MUSHROOM NEWS

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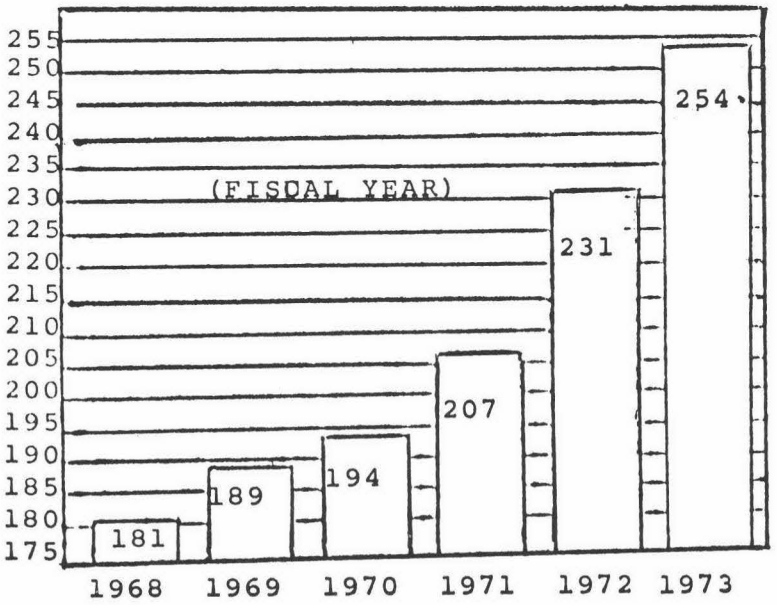
1972-73 MUSHROOM PRODUCTION UP 10 PERCENT

United States Department of Agriculture reports in its statistical survey: United States mushroom production during the year ended June 30, 1973, totaled 254 million pounds, according to the Crop Reporting Board. This is 10 percent above the 1971-72 crop and 23 percent above the 1970-71 crop. Average yield at 2.48 pounds per square foot compares with the 1971-72 crop yield of 2.47 pounds and the 1970-71 yield of 2.36 pounds. Pennsylvania, with 146 million pounds, accounted for 57 percent of the Nation's production.

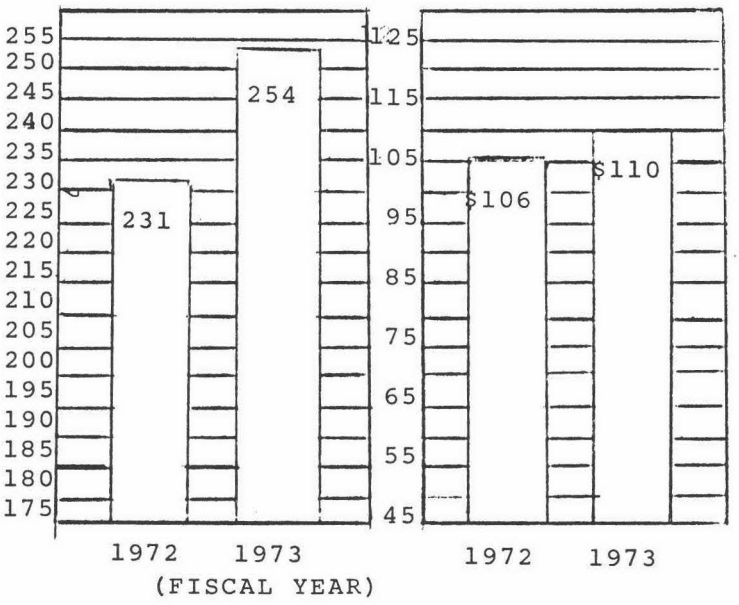
U. S. MUSHROOM PRODUCTION
(In Millions Pounds)



An estimated 102 million square feet of bed and tray area was used for mushroom production during July 1, 1972 - June 30, 1973, 9 percent more than the same period a year earlier and

U.S. MUSHROOM PRODUCTION
(In Millions Pounds)

U.S. MUSHROOM SALES
(In Millions Dollars)



17 percent more than in the 1970-71 period. First fillings accounted for 37 percent of the total area, second fillings 32 percent, and additional fillings 31 percent. In previous season, first fillings accounted for 37 percent, second fillings 33 percent, and additional fillings 30 percent. (Fillings for growers with continuous operations were prorated to first, second and additional fillings.)

