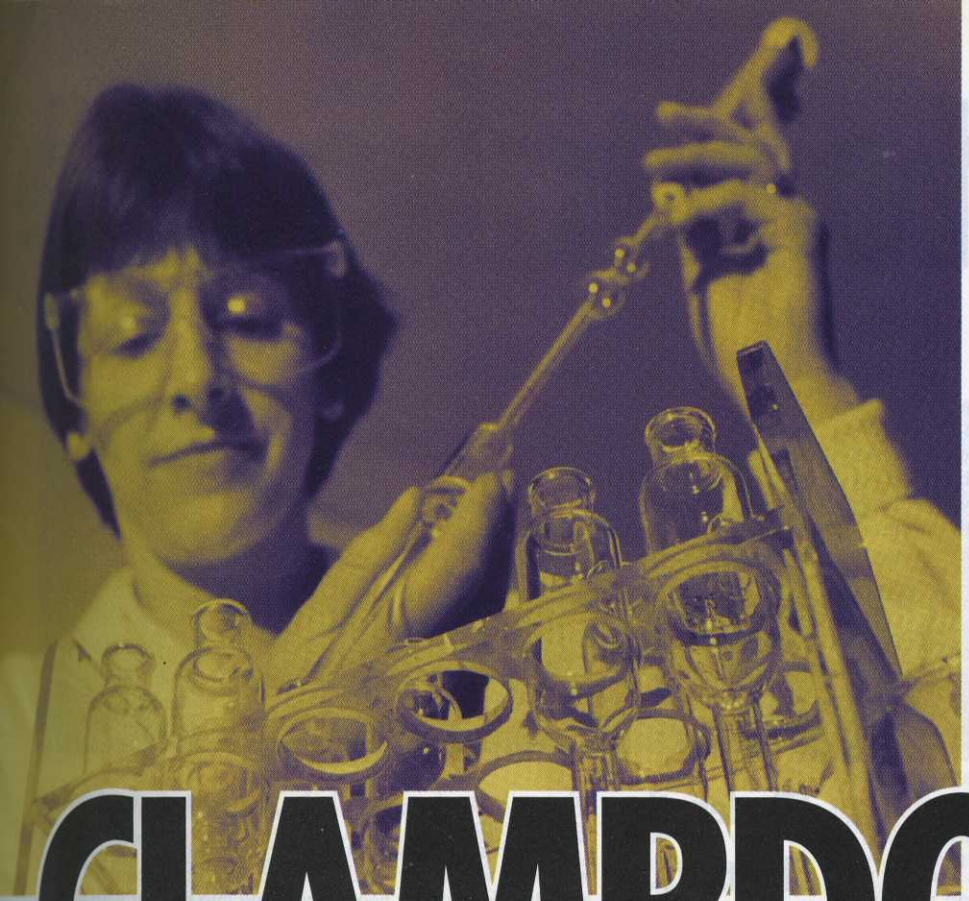


CHEMICALS and the GREENKEEPER

Certain chemicals are now OFF the shopping list, leaving greenkeepers weighing up the alternatives. Greenkeeper International asked experts Graham Paul, Geoffrey Ellis and David Stansfield to take a look at the options, the fungicides and the pesticides which keep YOU in control

CLAMPDOWN

The passing of 1992 saw the withdrawal of approval for the use of the wormkiller chlordane. Later this year a similar fate will befall some of the triazine herbicides – namely atrazine and simazine. Is this 'weeding out' of chemicals going to become a trend for the years to come? GRAHAM PAUL looks at the future for the chemicals we have come to take for granted and suggests measures we might take to preserve their usefulness.

by GRAHAM PAUL

The loss of atrazine and simazine will mean that almost one hundred products will no longer be available to the greenkeeper. This will be quite a devastating blow for users and suppliers alike, for the triazine herbicides provide useful long-term control of weeds and grasses in non-crop areas. They persist in the soil, preventing seeds from germinating, and it is this persistent behaviour which has resulted in the detection of minute amounts of triazines in ground water. One could argue that the popularity of this large group of products has contributed to their demise. Alternative methods of controlling weeds in non-cropped areas are not easy to find. There are chemical alternatives – such as diuron and imazap – which are available, but the process of developing and registering new products based on them is very costly and can involve long delays: three or four years to develop a formulation and carry out laboratory studies and field trials, plus up to two years waiting for the necessary approval from the Ministry of Agriculture.

