low.

Expected commercial effects

The original purpose of these experiments was to determine the losses a grower is likely to encounter if he incorporates insecticides in his compost. The mathematical treatment of the results has the effect of smoothing the variable data into a logical form, which can then be used to estimate crop loss with a reasonable degree of confidence.

The calculations indicate that, if diazinon is incorporated at 10 ppm, a loss of 6% could be expected in the first flush, no change in the second, a 5% increase in the third and 3% increase in the fourth. This would result in a 0.5% loss of total yield, which a grower would be unlikely to notice; but he would benefit from somewhat larger mushrooms, his crop would be better spread over the flushes, and he would of course have the benefit of pest control.

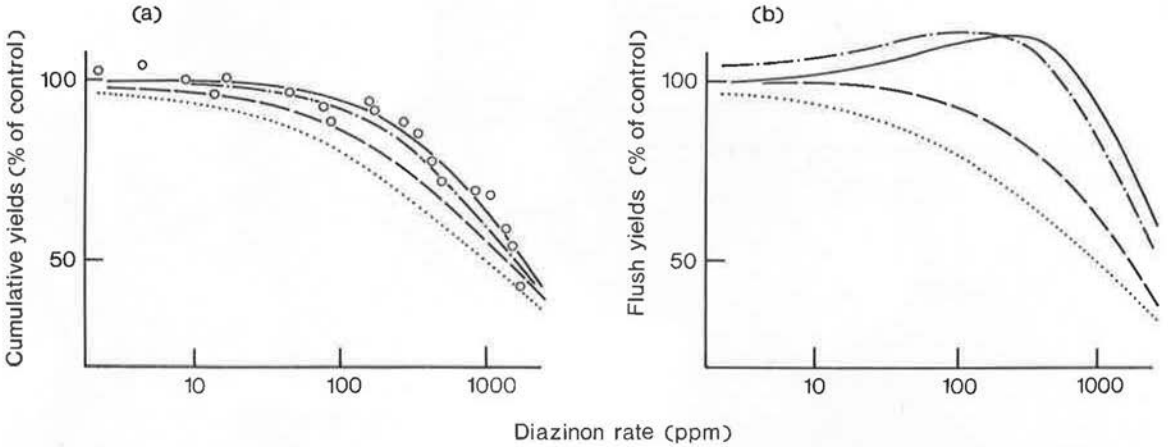

Fig. 1. Effect of diazinon in the compost on (a) the cumulative yields and (b) individual flush yields of mushrooms. ....., – – –, –·–·, ——, first, second, third and fourth flushes respectively. O = observed values for fourth flush (total yield).

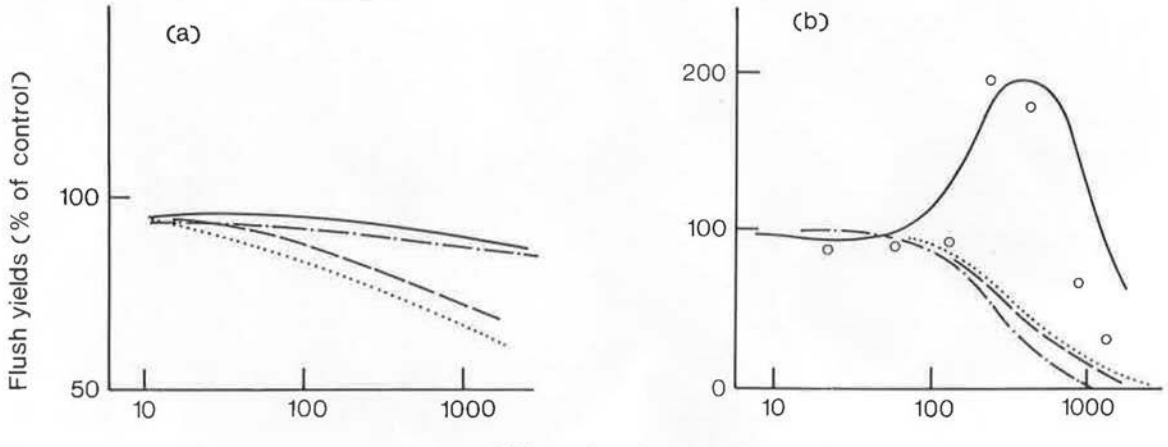

Fig. 2. Effect of thionazin in the compost on individual flush yields in (a) one large experiment and (b) two small experiments combined. ....., – – –, –·–·, ——, first, second, third and fourth flushes respectively. O = observed values for fourth flush.