Growers received an average of 43.3 cents per pound, down 2.9 cents from the price received a year earlier. Value of production at $110 million

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for the 1972-73 crop is up slightly from the previous years' value of $107 million. Processors used 70 percent of the current mushroom production compared with 71 percent in 1971-72. Processing sales in 1972-73 averaged 38.0 cents per pound, down 3.5 cents from the previous period, while fresh market sales averaged 55.5 cents per pound, down 2.4 cents.

Growers intend to increase production area for the 1973-74 season by 11 percent over the past season. If intentions materialize, the first fillings will account for 36 percent of the 114 million square feet, second fillings 31 percent, and additional fillings 33 percent.

MUSHROOMS: AREA, PRODUCTION, PRICE AND VALUE
JULY 1, 1972 to JUNE 30,1973

State	Area 1,000 square feet	Production	Price per pound	Value of production
		1,000 pounds	cents	1,000 dollars
New York	3,287	5,468	44.6	2,437
New Jersey	226	496	36.7	182
Pennsylvania	54,989	145.648	40.7	59,207
Ohio	3,026	8,808	42.6	3,754
Delaware	2,183	5,597	37.1	2,210
Maryland	1.123	2,803	41.8	1,171
Other States 1/	37,481	84,822	48.4	41,014
United States	102,315	254,002	43.3	109,975

Editorial

By J. C. Bovenkerk
Executive Director

MUSHROOM PROCESSORS CONFIDENT OF A SAFE PRODUCT

WE, OF THE AMERICAN MUSHROOM INSTITUTE ENDORSE THE RELEASE OF THE MUSHROOM PROCESSORS ASSOCIATION.

The Mushroom Processors Association of Kennett Square, Pennsylvania, citing a history of over 50 years of canning mushrooms, including some 2-½ billion consumer cans in the last 10 years, states no illnesses have ever resulted from eating canned mushrooms.

In answer to inquiries prompted by a recent Food and Drug Administration release, that it will conduct a nationwide examination of canned mushrooms, the Mushroom Processors Association advised all consumers that there is no reason to be more concerned about the mushroom products on their shelves than they would be about any other canned vegetables.

The Mushroom Processors Association explained that in the Food and Drug Administration's newly launched inspections, its staff will simply be looking for mushrooms that are abnormal -- that are leaking or swollen. "This," a Mushroom Processors Association spokesman said, "is a precaution every consumer should always take with any canned foods on her shelves."

The Mushroom Processors Association noted that the Government inspections have nothing whatsoever to do with fresh mushrooms.

A spokesman for the Mushroom Industry stated that domestic mushroom processors are cooperating in every way possible with the Food and Drug Adminstration to assure the continued supply of safe and wholesome mushroom products.

"GROWING TIPS"

by

ARON KINRUS

AGRONOMIST

PUBLIC RELATIONS COORDINATOR

TO KEEP YOU INFORMED

THE ADVANTAGE OF GROWER'S MEETINGS

In early spring, the AMI initiated growers' meetings from Coast to Coast. The purpose of those meetings were to inform the AMI members of the most important events concerning the mushroom industry. Over 300 people attended these meetings.

Direct dialog between growers in Ohio, Michigan, California and other states was of vital importance to the industry. These joint meetings and individual farm visitations gave the AMI representatives the opinion, reaction, and strategy of our members. Their opinions are evaluated before the Board of Directors, and the policy made, reflects the desire of all our growers from East to West.

During these meetings, different growing problems and techniques were discussed, and the growers had the opportunity to see slides and listen to some new inovations and old techniques used by their colleagues in other states.

If research work conducted elsewhere in the world could be applied and benefited by our grower, we should take the opportunity and invite these scientists to our country if they wish to share with us, those research findings

The Fourth AMI Conference held on August 25, 1973 had the best professional group of guest speakers from Penn State University and Ohio State University and from Europe.

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The latest convention was held in September by the Canadian Mushroom Growers' Association. The 19th Annual Convention held in Toronto, Ontario, deserve special attention and comments.

The 19th Annual Canadian Mushroom Growers Association convention could not be compared with any of the previously held meetings. Here the success of this meeting should be credited not only to the speakers but to the audience, and to the members of the Canadian Mushroom Growers' Association and its organizing committee.

