

THE BETTER WAYS OF BEATING BOTRYTIS

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Botrytis Cinerea is probably the most common fungal pathogen of protected crops causing a rot of leaves, stems, fruit and flowers. The familiar grey mould symptoms can be seen in most crops in most seasons.

Epidemic levels of this pathogen can be prevented by maintaining an environment which is unfavourable for botrytis to develop and this means keeping the relative humidity within the crop at a level below 93%. All factors which encourage a high humidity such as frequent overhead watering, no ventilation, use of thermal screens and a constantly wet soil surface, will contribute to producing conditions favourable for botrytis development.

The easiest and most effective way to control botrytis is to heat and ventilate the crop but this is now so costly that it is infrequently practised. For this reason growers have become increasingly dependent upon the use of effective fungicides.

There are a number of fungicides available for the control of botrytis although they are not all recommended for use on all protected crops (see Table 1). Since the early 1970s, the industry has used the carbendazim fungicides very successfully and more recently the dicarboximide group has become widely used.

In addition to these there are others that have been on the market for many years including chlorothalonil, dicloran, dichlofluanid, tecnazene and thiram. So the grower has a wide choice of materials, many unrelated, and in different mode of action groups (see Table 1). Unfortunately because

of fungicide resistance the situation has changed dramatically during the past few years reducing the choice, especially on some crops, to very few fungicides.

Fungicide resistance

ADAS survey work in 1980 showed that whereas resistance was then fairly commonly found to the carbendazim group it was almost nonexistent to the other main group, the dicarboximides. A recent re-examination of the situation shows a dramatic change (see Table 2).

Whereas carbendazim resistance has increased from 31% to 52% dicarboximide resistance has increased from less than 1% to 66%. What is even more worrying is the fact that a third of the isolates tested were resistant to both the major groups.

Disease control failures were widespread in the mid 1970s when various pathogens developed resistance to the carbendazim fungicides. With botrytis the sensitivity to this group of fungicides changed from completely sensitive to resistant in one step with almost no intermediate stages.

The highly resistant botrytis populations were not controlled by the carbendazims and the industry changed to other materials, largely the dicarboximides, which arrived on the market at about this time.

The loss of sensitivity to the dicarboximides has not resulted in such a dramatic change in disease control. It has been shown that the resistant populations will produce

Table 1: Fungicides recommended for botrytis control

	Tomato	Cucumber	Lettuce	Crop Celery	Pepper	Aubergine	Ons
Dicarboximide	Rovral Ronilan	Rovral Ronilan	Rovral Ronilan	Ronilan	Rovral	Rovral	Rovral Ronilan
Carbendazim	Benlate Derosal Bavistin Focal	Benlate Bavistin	Benlate	Benlate Derosal	Bavistin	—	Benlate Derosal Bavistin Focal
Chlorothalonil	Repulse Bravo Thiram	Repulse Bravo	— — Thiram	Repulse Bravo Thiram	— — —	— — —	Repulse Bravo Repulse
Dithiocarbamate	Zineb	—	Zineb	Zineb	—	—	Bravo
Others	Elvaron *Tecnazen —	— *Tecnazen —	— *Tecnazen +*dicloran	— — —	— — —	— — —	— *Tecnazen —

*available as a smoke

+available in mixture with thiram as Turbair Botryticide

Table 2: Botrytis cinerea isolates showing resistance in 1984

Crop	iprodione	iprodione and benomyl	benomyl	not resistant
Carnation	5	0	0	0
Cucumber	10	0	2	0
Cyclamen	2	31	13	13
Chrysanthemum	13	9	13	7
Lettuce	37	25	6	17
Pot plants	0	25	7	3
Peppers/aubergines	0	0	10	4
Tomato	98	80	45	33
Total	165	170	96	77
Per cent 1984	32.5	33.5	18.9	15.1
Per cent 1980	0.7	0	30.7	68.6

disease symptoms especially if sprays of dicarboximide fungicides are continued.

In 1980 an examination of resistant isolates showed them to be not very virulent, disappearing from the population when dicarboximide application ceased. Some of the 1984 isolates are of this type but many of them are capable of growth at high concentrations of these fungicides and some have been shown to be as virulent as the sensitive isolates.

This pattern has already been well documented in Spain and Israel where botrytis control with the dicarboximides has become very difficult.

Avoiding the Problem

The best way to avoid botrytis problems is to grow crops in an environment not conducive to the development of the disease. This is expensive and often difficult and most growers will still need the help of effective fungicides.

Carbendazim resistance with disease control failures is now

commonplace and we have a clear warning that dicarboximide resistance, also with disease control failure, is likely to become widespread if these fungicides continue to be intensively used. Unfortunately there are no effective fungicide mixtures available at present; a dicarboximide plus a material from another mode of action group (excluding the carbendazims) would be well worth having.

In order to prevent resistance increasing and becoming more severe it is important to minimise the use of dicarboximide materials in order to retain their effectiveness. Programmes for the major protected crops with this in mind are suggested (see Table 3). The situation is particularly acute for lettuce growers.

As long as fungicides are used sensibly there is no reason why fungicide resistance cannot be delayed or prevented. Once resistance has arisen it is very much more difficult to implement an effective programme. Wise action now, especially with the dicarboximide fungicides, could prevent expensive disease control failures in the future.

Table 3: Suggested fungicide spray programmes

Tomato	Cucumber	Lettuce	Celery	Ornamentals
ELVARON from second truss in flower and fortnightly or according to conditions until picking ↓	ROVRAL or RONILAN ↓	Thiram for first 2/3 weeks ↓	BRAVO or REPULSE ↓	see footnote
ROVRAL or RONILAN ↓ *ELVARON ↓	BRAVO or REPULSE ↓ FUMITE TCNB smoke generators ↓	ROVRAL or RONILAN ↓ TURBAIR ↓ BOTRYTICIDE and/or FUMITE TCNB smoke generators ↓	Thiram ↓ RONILAN ↓	
Continuing in sequence if necessary *If ghost spot is a problem Elvaron should be used more frequently	Continue in sequence with a suggested maximum of two applications of dicarboximides preferably well separated	Continue in sequence with a suggested maximum of two applications of dicarboximides preferably well separated	Should be possible to limit the dicarboximide sprays to once only	

For ornamentals read the label to make sure that the product is recommended for a specific crop and then alternate materials from different mode of action groups keeping the numbers of dicarboximide sprays to a minimum.

Carbendazim sprays may be inserted in the above programmes but should not be used more than once per crop. Where biological control is being practised they may be deleterious.

Fungicidal paints of Benlate/Actipron can be used to treat stem lesions.



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