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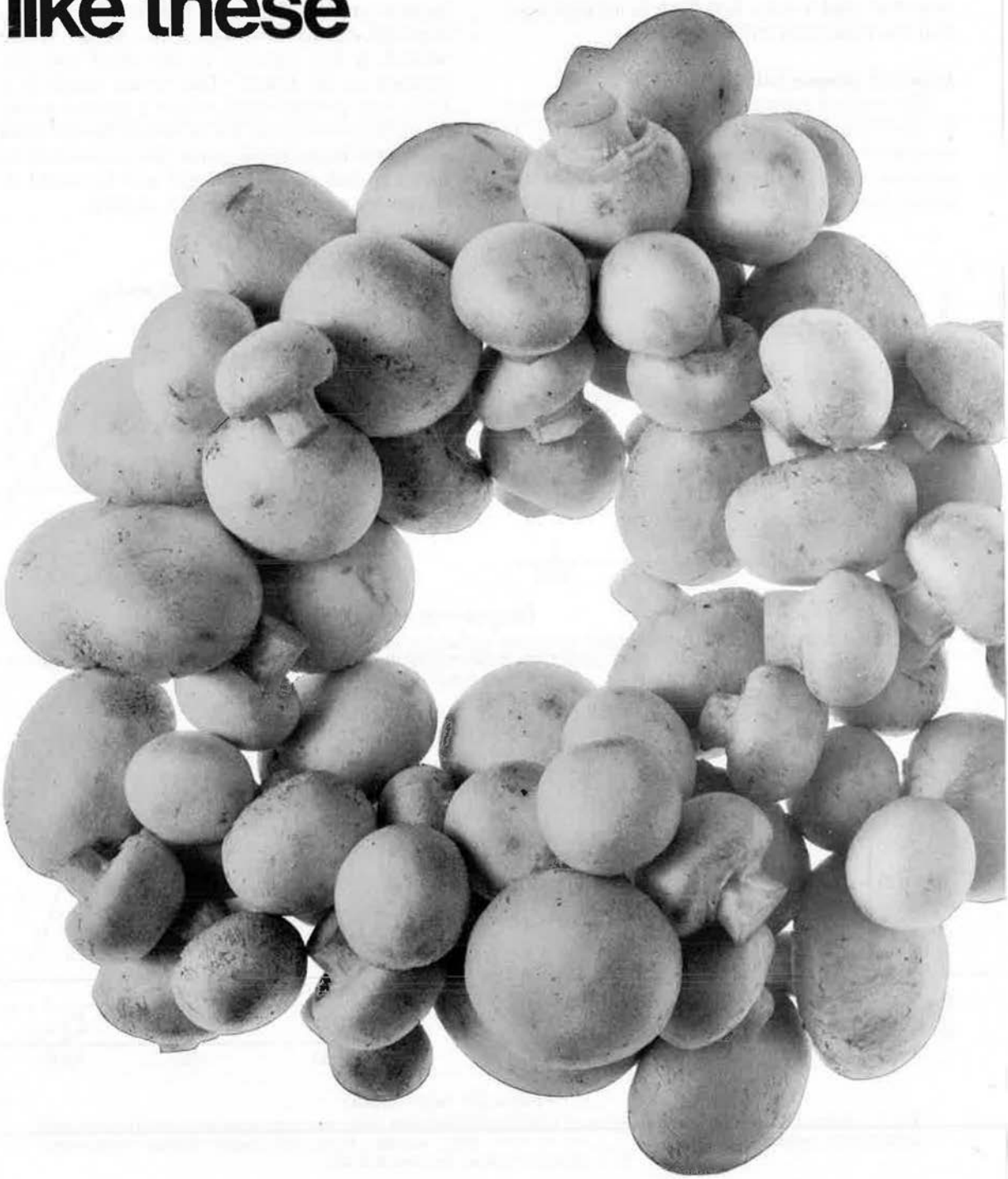