The attendance and program were over their expectations. The CMGA is growing very rapidly. It does not take much effort to see the reasons for this wastly growing association. Only a team of key people working together could so succeed in such a short time like the CMGA.

The convention that opened officially on Monday, September 10 by its President, John LoPresti and Chairman, Irving Slack and Ernie Skrow who served until this convention as Vice President of this association opened the first lecture on the subject, "Architecture in Mushrooms". It seems to me that the program and subjects for presentation are scheduled the way the experienced growers from the association speak on the subjects they have had the best experience.

J. Leaver, Leaver Mushroom Company, spoke on Phase I composting. His colleague and also well-experienced grower, Nick Pora, Continental Mushroom Corporation, spoke on Phase II pasteurization.

Two topics on mechanization in shelf system were presented by U. S. companies. Mr. G. Valentino, Pannell Manufacturing Corporation, spoke on Automatic Conveyors and Turners and Tom Piacentino, representing the Longwood Development Corporation spoke on clean-up and spawning machinery. A very well-presented educational program was presented by William C.

Anderson, Jr., Mrs. Wm. C. Anderson and Marianne Schmidt all from Unionville, Pennsylvania on the subject, "The Mushroom Industry As a Resource in Environmental Education."

A topic on "The Mushroom Industry In 1972-73", was presented by myself.

At the annual Business Meeting, Ernie Skrow was elected the next President of the CMGA replacing outgoing President, John LoPresti.

The Annual Banquet of the 19th Convention will be long remembered by American and Canadian groups. Here Ernie Skrow formally took over the duties of new CMGA President.

In his first presentation before the audience, Ernie expressed his thanks to the past President, John LoPresti, and presented the outgoing President, LoPresti with a beautiful placque for his achievements in bringing this association to its excellent performance.

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The peak of the Annual Banquet was the appearance of the Honorable E. Whelan, Federal Minister of Agriculture, Ottawa, Canada. Mr. Whelan's presentation was very encouraging.

Here are some of Mr. Whelan's quotations.

"The Federal government is doing a number of things right now that have a direct bearing on the mushroom industry in Canada. First of all, I have asked the Tariff Review Board to make a complete examination of a number of tariffs that we now have on items such as fruits and vegetables. Mushrooms are on the list. One of the key points in this review is the need here in Canada for some method to protect our own industry and farmers, from unfair trade. We need better protection of our industry in order to protect the consumer. Take away our producer and see what price imported food will rise to. And we need protection that will respond right away, not a week, ten days or a month after the damage has been done. As Minister of Agriculture, I am not interested in protection of an inefficient industry. Our farmers and processors should win the Canadian market through fair and square competition. But I believe we have some of the best and most efficient farmers in the world. Let me review what is taking place in regard to the mushroom industry. The average annual quoted prices of mushrooms to

producers over the past five years are as follows:

IN 5-POUND CONTAINERS

1968 - $2.27
1969 - 2.31
1970 - 2.45
1971 - 2.61
1972 - 2.45
1973 - Estimated to be very close to 1972 average price of $2.45.

The Cabinet has asked the Anti-Dumping Tribunal to make a thorough investigation of mushroom imports to determine if any mushrooms are being dumped into your Canadian market, and causing harm to you the producers and processors. Public hearings were held the last week of July, and the Tribunal is now digging into the case. No decision has been reached so far, but I expect one will be handed down in the near future. It would not be proper for me to comment on the case while it is before the Tribunal at this time.

The Tribunal will have to do a thorough and complete job because dumping is usually defined as one country selling its products into another country at prices lower than it charges its own people. But in the case of Taiwan and Mainland China, where there really is no domestic market for mushrooms, it is very difficult to prove dumping is taking place. So we have asked the Tribunal to determine if imported mushrooms are coming into Canada at prices, or volumes that will cause, or even threaten to cause, serious injury to Canadian producers and processors.

The Tribunal has been asked to give us the most complete information possible on:

- The volume and prices of imported and domestically produced preserved mushrooms.

- The structure of the industry.

- The supply and demand situation

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for both the imported and domestically produced mushrooms marketed in Canada, and especially things such as quality and pricing.

- Trends in profits for the industry.

- Trends in employment in the industry.

