AGRICULTURAL DEVELOPMENT AND ADVISORY SERVICE

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CONTRACT REPORT
HO/21
Hebe Downy Mildew Control
Undertaken for Horticultural Development Council

COMMERCIAL - IN CONFIDENCE

PRINCIPAL WORKERS

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AUTHENTICATION

I declare that this work was done under my supervision according to the procedures described herein, and that this report represents a true and accurate record of the results obtained.

.....David R Jones.....D R Jones PhD

Date 6 January 1992

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SUMMARY

Nine fungicide programmes plus an untreated control were evaluated for control of downy mildew on hebe grown in a polythene tunnel. A programme consisting of a repeated sequence of two sprays of Aliette (fosetyl-aluminium) and one of Bombardier (chlorothalonil) gave very good disease control. A programme consisting of Aliette, Bombardier and Favour (metalaxyl + thiram) also gave good control. Other treatments had very little effect.

OBJECTIVE

To identify the best fungicide control programme for control of downy mildew of hebe, caused by Peronospora grisea.

MATERIALS AND METHODS

Site

Horticulture Research International, Efford, Lymington, Hants, SO41 0LZ.

Layout

Ten treatments x three replicates in randomised block layout. Each plot consisted of eight test plants of Hebe salicifolia, surrounded by sixteen guard plants of Hebe 'Midsummer Beauty'. Plot size = 1 m^2.

Treatments

Treatments are listed in Table 1, and active ingredients of the fungicides and dose rates are in Table 2.

Crop diary

All plants were potted on 4 July, and the Fongarid drench applied to Treatment 6. Plants were kept in close proximity with infected plants such that all plants were infected by the time they were transferred to the tunnel on 6 August. The tunnel was closed up at night and plants were frequently irrigated from overhead to provide conditions favourable for downy mildew. Spray treatments were applied on the dates listed in Table 1. Mildew was assessed at each of the top 5 leaves on 24 September. All plants were pruned severely on 12 October. Mildew on the regrowth was assessed on 21 November, and plant vigour was assessed on a 0-5 scale (5 = most vigorous). After the final assessment on 14 December the regrowth was removed from each plant for dry weight determination.

Statistical analysis

All data was subjected to analysis of variance, and means separated using Duncan's Multiple Range test.

TABLE 1 Treatments

Date	Treatment number									
	1	2	3	4	5	6	7	8	9	10
4 July	Untreated	Untreated	Untreated	Untreated	Untreated	Fongarid	Untreated	Untreated	Untreated	Untreated
8 August	Untreated	Favour	Filex	Aliette	Favour	Aliette	Galben M	Curzate M	Trustan	Zineb
20 August	Untreated	Favour	Filex	Aliette	Filex	Aliette	Galben M	Curzate M	Trustan	Zineb
4 September	Untreated	Bombardier	Bombardier	Bombardier	Aliette	Bombardier	Bombardier	Bombardier	Bombardier	Bombardier
19 September	Untreated	Favour	Filex	Aliette	Favour	Aliette	Galben M	Curzate M	Trustan	Zineb
3 October	Untreated	Favour	Filex	Aliette	Filex	Aliette	Galben M	Curzate M	Trustan	Zineb
18 October	Untreated	Bombardier	Bombardier	Bombardier	Aliette	Bombardier	Bombardier	Bombardier	Bombardier	Bombardier
2 November	Untreated	Favour	Filex	Aliette	Favour	Aliette	Galben M	Curzate M	Trustan	Zineb
15 November	Untreated	Favour	Filex	Aliette	Filex	Aliette	Galben M	Curzate M	Trustan	Zineb
29 November	Untreated	Bombardier	Bombardier	Bombardier	Aliette	Bombardier	Bombardier	Bombardier	Bombardier	Bombardier
11 December	Untreated	Favour	Filex	Aliette	Favour	Aliette	Galben M	Curzate M	Trustan	Zineb

TABLE 2 **Active ingredients and dose rates**

Product	Active Ingredients	Dose rate (product/water volume/m²)
Aliette	fosetyl-aluminium (800g/kg)	0.15g/40 ml/m²
Bombardier	chlorothalonil (500g/l)	0.3 ml/20 ml/m²
Curzate M	cymoxanil & mancozeb (100 + 680g/kg)	0.2g/20 ml/m²
Favour	metalaxyl + thiram (100 + 500 g/l)	0.15 ml/75 ml/m²
Filex	propamocarb hydrochloride (722g/l)	0.86 ml/570 ml/m²
Fongarid	furalaxyl (250g/kg)	2.3g/570 ml/m²
Galben M	benalaxyl + mancozeb (80 + 650g/kg)	0.2g/20 ml/m²
Trustan	cymoxanil + mancozeb + oxadixyl (32 + 560 + 80g/kg)	0.25g/20 ml/m²
Unicrop Zineb	zineb (700g/kg)	1.1g/570 ml/m²

RESULTS

All results are given in Table 3.

In the assessment on 24 September, on each of the top four leaves the Aliette/Bombardier programme (Treatment 4) was significantly more effective than any other treatment. This treatment gave complete control on leaf 1 (the youngest leaf) and virtually complete control on leaf 2. The Favour/Filex/Aliette programme (Treatment 5) was as effective as Treatment 4 on the youngest leaf, and was the next best treatment on leaves 2 and 3. None of the other treatments differed significantly from the untreated plants in mildew levels on the top 4 leaves, but Treatments 7, 8 and 10 significantly reduced mildew on leaf 5.