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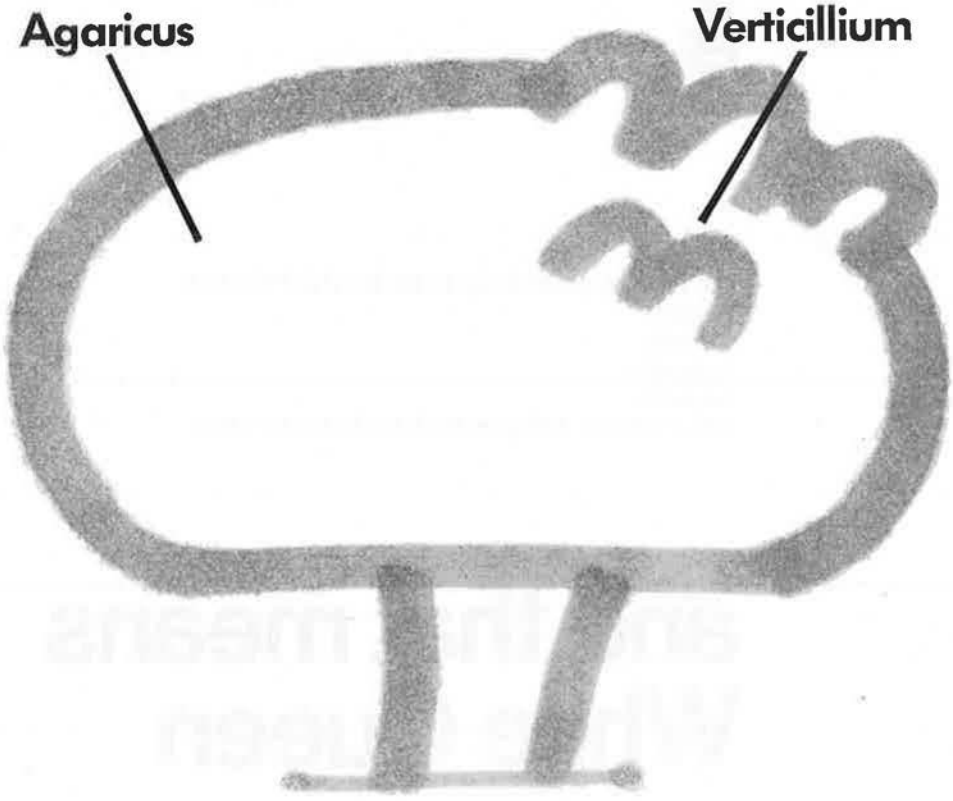

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If a rate of 50 ppm were used, he could expect a 14% decrease in the first flush and increases of 10 and 9% in third and fourth flushes, resulting in a 2.5% loss of total yield. The above benefits would be increased, but it would be necessary to weigh the loss and the cost of treatment against the possible advantages.

It should be pointed out that a particularly sensitive strain was used in these tests and it is unlikely that losses of this order would be encountered in practice. But this is no guarantee that equally susceptible strains are not on the market, and I can only repeat a former warning (Wyatt, 1973) to test out any new combination of strain and pesticide before putting it into general use.

The two similar thionazin experiments indicated a loss of only 0.3% from 10 ppm, both for the first flush and total crop, despite severe losses at high doses. The third experiment showed a corresponding loss of 6%. So, apart from varying reactions, thionazin seems to cause losses in the same order as diazinon, but without the attendant advantages.

The one conclusion which emerges is that a grower must be prepared to accept small crop losses from compost incorporation of insecticides in exchange for the anticipated, and unexpected, benefits.

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OUT OF THE RUT

For anyone who looks out on his premises and sees ruts and cracks in the tarmac where heavy lorries have been playing havoc with the surface, we hear that an instant road repair kit is now on the market. It is marketed by Emcol International Ltd. of Bristol, who claim that the materials they use to patch up concrete and macadam can be utilized speedily and provide a permanent answer.

Fruit Trades Journal, 14th April/78

TERRAMYCIN FOR THE CONTROL OF BACTERIAL BLOTCH

The results reported by Dr. B. B. Stoller in the July issue of *The Journal* are very interesting. Unfortunately Terramycin (oxytetracyline hydrochloride) has not been 'Cleared' by the Pesticides Safety Precautions Scheme for use on mushrooms in this country. Antibiotics have rarely been cleared for use on edible crops in Britain and it seems unlikely that Terramycin will be an exception. This antibiotic is widely used for the treatment of diseases of human beings and animals. By extending its use to crops, particularly edible ones, there is a danger of increasing the likelihood of tolerance developing in human and animal pathogens. Even very low doses may do this. Mushroom growers should not use this antibiotic on mushrooms for if they do they may be increasing the chance of strains of human or animal pathogens becoming tolerant to it.