As Minister of Agriculture, I think our Canadian Mushroom growers and processors must face up to fair and square competition from other countries. But I do not expect you to compete with dumping, with poor-quality imports that don't measure up to our Canadian standards and regulations, or with unfair trade practices. As I understand the situation, all youask for is a fair chance to compete. I am going to do my best to make sure you have that chance. Thank you."

Irving Slack, Chairman of the Convention, expressed his sincere thanks and appreciation for the warm words and strong support for the Canadian Mushroom Growers' Association.

We wish to present to you the speech made by Dr. N. W. Hussey of the Glasshouse Crops Research Institute as he presented it at the Fourth AMI Conference.

THE STRATEGY OF MUSHROOM PEST CONTROL

N. W. Hussey

Advice on pest control procedures can appear both bewildering and confusing to the practical grower for it frequently appears as a catalogue of recipes without comment as to the advantages and disadvantages of apparently similar techniques. More seriously it is usually unrelated to the biology of the target pest and rarely comments on the costs of rival treatments. My purpose is therefore to draw your attention to the considerations which should influence the choice of both chemical and application techniques.

There is abundant information already available in the writings of Thomas, Snetsinger and my team at the G.C.R.I. on the essential facts of the life-history of the different pests. Fortunately, the pest complex affecting mushrooms seems to be largely the same throughout the world. Although different specific names are used for some American pests the published biological data suggests that they may one day be shown to be synonyms of earlier European names and meantime may, for practical purposes, be regarded as identical. For the purpose of the ensuing discussion I shall, therefore, refer to them by their familiar family names of sciarid and phorid, etc. My experience is, of course, based on a different mushroom scene and so my remarks should be regarded as a potential approach to the problems rather than as offering positive solutions for an American audience.

Not unnaturally, growers tend to fall into two groups in regard to pest control - those who defer action until they feel the pest population is dangerously high and those who insist on routine 'insurance' controls aiming

to prevent any sign of the pest. Both approaches have their merits and demerits but, in my view, they are based on oversimplified criteria. It is important to recognise the damage threshold which relates each pest to the mushroom crop and to decide how, most economically, to prevent this level being exceeded. Further, in the closed environment of protected cropping we should consider the ever present threat of selecting pest strains tolerant to our pesticides. Since the occurrence of some pests like phorids can be predicted some months before they occur, the strategy of pest control has a long-term component, but short-term modifications must also be available for the unexpected outbreaks of less regular pests such as tarsonemid mites.

To outline the basic criteria on which a strategy can be developed it is convenient to consider the main pest groups separately.

The Pests and their Control

Phorids - pose a threat to production in a variety of ways. The most obvious damage, that caused to the mycelium by the developing larvae, has greatly diminished since the introduction of through spawning with grain spawn. Larvae feed by sucking cell contents at the tips of the individual hyphae and the vast number of continuously growing mycelial tips spreading from individual grain normally prevents this feeding achieving anything more than a little 'pruning'. Experiments have shown that loss of mycelium begins at a larval density of 40 per handful of compost and that complete destruction occurs when 300 larvae occur in each handful.

There is, additionally, a quite different threat posed both to the farm and local residents, merely by the presence of large numbers of flies. It is widely believed that phorid flies transmit mushroom diseases but despite many tests at the G.C.R.I., they are found to be very inefficient carriers of fungal spores and bacteria. Tests for virus transmission by

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feeding larvae on diseased mycelium failed to demonstrate carry-over of virus through the eggs of the next generation. However, their nuisance value to pickers is far more serious and can occur at relatively low larval populations. Similarly, the tendency of the flies to form mating swarms at some distance from mushroom farms often leads to their becoming a public nuisance as males congregate on the windows inside dwelling houses. It is, of course, difficult to precisely establish a population level which will lead to those problems but from experience at the G.C.R.I. we believe that one larva per handful is the maximum tolerable threshold.

All too often growers attempt to control phorids merely by releasing fogs or aerosols into the cropping house or by dusting the bed surface with insecticides. Neither technique is effective because almost all the eggs are laid within three weeks of spawning while the mycelium is still actively colonizing the substrate. When they are about four days old, female phorids are attracted from the growing houses, where they have matured, to swarming males. This opinion is often contested by growers who contend that flies are coming into cropping houses from outside and, at first sight, the low larval counts often associated with heavily infested houses tends to bear this out. However, by trapping within houses with Johnson suction traps which give a measure of the aerial density of flies we have shown that the fly density is always a fraction of the theoretical density to be expected if all the larvae in the compost matured steadily over the six week cropping period. It is clear, therefore, that the number of flies entering cropping houses from outside is minimal. Having established that the problem arises from flies maturing within the crop then it is clear that control depends on preventing oviposition or killing the larvae.