The wormkiller chlordane has been off the shopping list for some time now, although the approval for its use remained until December 31, 1992 to enable stocks to be used up. In a similar way to the triazine herbicides, the persistence of chlordane in the soil made it an excellent product for achieving long term control. Now that we have to use less persistent products we might need as many as ten applications to do the same job – a fact that will be welcomed by the manufacturers and, I imagine, by the worms!

When mercury based fungicides were withdrawn in 1981 their place was filled by alternative, less persistent fungicides such as iprodione, chlorothalonil, quintozene and the systemic fungicides; thiophanate methyl, carbendazim and thiabendazole. These chemicals were available as substitutes because they had been developed for uses in the much larger agricultural market. However, that happened in the 1980s. Registering new products was easier then and there were more new active ingredients being discovered and developed for uses in agriculture.

Today there is no endless supply of alternatives to replace those being withdrawn and we have to take great care in the use of the remaining armoury of pesticides, or they too maybe withdrawn. it is not just the recession that has reduced the rate of registration of new products, but more durable causes such as the effect on the farmer's purse of policies to reduce surplus food production. Farmers have been forced to spend less on chemical sprays and so the manufacturers are looking harder at what money they can invest in the search for new active ingredients. Currently it costs about £30 million to bring a totally new active ingredient to the market-place. A large proportion of this is the cost of providing data on the toxicology and environmental impact to support the approval of products containing it.

Clearly, if we wish to continue to benefit from using chemicals to control weeds, pests and diseases, then we must learn to safeguard those we already have. This might be achieved by ensuring that all pesticides are only used when necessary, with the utmost of forethought and care to prevent contamination of ground water supplies. We should take particular care in using the few residual herbicides new to this market, such as those based on diuron, lest these too find their way into ground water and are banned – like the simazine and atrazine products.

Users should avoid under-dosing as well as over-dosing because the former can result in the need to re-apply a product which fails to perform, thereby using in total nearly twice the correct dose. Consideration must also be given to the possibility of pesticides losing effectiveness through resistance developed by the target species. Although this has not been common in the past, cases have occurred in most areas of pesticide use; such as warfarin resistance developed by rodents and fungicide resistance in grey mould and powdery mildew.

In many cases such resistance can be attributed to popularity and sheer over-use of the product. Where there are several alternative products to choose from, as with turf pesticides, sensible rotation will go a long way to help preserve our armoury.

We are all in favour of cleaning up our environment to improve the quality of life on earth, but pesticides can provide a useful benefit to our society without posing a threat to its future. The continued availability of these valuable tools will only be assured by sensible and responsible use.

■ The author, Graham Paul, has over 20 years experience in the chemical industry, having been closely involved in the development of the Rhône-Poulenc range of environmental products for much of that time. Graham is now territory sales manager for Sta-Brite Supplies Limited.

How to make the

Earthworms have both beneficial and harmful effects on fine sports turf. If you like, this makes them both baddies and goodies. The good news is that by going about their daily business, worms tunnel through the soil and give much needed aeration. The bad news is that some species, actually only two or three of the twenty or so found in Britain, come to the surface to cast. This causes the unsightly heaps of which we are all aware.

So how can we prevent the harmful effects of the baddie earthworms, while encouraging the benefits provided by the ones in the white hats? Well, a knowledge of their life cycles, plus knowing when and why they cast can help with a sensible approach to their control. The first point to note is that in any healthy soil, whatever may be growing, earthworms are present in abundance. This is particularly true in undisturbed turf, which unlike annually cropped land is not regularly disturbed by ploughing or cultivating. Up to one million worms per hectare were recorded in trials conducted at the Sports Turf Research Institute.