J. T. Fletcher
Agricultural Development and Advisory Service, Newcastle upon Tyne

AT THIS MOMENT IN TIME...

The English language is in danger; and since it is impossible to write or think clearly without a clear, unmuddied language to write and think in, the minds of those who use the English language are in danger too. When language decays there can be no relevant, meaningful communication, no on-going dialogue. The main clause of the last sentence is a small pustule or symptom of the disease which is attacking our language: jargon.

Michael Wharton
in *Daily Telegraph*, 16th March/78

TAXONOMIC NOTE

Agaricus hortensis is not a cultivated race of *A. campestris*, as is usually stated in books, but is most closely related to *A. bisporus*. Both species occur naturally, but are quite uncommon, since favourable conditions for their development are rarely found.

A. Pilat
in *Mushrooms and Other Fungi*
(Peter Nevill, 1961)

Reprinted from *Agriculture in Northern Ireland* (1977), **52** (5), pp. 160–62

MUSHROOMS: CASING TECHNIQUES

W. M. Dawson, B.Sc. (Hort.)
Horticultural Centre, Loughgall

The casing of mushroom beds is undertaken because it remains the only method available to induce mushrooms to form in quantity on the cropping beds. The effect on cropping and yield of a number of casing techniques is examined.

It has been known for at least two hundred years that the application of a layer of mineral or organic material (casing) to mushroom beds is necessary to induce the formation of the mushroom crop. However, its precise function in inducing this change from the vegetative to the reproductive phase is not clearly understood. Many materials are used in the making of casing, although traditionally medium grade sphagnum peat neutralized with ground limestone is the casing mixture used in Northern Ireland.

The effect of a range of casing mixtures and techniques on times of cropping and total yield has been the subject of a number of trials at the Horticultural Centre, Loughgall. These trials were carried out under normal commercial conditions using 1.86 m^2 trays. Locally available limestone types, and the effect of casing soil amendments, were investigated. The time of application of casing from spawning to normal casing time was the subject of further trials and the 'roughening-up' of the casing layer after partial colonization practised by some Dutch growers was included as a technique in later trials.

Casing mixtures

Two locally available types of limestone, a hard white type containing a small percentage of dust and a pink amorphous type with a high percentage of dust, were compared at several rates. The hard white type gave a better structure to the casing and the management of the crop was less difficult. It also gave marginally higher yields. No differences in pH values were recorded with either limestone at any of the rates used which varied from 110 to 240 kg./m^3 (184 to 401 lb./yd^3) dry peat.

The addition of compost fully colonized by mycelium, i.e. 'spawn-run compost' to the casing mixture in the ratio of 1:35 was originally described in 1972 by MacCanna and Flanagan. In their trials the use of this 'spawned casing' gave a saving of seven days in the time taken from spawning to cropping and also had other management advantages.

In the trials carried out at the Horticultural Centre a maximum saving of two days from spawning to cropping was recorded. However, from the Table it can be seen that the technique did give a significant increase in total yield. Other management advantages were apparent.

Table 1. Cropping data and total yield (kg./tonne) for a range of casing treatments

Casing	Time	at Spawning		Spawning +5 days	Spawning +10 days	Spawning +15 days	
	Type	Normal	Spawned	Normal	Normal	Spawned	Normal (control)
Days from spawning to cropping		29	29	29	33	34	36
Yield (kg./tonne)*		152.0	148.3	130.9	127.5	146.9	109.9

Figures underlined indicate yields significantly higher than control.
* 131 kg./tonne = 300 lb./ton

Pinning (mushroom initiation) was consistently on the surface of the beds and there was a reduction in clumping, particularly in the first flush with a consequent improvement in quality.

It is essential to use spawn-run compost which is completely healthy, otherwise the spread of the disease will be facilitated. Thus the use of manure spawn to replace spawn-run compost was investigated. Its inclusion in the casing mix gave similar results to spawn-run compost without the attendant disease risks.

Time of casing

In the trials carried out, normal and spawned casing were applied to the beds at intervals from spawning up to normal casing time. The results showed that the time of application had a more significant effect than the type of casing used. Casing at spawning with either normal or spawned casing resulted in an increase in yield. It also reduced the spawning to cropping period by up to eight days, with an average of seven days over all trials.