To prevent oviposition it is necessary to maintain a lethal concentration of insecticide in the air, both in

the spawn-running rooms and in the holding-room, throughout the three week period. Some economy can be foreseen by restricting the controls to the annual period of fly activity between May and October when the air temperature is above 60° F, remembering that phorids cease to fly at twilight and when the mean air-speed exceeds about 20 m.p.h. However, for costing purposes we must suppose that at least 34 applications (twice daily) will be made by some form of low volume application. There are a variety of materials available for this purpose but remembering that the flies are normally actively seeking growing spawn from about 9 a. m. to 8 p. m., with a peak soon after mid-day, application should be made towards mid-day and later in the afternoon and be designed to provide protection for several hours; Dichlorvos (6cc 50% e.c./1000 ft.^{3}) applied 34 times between the 4th and 21st day after spawning would costs $16.3 per 1000 ft^2 of bed area. Alternative materials such as BHC/DDT smokes would cost a similar amount but pyrethrins which might also be considered are much more expensive at $82.5.

It is tempting to believe that it would be feasible to physically exclude flies from buildings which, once filled, are not normally entered and which are commonly ventilated with filtered air. Unfortunately this is not so as the flies have a remarkable facility for locating the smallest access holes. Preliminary work suggests that a proportion of the females become sensitive to the odour of growing mycelium, these then enter the building at the same time releasing pheromones which 'mark a trail' for other females, unstimulated by mycelium, to readily follow.

Since none of the available pesticides are sufficiently persistent in the air to prevent some flies laying eggs the larval population will rise to unacceptable levels when large numbers of flies are present on the farm or its immediate environment. It is important to realise that phorids may be attracted over a long distance - probably several miles, by

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the volatiles released by growing mycelium.

Obviously, more satisfactory techniques must be considered if the necessary three week protection is to be achieved. Our work suggests that a low rate (10 ppm) of diazinon incorporated in compost can provide an effective alternative provided that it is evenly distributed through the substrate. My department has made an extensive study of the mixing efficiency of commercial spawning machines and is attempting to position spray booms so as to ensure that 90% of the compost is satisfactorily treated. At present, if the insecticide is applied before the compost is spun by the tines only about 30% receives at least the minimum effective dose.

Diazinon is available as an emulsifiable concentrate or as a granule, but before quoting their respective costs I should draw your attention to the fact that the deeper the beds the more compost which must be treated to control flies over a given bed area. For convenience and relevance to the modern large grower, I will quote figures for compost treatments on deep trays. Granule control (1/2 lb 5% granules/ton) would cost \$2.4/ 1000 ft^2 compared with \$4.8 for emulsifiable concentrates (2 1/2 fl. oz. 16% e.c./ton). Although some growers prefer the apparent convenience of granules it must be realised that the limited toxic foci obtained are not so efficient as the liquid method, though the latter may increase the water content of the compost (by about 2% where 6 gallons is used to treat 1 ton of compost). No allowance has been made for the depreciation of the granule distributor or insecticide sprayer, either or which, of course, would have to be operated by electronic control of the valves as the boxes pass down the line. This is, however, unlikely to exceed a further 75 cents even if the whole process were automatic.

Attention should also be drawn to the fact that in the U. K. we are allowed to use thionazin at 20 ppm (1½ fl. oz. 46% e.c. ton) for mushroom pest control and so, for \$8.5/

1000 ft^2, you could control sciarids, cecids and eelworms at the same time as phorids.

Increasingly, spawning lines are located within covered buildings so that problems may arise from the fumes given off as the insecticidal spray is distributed by the spinners. Large hoods and extractor fans should therefore replace the mechanical guards usually used.

It may be asked why insecticides cannot be mixed into compost during the last turns in the compost yard. We have shown that at least 50% of the diazinon and with thionazin up to 80%, may be lost during the subsequent peak-heat and since those losses cannot be accurately predicted they are unlikely to be either economic or reliable.