All these earthworms naturally are very hungry. They eat virtually anything organic, including living and dead plant and animal material. Thatch formed under fine turf is one of their favourite feeding places. So if you control earthworms too thoroughly by chemical means you could finish up with a worse build-up of thatch. If you add the benefits they give from improving soil aeration and structure, their general activity is beneficial. But the difficult trick is to balance this with the suppression of surface casts.

The three worms which cast are the two Allolobophoras species longa and nocturna and the common Lumbricus terristris. Like most earthworms, their activity is worst in heavy soils containing a large reserve of organic matter, and least on lighter, well-drained turf like the greens of links golf courses. Moisture also plays a part and casting is always more prevalent in moist springs and autumns than in a dry summer, when worms go deep down in the soil to avoid the effects of drought. At this time they go into a form of suspended animation, waiting for moisture to return. Obviously, this is less likely under heavy irrigation.

The damage caused by casts is obvious, but not always fully appreciated. They are unsightly, ruin the true running of a green, suppress grass growth, spoil surface drainage and encourage fungus disease, whilst the excreted fine soil particles make ideal weed seed-beds. After a wet autumn, unless they are swept up, the casts can lead to muddy playing conditions all winter.

Finally, all earthworms, but especially those that live near the surface, also encourage moles – I speak with a lawn currently looking a bit like a miniature version of the western front. So, as most greenkeepers would agree, casting worms must be controlled. Adopting the right cultural measures will help; quite a lot can be achieved, for example, by regularly discouraging the production of the thatch, which gives the casting species a near-surface source of bed and board. A regular programme of slitting and coring where it is needed is therefore important, coupled with the removal of grass clippings and restriction in the use of organic surface dressings.

Earthworms also dislike acid conditions, so be careful of overliming and in naturally chalky conditions use acidifying fertilisers like sulphate of ammonia and sulphate of iron. In a wet, heavy soil further improvements to the drainage system are also worth considering.

In past years, a number of different chemical pesticides were used to kill earthworms. These were usually aimed at the whole population, casters or not – I don't think in those days we knew the difference. These included mercuric chloride, lead arsenate, copper sulphate, sodium hypochlorite and potassium permanganate. Some of these are very nasty materials indeed and at least two of them may by law no longer be sold for any horticultural use. Apart from the now totally banned lead arsenate, which gave control for up to two years but also killed off most other soil organisms, most had a short-term effect and needed repeat treatment.

'The length of activity of the modern wormicides is usually less than older materials like lead arsenate, which also helps make them more environmentally friendly'

Mowrah meal was a much safer alternative to all these and was used widely for earthworm control until about 25 years ago. Broadcast dry, it needed watering into the turf with a copious amount of water by hose pipe. After a fairly short period the worms came wriggling up to the surface, quickly died and could then be brushed up and removed.

This treatment undoubtedly helped to control a lot of worms, most of them sub-surface and probably casting species. The effect could be seen for up to two seasons. But it used a lot of mowrah meal, up to eight ounces per square yard was the recommendation, and thorough watering-in was needed to gain full effect. Removing the bodies, which otherwise could make an even worse playing hazard than casts, was another tedious operation. Therefore, as older greenkeepers will remember, all in all, applying mowrah meal was a very time consuming process. The organic matter left from this bulky material might itself also have helped encourage another generation of sub-surface feeding species.

In more recent years chlordane has been a successful successor to mowrah meal. The two forms available were the liquid Sydane 25 and Sydane Granular. It was relatively safe to apply, controlled worms for a fairly long period, but has been decreed to be excessively harmful environmentally. So, as most greenkeepers will now be aware, official approval for sale and supply ceased on 31 December 1990, and storage and use for earthworm control ceased to be permitted after 31 December 1992. After this date, unused stocks of chlordane should have be destroyed.

Fortunately, we have approved alternatives. One of the most useful is a mixture of gamma-HCH with thiophanate-methyl, which controls both earthworms and leatherjackets – a considerable bonus where they are troublesome. It is sold as Castaway Plus and is available in normal flowable and CDA formulations. The makers also claim that it gives selective control of casting worm species.