No difficulties with pre-cropping management were experienced in those treatments where casing was applied at spawning.

Post casing mixing

The mixing or 'roughening-up' of the casing layer down to compost level six to seven days after its application has been reported to give an increase in yield and an improvement in the even distribution of mushrooms on the bed surface (Vedder, 1976). The mixing of the casing at this time thoroughly breaks up the mycelium and distributes it throughout the casing layer. In trials carried out to investigate the timing of this operation results have shown an even distribution of mushrooms but no significant yield increase. No delay in cropping was recorded. Further trials will be carried out but at this stage there does not appear to be any definite advantage in the technique for Northern Ireland growers.

The most critical point in the production cycle is the management of the crop between casing and pinning. It is during this period that the crop shows the least tolerance to environmental fluctuations. Any technique which eases the management of the crop at this time merits serious consideration.

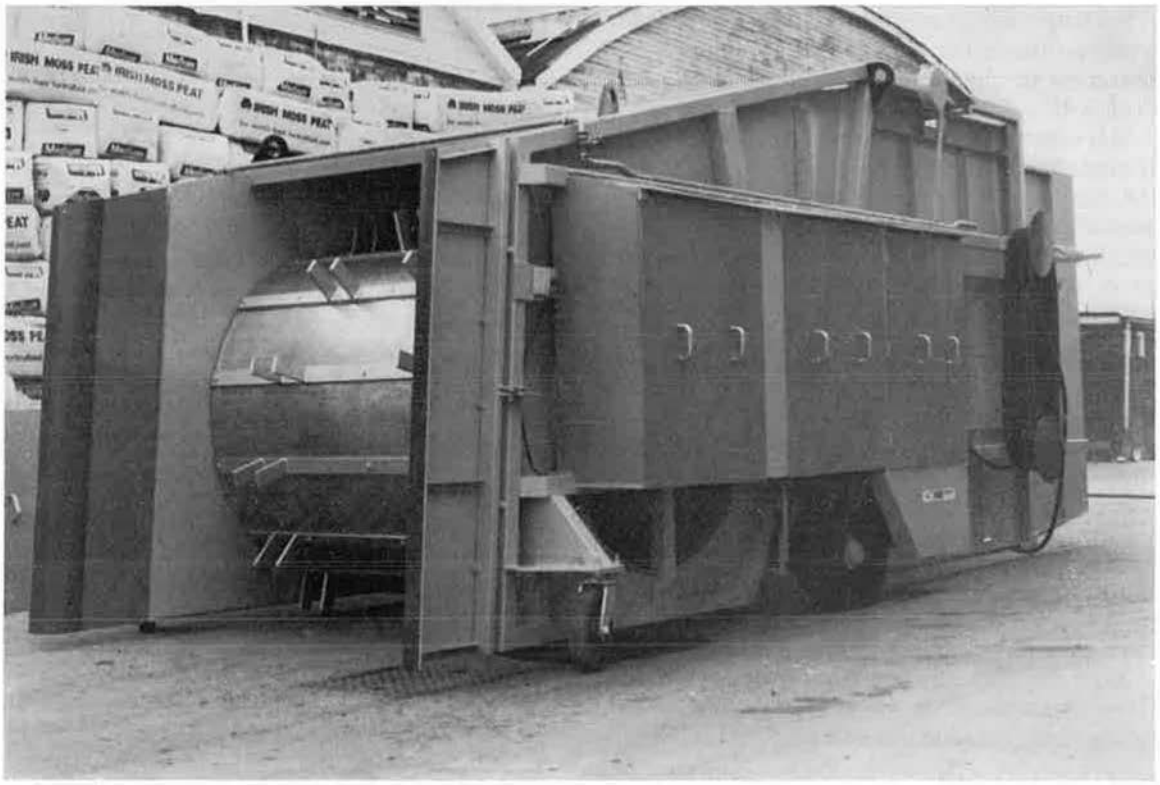
Fred. C. Atkins *writes about:*

KNEEBONE and SCHISLER

The 20th Mushroom Industry Short Course at Pennsylvania State University last year broke several records, with 343 paying delegates and a total attendance of 471 people. It was also the last to have Leon Kneebone as its Chairman.