It should also be obvious that incorporation of insecticide by any form of 'in-tray' or 'in-shelf' spawner will almost certainly not give adequate control since the peripheral 2" on the sides and bottom of the tray or bed will probably be untreated and this volume accounts for 42% of the total fill.

Another matter which should be carefully considered when designing spawning lines is that insecticide cannot be directly applied to exposed spawn before mixing as many chemicals may delay or even inhibit mycelial growth from contaminated spawn grains.

Sciarids pose a quite distinct problem for, unlike phorids, they may invade crops at any time. Further, they cause serious direct, as well as indirect, damage. Indeed, their threat to production has been underestimated in recent years.

It is difficult to express the threat of disease spread in terms of fly density but as the adults are most efficient vectors of bacterial blotch and Verticillium, it is reasonable to keep their numbers at a very low level. As they crawl much more readily than they fly, it is easy to underestimate their numbers and hence

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fail to appreciate their real effects on production. Undue emphasis has been placed upon the damage they inflict upon sporophores when the larvae tunnel within the stalks - much more serious is the loss of pinheads only a millimetre or so in diameter as the larvae bore within the tissues. Detailed sampling on commercial units has revealed that populations of more than 35 larvae per sq. in. of peat-casing can completely inhibit cropping and even 6 larvae can cause the destruction of 25% of the pinheads. Interestingly, this order of loss may not be important for we have shown, in mechanical 'pruning' experiments, that mushroom size and yield is not affected until 60% of the young pinheads are removed. In view of the difficulty of obtaining precise figures, 6 larvae per sq. in. of casing seems a suitable threshold population to maintain. It is naturally difficult to use larval numbers conveniently but we have shown that sticky traps (12 x 1 in. lay-flat tubing coates with adhesive) at the rate of 1 per 1000 ft^3 can be used to establish the aerial population. The traps should be placed along a bed-board in such a position as to avoid nuisance to workers. If more than 10 flies are caught in a weekly period the larval population will exceed the quoted threshold.

Prevention is somewhat complicated with a variety of possible options. The flies are apparently attracted to composts during the "cool-down" from peak-heat. Synthetic composts are especially attractive though other composts may also be affected. Apparently some unidentified volatile is involved. Obviously smokes and fogs applied to closely packed trays in the peak-heat are unlikely to be effective and other controls should be sought. As with phorids, chemicals can be applied to the compost at spawning to kill the larvae of this first generation. At present the poor mixing capability of existing machines makes the technique less attractive though this can be overcome by using the volatile pesticide thioazin at a cost of $8.5 per 1000 ft^2.

An important characteristic of the biology of the mushroom sciarids is that the second, and later, generations of flies lay their eggs in the casing layer rather than the compost. Where casing consists largely of peat the larvae find a particularly favourable habitat though they need the coarse mycelial strands and pinheads for survival - they cannot complete development in damp peat alone. Probably the most efficient sciarid control is therefore based on incorporating chemicals in the compost. Chlorfenvinphos at 30 ppm (5 fl. oz. 24% e.c. or 3/4 lb. 10% granules per ton of casing) is particularly effective. As with compost, even incorporation of the chemical is essential but in this case, is easier and some form of rotary mixing or even manual turning is usually possible. It is particularly important to appreciate that the rate of pesticide application is based on the weight of casing as ready to apply to the beds. It is therefore essential for growers to measure the weight of casing which they apply. Granules cost $1 and the liquid formulation $0.7 mixed by machine, but hand mixing is expensive @ $2.2 and $1.8 respectively per 1000 ft^2.

As sciarid adults rarely fly their presence is often overlooked and betrayed only by the characteristic damage to pinheads. This is particularly so when they are associated with mass-pinheading when they may sever many minute pins which can be made to roll across the beds by gentle blowing. It is therefore necessary to have other methods of checking sciarids when they are detected in a crop after it has been filled. Fortunately, routine trapping has revealed that since sciarids are established at cool-down, subsequent generations emerge at fixed intervals. Malathion drenches applied to the bed surface will kill young larvae in the casing and so we recommend the use of 0.1% dilutions (1 1/2 pints 60% e.c. per 100 gallons) at 40 gallons per 1000 ft^2. These should be applied at about 28-30 days after spawning to span the period when most of the second generation are expected

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to be newly hatched from the egg. A programme of this kind will cost $6.3 per 1000 ft.^{2}.

