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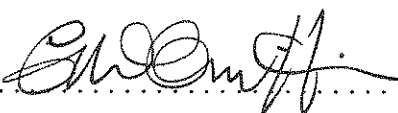
Lettuce Ringspot:
Control by Fungicides

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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.

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Abstract

In three trials, fungicides were compared for effectiveness against lettuce ringspot (Microdochium panattonianum). In the first two experiments Octave, thiram, captan, Ronilan, Topas or Hy-mush applied as fortnightly sprays were compared with Hy-mush or Hy-Vic used as pre-planting single applications at Rosewarne EHS and at a farm site in Lancashire.

Ringspot reached moderate proportions in Lancs where Octave, Captan, Corbel, Topas and Hy-mush sprays reduced severity of the disease. Only Octave significantly increased trimmed head weight (cv. Saladin).

At Rosewarne all fungicide treatments significantly reduced low levels of ringspot at first but the effect was lost by harvest. Downy mildew was reduced by Corbel but increased where Hy-mush had been applied pre-planting. Head weight was severely reduced where Corbel had been used (cv. Clarion).

In the third experiment, Octave, Topas, Captan or Hy-T were applied at different rates and frequency and compared with selected programmes using two of the fungicides in an alternating sequence.

Reduced rates of Octave and Topas applied every seven days were the only treatments to significantly reduce ringspot and increase marketable heads.

Emergency Off-label Approval was obtained for the use of Octave to control ringspot on outdoor lettuce.

Introduction

Field lettuce crops, particularly in the wetter western counties have suffered severe attacks of ringspot (Microdochium panattonianum) in recent years. The fungicides currently Approved for use on this crop have not given adequate control under commercial conditions.

ADAS trials demonstrated activity by prochloraz and captan against ringspot but there were signs that prochloraz formulated as Sportak may be phytotoxic (1). An alternative formulation used in other trials showed no damage (2). The object of this work was to test selected fungicides including captan and prochloraz for activity against ringspot under field conditions.

The report is presented in two parts; the first describes trials in 1988 which then formed the basis for the final trial described in part II.

PART I

1988 Trials: Materials and methods

Sites

The trials were located within a commercial crop of lettuce at Hesketh Bank in Lancashire and in a specific trial planting at Rosewarne EHS. In both cases the crop preceding the trial was lettuce infected by ringspot.

Design

The experiment was a randomised block design with four replicate blocks. At Hesketh Bank, plots consisted of four rows of sixteen plants; at Rosewarne six rows of seven plants. They were spaced 40 cm x 30 cm. Records were taken from the centre 20 plants in each plot.

Husbandry

All treatments, other than fungicide use were as per farm or station practice and are detailed in Appendix I.

Due to the slow development of ringspot in the trial area at Hesketh Bank, infected leaves were pegged between each plot on 23 August and 5 September.

Fungicides

Details are given in table 1.

Table 1. Fungicides, their active ingredients and dose rates.

Fungicide	active ingredient (a.i.)	amount of a.i. in product	dose rate product/ha
Octave	prochloraz - manganese	500 g/kg	0.4 kg & 0.2 kg
Hymush	thiabendazole	600 g/kg	0.4 kg & 1 kg
HY-Vic	thiabendazole + thiram	255 g/litre 255 g/litre	2 litres
Tripomol 80	thiram	800 g/kg	0.5 kg
Captan 83	captan	830 g/kg	0.5 kg
Corbel	fenpropimorph	750 g/litre	1.0 litre
Ronilan	vinclozolin	500 g/litre	200 mls
Topas	penconazole	500 g/kg	2 kg

Treatments

Details are given in table 2.

Table 2. Treatments and timing of fungicide applications

1.	Unsprayed
2.	Octave at full rate (0.4 kg)
3.	Octave at half rate (0.2 kg)
4.	Hymush spray (0.4 kg)
5.	Hymush pre-planting (1 kg) in 400 l/ha
6.	HY-Vic pre-planting " " "
7.	Tripomol 80
8.	Captan 83
9.	Corbel
10.	Ronilan
11.	Topas

All treatments except 5 and 6 were applied immediately after planting, using an Oxford precision sprayer (210 kPa) at the Lancs site and a knapsack (Hills) sprayer (200 kPa) at Rosewarne delivering 400 litres per ha. Spray treatments were applied on a 14 day schedule, details of which are in table 3.

Table 3. Details of fungicide applications and harvest date

	Hesketh Bank	Rosewarne EHS
Pre-planting treatments:	10 August	30 August
Planting date:	"	"
Spray treatments:	11 August	31 August
	22 August	14 September
	7 September	28 September
	20 September	
Harvest date:	14 October	19 October

Assessments

At harvest 20 plants per plot were cut. The total untrimmed and trimmed weights were recorded. The level of ringspot infection was assessed and categorised using the following classes.

0 = No infection

1 = 2 lower leaves infected, plants marketable

2 = Moderate infection requiring heavy trimming but still marketable

3 = unmarketable because of ringspot.