Professor Leon Russell Kneebone, Professor of Botany and Plant Pathology, retired from the University this month. His mother was born in Totnes, near Torquay, England; she emigrated to the USA with her parents when she was 13 years old. Leon himself was born in Bangor, Pennsylvania, in 1920. There he attended the public schools and graduated from Bangor High School in 1938.

He entered Pennsylvania State College, as it then was, in 1939, and gained his Bachelor of Science degree *cum laude* three years later. He spent the next four years in the paratroops of the United States Army, and was honorably discharged as Captain in 1946, when he returned to Penn. State for graduate study, guided by the



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Faculty Committee which had Dr. James W. Sinden as Chairman. Awarded his Doctorate of Philosophy in 1950, he was retained as Assistant Professor of Botany as from September that year. In 1953 he was given chief responsibility for mushroom research at what was now Pennsylvania State University.

He struggled with the inadequacies of the original experiment unit provided around 1930 by the Mushroom Growers' Co-operative Association, and in 1959 more modern buildings were erected and then adapted to accommodate work on pests and diseases.

Research accommodation was provided in the Buckhout Laboratory and several other buildings on campus. A new Mushroom Test Demonstration Facility made possible a continuing investigation into climate control and the automation of Phase Two and, later, the critical period between casing and coming into crop.

Leon first came to England in 1958 on a reciprocal arrangement between MGA and AMI whereby I went over to PSU to present two papers at the second Short Course and he came to talk to our first Bournemouth Conference. All told, he has now made thirty-one trips to England.

Twenty years on, I asked him for his thoughts. He replied: 'As I look over our mushroom staff, almost without exception they are my former students and/or people whom I participated in selecting and help to become established. We have a good team here, a strong programme of graduate study and research, excellent facilities, good budgetary support, and fine rapport with our industry. Along with the Short Course I gain a great deal of inner peace from these developments.'

Won't you miss the mushroom excitement, I wondered? 'Lee Schisler has succeeded me as General Chairman of the Short Course, at my suggestion, and University Administration has approved the search for my replacement; but I expect to remain close to the Penn. State mushroom research and education programme as Professor Emeritus.'

His record of service outside the mushroom industry is of staggering diversity; it is regrettable that space does not allow details. But it should be mentioned that his primary research areas have been mushrooms of commercial and potential importance, their nutrition, development, pathology, genetics and spawn (with more than 100 publications).

One of the valid indices of the effectiveness of a research programme at a University is the number of research-degree theses completed. Fifty such theses during Leon's period at PSU are supplemented by current work by eight graduate-student candidates pursuing research into some area of mushroom production, processing or merchandizing.

Professor L. C. Schisler

Lee Charles Schisler, one of the best-known mushroom researchers on the American scene, and liked and respected throughout the world, was born in Northampton, Pennsylvania, in 1928. He graduated at Northampton High School in 1946.

He obtained his B.S. in Botany in 1950 at Pennsylvania State University, and his M.S. in 1952. The title of his thesis was 'An attempt to overcome the stunting effect of short-wave radiation with synthetic plant growth substances'.

He was employed in the Agricultural Chemicals Division of the American Chemical Paint Company in Ambler for a brief period until August 1952 when he was drafted into the US

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Army. For the next two years he served in the Chemical Corps at Fort Detrick, Frederick, Maryland.

Lee re-entered Penn. State University in September 1954, and received his Ph.D. in January 1957 (major – Botany; minor – Agronomy). His thesis on this occasion was 'A physiological investigation of sporophore initiation in the cultivated mushroom, *Agaricus campestris*, L. ex Fr.'

He went to Butler County Mushroom Farm in October 1956 and remained there as research director for the next eight years. Since then, for fourteen years to date, he has been with the Department of Plant Pathology at PSU. Currently he is Professor of Plant Pathology.

His areas of research include: Physiological studies of the fruiting mechanism of the cultivated mushroom; influence of the casing layer as it affects mushroom production; nutritional requirements of cultivated mushroom through techniques such as compost supplementation after pasteurization and at casing; composting and casing-soil pasteurization processes; spore transmission of La France disease; identification of cause of Mummy disease; lipid metabolism in cultivated mushroom; delayed release nutrients; utilization of waste products in compost; and design, evaluation and refinement of a mechanized system of mushroom production. It is an awesome list.

His publications, alone and with associates, at present total 38, and aready he has successfully guided five graduates in their theses.