Another method of combating these flies stems from the fixed emergence pattern of successive adult generations. These flight periods can be covered by an intensive smoke or U.L.V. application programme based on sulfotep, BHC/DDT and dichlorvos on alternate days from the 7th to 17th and 35th to 43rd days after casing at a total cost ranging from $3.7 - 5.5 per 1000 ft^2.

Cecids are also capable of causing direct financial loss to the grower. The white larvae of Heteropeza may occur in such vast numbers when they gain access to the crop at, or soon after, spawning that the mycelium is affected and the total crop reduced by up to 10%. These larvae swarm from the beds on to the sporophores approximately 9 weeks after spawning. Apparently in response to some physiological change within mushroom mycelium. However, this species is most unusual in that it does not moult so, as the young larvae split the mother's body, faecal material is released which contaminates mushrooms with a bacterium producing brown discolouration of the stipe and black pustules on the gills. The orange Mycophila larvae reproduce more rapidly than Heteropeza and if they become established at spawning; 80% of the first flush may be affected. As this species tends to contaminate the crop earlier, later flushes are less affected, resulting in an overall loss of about 60% of production.

Cecid larvae are almost immune to chemicals but can be killed by chemicals related to lysol which are therefore the basis of hygiene control aimed at sterilizing floors and cultural equipment. On the other hand certain pesticides can delay or prevent reproduction of the larvae and also their migration from the compost to the sporophores.

Incorporation of gamma-BHC into the casing at 50 PPM (1 pint 10% e.c./ ton) by machine at $2.3 or by hand at

$5.7 per 1000 ft^2, gives reasonable control though it must be remembered that the results may be less satisfactory then expected where larvae descend from compost in the upper trays of shelves. Compost incorporation to prevent breeding is therefore the most efficient approach provided the limitations of mixing through spawning machines is appreciated. The thionazin treatment at $8.5/1000 ft^2 is most desirable as volatility overcomes mixing deficiency, but diazinon at 20 ppm (5 fl. oz. 16% e.c./ton) at $9.6 also gives good control in experiments at the G.C.R.I.

The last primary pest group to consider are the tarsonemid mites which are frequently troublesome during the later stages of cropping. These mites feed on mycelium within the casing and compost and hence cannot be effectively reached by chemicals applied to bed surface. However, like cecids, the damage is caused by individuals which swarm on to the mushrooms. When more than sixty mites occur in every handful of casing the first signs of trouble can be detected. Such numbers occur early in cropping only if the mycelium is infested soon after spawning. If more than 100 mites reach a mushroom then the base of the stipe becomes stained bright chestnut-brown. Larger numbers, up to 500, discolour the whole surface of the mushrooms. As the mites are almost immune within the compost control depends mainly on hygiene. It is particularly important to prevent contamination of the spawn and to spray out empty growing rooms with 0.1% dicofol (32 fl. oz. 10% per 100 gallons). However, it is possible to prevent swarming by treating the casing as for cecids at a cost of $5.7/1000 ft^2 to achieve a worthwhile insurance.

Strategic Considerations

Obviously, all the costs quoted are highly economic in terms of the crop loss which they obviate or prevent. They merely serve therefore to choose between competing techniques and to emphasise that pest control is most unlikely to be curtailed on purely economic grounds.

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However, strategic decisions are complicated by the need to prevent the selection of strains resistant to pesticides. So far, there is little evidence of such pressures but we have shown that phorids consistently become more tolerant to pyrethrum as the fly season advances from June to October. Fortunately, this tolerance is lost by the beginning of the next season presumably because the first flies to reach the farm come from wild mushrooms in the fields where they have not been subject to pesticide pressure.

The real problem confronting the grower is the fact that although there appear to be a multitude of commercial insecticides they belong, in fact, to only four groups. Resistance to any one member of the group normally confers similar tolerance to other members of that group. This puts serious restrictions on any intelligent manipulation of the control programme designed to delay the development of resistance. Of the commonly used insecticides there are seven whose active ingredients are organophosphates, two, 'BHC and methoxychlor, are organochlorines in addition to pyrethrins which form a distinct group.