Another modern approved replacement is the carbamate insecticide carbaryl, sold in flowable formulation as Twister Flow by Rhône-Poulenc. Carbaryl is a pesticide with a wide range of uses as an insecticide, even for use against head lice!

The length of activity of the modern wormicides, or lumbricides to use the official term, is usually less than older materials like lead arsenate, which also helps make them more environmentally friendly. The proper time of application for all of them is when the earthworms are casting most actively, usually in wet periods in spring and autumn. In areas where levels of casting worms are high, repeat applications will almost certainly be needed to achieve complete control. Carbaryl is said to remain active in the soil for up to two months.

When and how much you use a chemical control will depend on the situation and the problem the worms are causing. Usually the problem is worse at the back end rather than spring, and it was particularly bad last year following a wet September and October. On light soils and where the playing surface is not used

worms turn

CHEMICALS and the GREENKEEPER

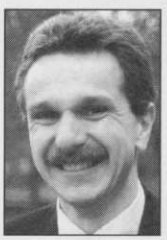
over winter you might decide not to bother. In that case you must be prepared to deal with any weed seedlings growing the following year in the convenient seed-bed the casts have left for them.

But I suspect that many greenkeepers on heavier, wetter soils, especially if they are chalky, will find it pays them to apply wormicides as a fairly regular treatment. It will also pay to remember the benefits from the goodie, non-casting worms and try to limit the control of the baddies to only what is strictly necessary. One day we might have a chemical that is guaranteed to distinguish between the two. Until then, care and caution appear to be the watchwords.

■ The author, Geoffrey Ellis, is an independent consultant and writer with some 30 years experience in the agro-chemical industry. He runs a small nursery specialising in the production of wild flowers.

◆ The way it used to be... pictures from 'Lawns for Sports' published in 1924, show how 'Carters Wormkiller' handled the problem. And you're right – the end picture *isn't* spaghetti!

FIGHTING THE FUNGUS



by DAVID STANSFIELD

In an ideal world we would never have any problems with fungus attacks on the golf course if healthy and vigorous turf, with good disease resistance, could be maintained by careful cultural management to shrug off disease. Then there would be no need to use chemicals to keep down pathogenic organisms. However, very few are blessed with the ideal golf course turf, especially on greens, where fungal attacks are most likely to occur and cause damage and where sustaining uniformity and density is vital year-round.

This is not to say that courses which do not have disease-resistant turf on greens (ideally fescues and bent grasses, carefully managed for growth, sited on healthy, well-structured, free-draining soil, out in the open air to produce a stable system) should not practise good cultural control of disease. Indeed, this is essential if reliance on chemical control is to be kept to the minimum. Whilst there is a range of fungicides available for treatment of turfgrass diseases, the range is not limitless: chemical applications are expensive and any input of chemicals into the environment should be avoided if possible. It is always best not to have to deal with disease in the first place and the use of fungicides should be a line of last resort.

The principle of good cultural practise is to create an environment in which disease is less likely to occur. Again, management to encourage disease resistant species within the turf has to be a primary consideration, looking for good aeration and free drainage, together with careful control of fertilizer input, application of irrigation and timing of top dressings. This latter item is a frequent means of encouraging autumn diseases, when year-end dressings are applied late and cause some smothering of the swards at a time when top growth is slow and the grasses are damp.

In the same vein, operations to promote drying of the grass cover are always valuable. The switching of surface moisture is an obvious one in this respect, but of equal if not greater value is ensuring that greens are recipients of a draught whenever possible. A good breeze across a putting surface, encouraged by the thinning of trees and under-scrub, is one of the best 'fungicides' around.

Applying Sulphate of Iron as a routine dressing is often cited as a means of limiting incidence of fusarium patch. This is true up to a point, and there are other beneficial spin-offs from applying sprays of Iron. On the other side of the coin though, acidification of the soil profile can come about by excessive use, and it must always be remembered that Iron is not a fungicide. It may make an outbreak of fusarium less likely, but it will not stop one which has already started.