Since 1968 he has been Chairman of the Mushroom Research Center at PSU. Long may he continue the stimulating work being done there, even if it does limit the time available for hunting birds and big game and his other pastime of freshwater fishing.

READY RECKONER

Regarding the controversy over Centigrade versus Fahrenheit, possibly I can ease the situation for many. There is an all-too-simple formula. If, say, the C figure is 20°, then the F figure is 70° approximately, that is, you double the figure and add 30.

Norman Green

in *Sunday Telegraph*, 28th August/77

MGA Literature List

Compiled by Dr. R. L. Edwards

Copies of literature cited are available from the MGA office, Science Reference Library, or Dr. R. L. Edwards, as indicated. See *Journal* No. 47, Nov. 1976, page 378.

SRL — Science Reference Library.
MGA — Mushroom Growers' Association.

Requests for photocopies

MGA Office Staff are not experts on scientific literature. To help them when requesting photocopies, will members please quote full details as given in the List, e.g.

Reference number
Title
Author
Name of Journal, volume (number), pages.

Failure to do this gives them additional work which is unnecessary and they may have to call for more expert assistance.

MGA can supply **only** copies of papers **marked MGA in the List.**

The field of interest covered by a paper is indicated as follows:

C. Commercial, economic
P. Practical growing
R. Scientific, research, experimental

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D. Henke
This is for the cultivation by cropping in deep beds with underfloor ventilation.

SENGBUSCH AND HIS FISH

At the Ahrensburg Institute, set up by **Professor R. von Sengbusch**, world-famous breeder of *Senga Sengana*, after his retirement from the Ahrensburg Research Station (then the Max Planck Institute), intensive work continues on strawberry varieties . . . But the Professor's main interest is with his fish farm. He has imported from the Amazon in Peru and Brazil a fish, *Arapaima Gigas*, which he says is of excellent flavour and can be eaten at 500 grams to 500 kilograms. He also imports the fish on which this variety feeds.

Gordon Schaffer
in *Horticulture Industry*, May/78

RAW MUSHROOMS FEATURED

Sally Adams featured mushrooms in a recent article in the admirable *Caterer and Hotelkeeper*, in which she referred to several people we know.

Sheila and Jimmy Hamilton-Hesse may be Britain's most northerly mushroom enthusiasts. While at the Ferry Boat Inn, Ullapool, in Ross and Cromarty, they were highly praised for their mushroom salad by a French contributor to the *Good Food Guide*.

Now they've moved to Overscaig in magnificent, incomparable Sutherland. Sheila says 'I'm a great believer in mushrooms, making my own mushroom soup — a dark soup with sherry in it — and of course at breakfast in the hotel.

'When Jimmy and I trained for this business, he straight from the stage and me from interior design work in London, we found ourselves at Norman Cross on the A1 near Peterborough. One of our customers was Fred. Atkins, a founder member and early chairman of the Mushroom Growers' Association. He took us over his farm and converted us to raw button mushrooms in salads.'

The article goes on to refer to Denis Locke, whose message to British caterers is Serve More Mushrooms, and relates that response from three articles in a local paper — 'Quarter of a pound, please, and can I see round the sheds?' — was so large that at Shackleford mushroom farm near Godalming, Surrey, they had to stop selling direct to the public.

Peter Cracknell, managing director of Baddow Park mushroom farm in Essex, is trying to convert the British public to the delights of raw mushrooms. Every year he takes a stand at the Essex Show and offers tastings. 'Members of the public will taste, say, a slice of mushroom with pâté on top and say "I like that, it's lovely". When I say the mushroom is raw they're aghast'.

CHEERS!

In a study of heavy drinkers with cirrhosis of the liver, six out of ten drank at least 160 grams of alcohol a day — the equivalent of a bottle of gin — but some drank less than 80 grams, which was considered the safety limit.

Daily Telegraph, 11th April/78

Fred. C. Atkins on . . .

RED SPIDER MITES

'The pale-to-yellowish brown, fast moving *Gamasidae* are predatory only, but can transmit disease'. That is my sole comment on Gamasid mites in *Mushroom Growing Today*, and in my *Guide to Mushroom Growing* I ignore them completely. In fact, I have never paid much attention to them, and I had never studied them under a microscope until very recently, when a friend sought my opinion on Red Spider Mite — a term quite new to me.

This strikes me as so extraordinary that I must attempt to rectify the situation.