It is obvious that most of the recommendations already referred to are based on the O-P compounds chlorfenvinphos, diazinon, dichlorvos, thionazin and malathion. We are, therefore, assisting in the clearance of the new material pirimiphos-ethyl as an alternative to chlorfenvinphos for sciarid control by casing treatment.

A strategic plan for mushroom pest control must therefore take account of both economic and resistance problems. Cecids and tarsonemid mites are unlikely to be a permanent threat to the average farm so that controls can normally be limited to hygiene treatments. When an outbreak does occur the subsequent crops should be routinely treated with their respective major controls (thionazin or diazinon in the composts for cecids and BHC in the casing for tarsonemids). When used, these materials may necessitate changes in the 'insurance' controls for the constantly occurring phorids and sciarids. The phorids are calendar pests with a distinct annual and daily flight periodicity. Since the main aim of the programme must be to delay the development of resistance, the early and late season treatments should rely largely on BHC/DDT smokes or vaporisers in the spawn rooms, but in the height of the period of attraction to spawn-rooms they should receive daily or continuous injection of dichlorvos, supplemented by diazinon or thionazin in the compost at spawning. Since the infestation in a single crop arises from the ingress of flies over a few days the genetic diversity of the pest population is probably fairly limited. Treatment to reduce the numbers of flies during cropping should therefore be distinct from the earlier methods and rely largely on pyrethrin, resmethrin or nicotine. Economics are therefore subservient to the efficiency of control and the only monetary consideration is to distinguish between the costs of competing formulations and active ingredients. For instance, diazinon granules @$2.4 seems preferable to thionazin at $8.5 per 1000 ft^2, but the latter is an 'all purpose' material.

Sciarids present a very different problem in that infestation may occur at any time of year and at any stage of the growth of a crop. It is not therefore possible to economise on pesticide usage in inclement weather or by identifying a period of risk. The problem in this case is the multiplicity of potential techniques. In the first place it is wise to monitor the fly populations by some form of regular trapping. Once numbers begin to rise a smoke programme, based on BHC/DDT or sulfotep should be applied at the flight time of the successive generations. As the problem intensifies malathion drenches as the first pins show should replace smokes and in the worst situation the insurance 'methods' of casing and/or compost treatments must be considered. Casing treatments alternating chlorfenvinphos and pirimiphos-ethyl are to be preferred to thionazin unless

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Mushroom News

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CLASSIFIED COLUMN

FOR SALE – Fully equipped mushroom farm. Located in the Poconos. Write to A. Ramke, R. D. #1. Tobyhanna, Pennsylvania or phone 717-839-9461. Reason for selling: Poor health.

FOR SALE – Poultry Manure. Available at White Wing Egg Farm, Quakertown, Pa. Call (215) 536-7730. Monday - Friday between 8 a.m. to 5 p.m. Ask for Linda or Lenny.

FOR SALE – Two Robins in-line mushroom trimmers. Good working condition. Reasonably priced. For details please write to Box No. O-1, American Mushroom Institute, Box 373, Kennett Square, Pa. 19348.

The strategy of Mushroom Pest Control

(Continued from Page 18)

other pests are also involved.

From this account detailing some aspects of the biology of the important pests it should be apparent that the external environment cannot be neglected if control is to be effective and cheap. Cecids and sciarids breed in decaying organic matter and so are favoured by dense brush and weed growth above deep litter. Phorid flight is encouraged by the shelter of hedges and trees and so there is every case to site the farm in a relatively exposed position and to maintain the area around the houses with mown grass.

The strategic guidelines for mushroom pest control are first to seek 'early warnings' by monitoring, second to consider the resistance problem inherent in any programme and thirdly to seek the cheapest technique relevant to the farm and its equipment.

ASTON ONE-DAY SEMINAR IN MUSHROOM SCIENCE

The first of a series of one-day Seminars on special topics relating to mushroom growing is to be held at the University of Aston, Birmingham, England, on November 9. The first Seminar is on The Casing Layer. The contributors, who represent industrial, research and academic interests include Dr. R. L. Edwards, Mr. G. W. Ganney, Mr. N. Barnard, Dr. N. G. Nair and Dr. W. A. Hayes. The Seminar is open to all mushroom growers."

In Memoriam

CARL PALONI
Hockessin, Delaware

PAST MEMBERS AMERICAN Mushroom INSTITUTE