Working on the above principles, there are clubs that rarely, if ever, use fungicides to deal with disease problems. Nevertheless, there are many more reliant on chemical applications to keep putting surface turf in as good a condition as possible year-round, and these have to apply fungicides fairly regularly.

The main problem to be dealt with in relation to fungicide is (by far and away) fusarium patch disease. On average, the majority of clubs will treat for fusarium on greens three times in any one autumn/winter period, costing in the order of £1000-£1500 for an 18-hole golf course. This average treatment frequency may fall within a range of 1-5 treatments per annum depending upon the weather.

So, for most clubs, use of fungicide is a significant item within the budget for the green, merely allowing for applications on putting surfaces. Treatment of other sections of the course beyond immediate greens surround is very rare. Here, the cost-benefit of fungicide application is much less, as the effect of disease is much less damaging in the medium term.

Returning to greens, while application of fungicide is not cheap, nine times out of ten procrastination in its use is expensive too. A few spots of fusarium can run riot in quite a short spell, causing lingering damage. Never forget either that fungicides work best at the outbreak of disease, and the earlier that spraying is carried out (wind and rain permitting) the more likely the chance of complete success first time. Constant monitoring of disease outbreaks is essential if timing of spraying is to be to the best advantage.

When it comes to choice of fungicide for treatment of fusarium, in principle, systemic types are best for the bulk of the year, confining use of contact type materials to the very ➡ 21

FIGHTING THE FUNGUS

CHEMICALS and the GREENKEEPER

19 ➧ slow or no growth season (which obviously varies in extent depending upon geographical area, but also with respect to the nature of the turf). Systemic fungicides work well and have the longer term of preventative effect. Also, they have a broad-based effect, so can deal with secondary diseases, and they do tend to discourage worm casting. While there has been suspicion that systemics can encourage thatch fungi, the link is very tenuous and can be safely ignored for the most part.

The systemic fungicides which have been widely used to date have been part of the benzimidazole (Benlate, etc.) family, and closely related in their chemistry. While no doubt these fungicides will continue to be widely used in future, the good news is that a completely new systemic fungicide has come onto the market recently – fenarimol (Rimidin) – which gives more options in terms of alternation of fungicides, so long as care is taken to avoid severe yellowing from use on *Poa annua* dominated greens, as can occur.

Alternation in the use of the types of chemical used for disease control (where practical) is good practice when disease has to be treated regularly, but this is not just a case of using different brand names. Alternation needs to be between different groups of fungicides. The benzimidazoles are very similar in action, as are the dicarboximides (eg. Rovral and Mascot Contact). Fenarimol is different and so too are Chlorothalonil (Daconil) and Quintozene. The reason for alternation is to avoid the development of disease resistance. Even though there is no proven resistance to any fungicide in the UK, this has occurred in the USA, where chemical usage is much more intensive.

Beyond choice of chemical, there is always the thorny question of whether to use fungicides as a preventative or a curative treatment. The principle has to be to stick to curative applications wherever practical, to limit chemical input into the environment. However, in certain situations, eg. at clubs which suffer four or five outbreaks of fusarium every year when treating curatively, the application of systemic fungicide on a preventative basis from September onwards can actually reduce chemical applications – and leave better greens.

Using fungicides on the golf course for diseases other than fusarium is comparatively rare. However, it can be necessary from time to time and in these situations accurate identification is essential to ensure the right specific can be applied quickly to deal with diseases such as brown patch, severe anthracnose or dollar spot. Also, to ensure that fungicide is applied in the most effective way, eg. when dealing with grade two fairy rings or superficial fairy rings, or to avoid fungicide use when it could actually be harmful (eg. for take-all) or totally unnecessary (eg. for yellow tuft).

All in all, there is a lot to get right when using fungicides on the golf course even before getting to the operational end of applications themselves, ie. handling and spraying.

The more everyone knows about fungicides availability and disease identification, the better. After that, good training in spraying is vital, ensuring the lessons learned are actually applied. Then, fungicide use will be effective and safe. Even so, the launch of a new fungicide which has no Hazchem warning has to be good news.

■ **The author, David Stansfield, is the golf course agronomist with PSD Agronomy Limited.**