Al Kligman's *Handbook* (1950) has these two paragraphs and a Thomas drawing: 'These are commonly called "red spider" by the mushroom grower. They are present in most manure piles and may frequently be seen on the floor during the peak-heat. They are reddish, fast moving and . . . unlike the other mites, are easily seen.

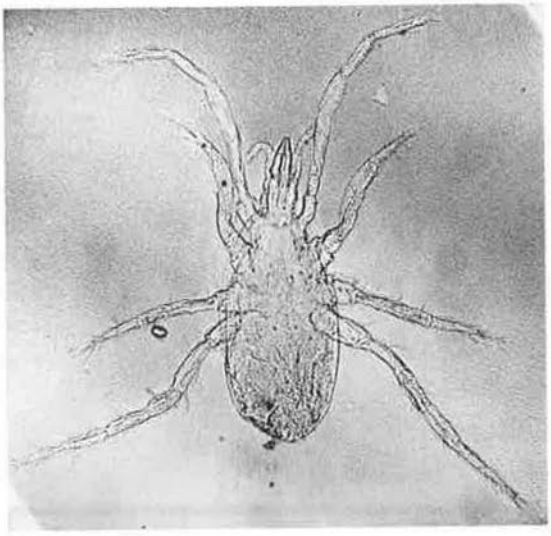
'Happily these mites are not mushroom enemies. They cause no damage so far as is known. As a matter of fact, they appear to be a natural enemy of other mites on which they feed. This habit is probably of little consequence in keeping down other pests.'

Aubrey Thomas in *Animal Pests of Mushrooms* (1958) reports that 'this mite may appear on the manure of the beds soon after filling, and may escape the heat by jumping on to the floor. Later they may occur in large numbers running rapidly over the compost and sometimes are annoying to the pickers by crawling over arms, neck and face.

'However, while these mites may possibly feed on mushroom mycelium or the mushrooms, probably they are only a minor pest in this respect. Actually they do some good by feeding on the various smaller animals in the beds, and have been observed eating nematodes, several kinds of mites, springtails and even flies and fly larvae. Therefore they are of value in the beds.

'In laboratory experiments these mites fed on Pigmy mites, Rhizoglyphid and Tyroglyphid mites, Sciarid, Phorid and Cecid fly larvae, springtails and eelworms, then starved or fed on each other rather than eat mushroom mycelium. When the spawn turned red and moist on damp spots on the compost surface in mushroom beds, Gamasid mites gathered in large numbers on these spots to feed on the eelworms which were eating the mycelium, but the mites did not eat the mycelium.'

I extracted a photograph from Joe Hussey, who wrote: 'Not a work of art but, I would have thought, adequate to convey the important characters — namely the eight long legs and, on either side of the head, sizeable palps used to identify the food.'



Gamasid mite
(*By courtesy of Glasshouse Crops Research Institute, 1978*)

HEAD OF HORTICULTURE, GCRI

Dr. Alun Rees succeeds George Sheard as Head of the Horticulture Department at the Glasshouse Crops Research Institute.

After graduating in botany at the University of Wales, Dr. Rees held a colonial post-graduate scholarship at Rothamsted Experimental Station and then spent seven years in Nigeria as plant physiologist and later as Head of the plant physiology department in the West African Institute for Oil Palm Research.

Returning to the UK in 1962 he was appointed to the Plant Physiology Department at GCRI with special responsibility for starting a programme of research on the physiology of bulbs.

Dr. Rees is well known in the industry in this country and internationally; his book on the growth of bulbs is unique in that field.

The Grower, 10th August/78

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Fred.

DIARY DATES

1978: GCRI Mushroom Day, 25 October.
Straw Conference, Oxford, 30 November — 1 December.
1979: British Growers Look Ahead, Brighton, 3–5 April.
Bath Short Course, mid–April.
PSU Short Course, 18–20 June
MGA's Yarmouth Conference, October.

INEXPLICABLE WEATHER

'The drought which began in the winter of 1975 was the driest 16-month spell in England and Wales since 1727. Yet we have just emerged from our wettest 10 months in 100 years', according to the *Sunday Telegraph* of 28th August 1977. What records have been broken in 1978?

Correspondence

ENOK MUSHROOMS

I am informed that ENOK mushrooms are now being grown in Los Angeles. Can anyone tell me what they are? **S. Gee**

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