There were no significant differences between treatments in mildew assessed on the regrowth on 21 November although the Aliette/Bombardier programme was the only one which gave complete control. There were also no significant differences in vigour. Similarly, there were no significant differences in mildew on 14 December or in the dry weight of the regrowth, although the differences in dry weight almost achieved statistical significance at the 10% probability limit rather than at the normal 5% level. There was a clear indication that all of the fungicide treatments increased the dry weight of the regrowth.

TABLE 3

Disease assessments, vigour and dry weights of regrowth

	Treatment	% Downy Mildew, 24 September						Mean % Downy Mildew 21 November	Vigour 21 November	Mean % Downy Mildew 14 December	Dry wt of regrowth (g)
		Leaf 1	Leaf 2	Leaf 3	Leaf 4	Leaf 5	Mean				
1	Untreated	64.0 bcde	99.0 c	100.0 c	91.3 b	66.9 b	84.2 d	6.7	3.4	2.5	19.3
2	Favour/Bombardier	44.6 b	90.4 c	91.5 c	76.0 b	36.7 ab	67.8 c	4.0	4.0	1.0	34.9
3	Filex/Bombardier	54.0 bcd	93.8 c	99.0 c	91.5 b	50.4 ab	77.7 cd	4.0	3.6	1.4	28.8
4	Aliette/Bombardier	0 a	0.6 a	8.8 a	29.0 a	18.5 a	11.4 a	0.0	3.8	0.0	27.6
5	Favour/Filex/Aliette	4.8 a	31.1 b	61.9 b	65.6 b	34.8 ab	39.6 b	1.2	4.4	0.5	40.9
6	Fongarid/Aliette/ Bombardier	47.9 bc	95.8 c	99.6 c	79.0 b	51.0 ab	74.7 cd	0.8	3.6	0.1	30.9
7	Galben M/Bombardier	67.1 cde	96.0 c	90.1 c	70.6 b	33.6 a	71.5 cd	2.9	4.3	0.8	43.3
8	Curzate M/Bombardier	69.0 de	88.5 c	98.8 c	69.2 b	18.9 a	68.9 cd	4.4	3.8	1.0	32.5
9	Trustan/Bombardier	52.3 bcd	86.0 c	96.0 c	90.8 b	50.6 ab	75.2 cd	0.2	3.9	1.4	37.6
10	Zineb/Bombardier	75.6 c	97.7 c	94.2 c	69.2 b	29.4 a	73.2 cd	7.1	3.8	1.4	35.1
	CV (%)	21.9	9.2	13.6	22.0	42.9	13.1	132.4	17.3	100.1	25.8
	SED (18 df)	8.58	5.82	9.35	13.13	13.7	6.9	3.38 n.s.	0.54 n.s.	0.82 n.s.	6.97 n.s.

Treatment means followed by a common suffix letter are not significantly different ($P < 0.05$)

DISCUSSION

This experiment showed clearly that Aliette was the most effective fungicide for downy mildew control. Although conditions in the polythene tunnel were manipulated to provide conditions which were exceptionally favourable for downy mildew, the programme in which 2 out of 3 sprays were of Aliette (Treatment 4) gave virtually complete control. The programme in which every third spray was of Aliette (Treatment 5) was the only other regime which gave reasonable control, though much less effective than Treatment 4. It is unfortunate that Aliette, the most effective of the three fungicides in this programme, was applied third in the spray sequence, after Favour and Filex. Treatment 6, in which a Fongarid drench on 4 July was followed by an identical spray regime to Treatment 4, did not give any control of the disease. This is a result which is difficult to explain since the Fongarid drench would not have been expected to have adversely affected the performance of subsequent treatments. The most likely explanation is that one (or both) of the Aliette sprays on 8 or 20 August was inadvertently omitted. There were indications in the November and December assessments that Treatment 6 was controlling the disease, which suggests that the fungicides had been applied correctly in the latter part of the trial, and were having an effect. However, this result requires further investigation.

There were indications that some of the other fungicides had a little activity against downy mildew, particularly in the November and December assessments. However, at the September assessment, even the most effective of them, Favour, gave a level of control well below that which would be commercially acceptable. The environmental conditions in the polythene tunnel were manipulated to be very favourable for downy mildew. It is possible that some of the other fungicides might have performed better had conditions been less extreme, but it seems unlikely that they could be relied upon for downy mildew control. The indication that all fungicides increased the dry weight of the regrowth also suggests that all of the fungicides gave some disease control under the lower disease pressure of late autumn.

There has not been any work investigating the possibility of fungicide resistance in the fungus Peronospora grisea. Several other downy mildew fungi have become resistant to the phenylamide group of fungicides, which includes metalaxyl (in Favour), furalaxyl (Fongarid), benalaxyl (in Galben M) and oxadixyl (in Trustan). The intense disease pressure from downy mildew on protected hebes and the frequent use of fungicides provides ideal conditions for resistance to develop, so it is possible that the poor control given by Favour, Fongarid, Galben M and Trustan might be due to resistance. The plants did not receive any fungicides between propagation and the start of the experiment, so the downy mildew in the trial would have been derived either from the stock plants from which cuttings were taken, or from other plants at Efford or in the vicinity. As a result, it is not possible to determine what fungicides these strains of the pathogen had been exposed to previously. However, there is not at present a test method to investigate this. There is no evidence of resistance of downy mildew fungi to other fungicides used in this experiment, so for these products it seems very unlikely that poor performance could be related to resistance.

Further work is required to evaluate the best method of using Aliette for downy mildew control. Points worth investigating include application rates of product, water volumes, spray quality and spray frequency. There is also

the question of whether drenches would be as effective as sprays. Since applying a drench rather than a spray would not get the foliage wet, this could be of considerable value.

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