A disease index was calculated using the following equation.

$$DI = \frac{(N_1 \times 1) + (N_2 \times 2) + (N_3 \times 3)}{20} \times \frac{100}{3}$$

Statistical analysis

Data were subjected to an analysis of variance and where the F-test was significant, means were separated using Duncan's Multiple-range test. In the tables, treatment means having the same letter do not differ significantly ($P < 0.05$).

Results

Disease development was slow at both sites and ringspot did not reach serious proportions.

- * At Hesketh Bank the number of leaves affected by ringspot was similar for all treatments although significantly fewer leaves were infected following treatment with the lower rate of Octave (table 4).
- * Severity of ringspot (disease index) was reduced by both Octave treatments, Hymush applied as a spray, Captan, Corbel and Topas (table 4)
- * Fungicide treatment had no affect on fresh untrimmed weight of lettuce (table 5).
- * After trimming (mainly ringspot-infected leaves) only the two Octave treatments yielded significantly heavier lettuce than the untreated. (Table 5)

Table 4. Effect of fungicides on disease at harvest - 14 October, Hesketh

Treatment	Disease Index	Number of diseased leaves
Control	27.45 de	8.85 b
Octave full rate	10.47 a	8.17 ab
Octave half rate	10.32 a	7.15 a
Hymush	21.32 bc	8.63 b
Hymush pre-planting	31.57 e	8.47 ab
Hy-Vic	26.15 de	8.35 ab
Tripomol 80	23.35 bcd	9.15 b
Captan 83	15.00 abc	9.65 b
Corbel	12.87 ab	8.95 b
Ronilan	29.00 de	8.85 b
Topas	14.25 ab	8.97 b
SED (30 df)	4.009	0.637
CV (%)	28.1	10.4

Harvested weights at Hesketh Bank are given in table 5.

- * Highest levels of ringspot were recorded following Hymush as a pre-planting treatment. Levels were significantly higher than those recorded following HY-Vic, Corbel or Ronilan.
- * Downy mildew at harvest was most severe following Hymush applied pre-planting. The disease was significantly less after all other treatments except HY-Vic and Captan.
- * Mildew was significantly reduced by Corbel treatment.
- * Most fungicide treatments had no substantial effect on untrimmed head weight except Corbel which significantly reduced the weight. (Table 7)
- * Following trimming, Corbel treated lettuce were substantially and significantly lighter than all other treatments.

Table 6. Effects of fungicides on disease - Rosewarne EHS

Treatment	Mean % leaf	ringspot	mean no. of	mean % leaf
	area affected by ringspot	index	leaves affected by ringspot	area affected by downy mildew
	6 Oct	19 Oct	19 Oct	19 Oct (at harvest)
Control	3.75 b	0.80 ab	0.73 a	6.30 bc
Octave full rate	0.38 a	0.45 ab	0.75 a	6.47 bc
Octave half rate	0.58 a	0.75 ab	0.80 a	5.91 bc
Hymush	0.85 a	0.60 ab	0.53 a	5.35 ab
Hymush pre-planting	0.88 a	1.93 b	1.25 a	8.85 d
Hy-Vic	0.83 a	0.27 a	0.43 a	7.70 cd
Tripomol 80	0.43 a	0.65 ab	0.88 a	5.70 bc
Captan 83	1.13 a	0.47 ab	0.65 a	7.22 bcd
Corbel	1.17 a	0.32 a	0.43 a	3.57 a
Ronilan	1.55 a	0.38 a	0.48 a	6.50 bc
Topas	0.45 a	0.63 ab	0.88 a	6.15 bc
SED (30 df)	0.90	0.64	0.43	0.98
CV (%)	117.6	136.8	82.7	21.8

Table 7. Effects of fungicide on yield - Rosewarne EHS (19 October)

Treatment	Mean weight of heads (g)		
	fresh	trimmed	% weight loss
Control	164.63 bc	109.75 b	33.18 a
Octave full rate	194.75 c	112.69 b	41.84 a
Octave half rate	172.25 bc	102.69 b	41.84 a
Hymush	151.26 b	101.19 b	33.01 a
Hymush pre-planting	180.13 bc	107.44 b	40.09 a
Hy-Vic	165.00 bc	104.56 b	36.85 a
Tripomol 80	158.69 bc	105.31 b	34.13 a
Captan 83	172.56 bc	99.31 b	42.57 a
Corbel	77.13 a	13.56 a	84.33 b
Ronilan	174.56 bc	106.75 b	38.72 a
Topas	165.44 bc	103.44 b	37.39 a
SED (30 df)	17.12	12.20	4.71
CV (%)	15.0	17.8	15.8

PART II

Following the 1988 trials in which Octave, Corbel, Captan and Topas gave significant reductions in ringspot, the third and last experiment in this series was designed to compare the more promising fungicides and their timing. Hy-T because it contained captan was included in this comparison.

Site

The trial was located at Rosewarne EHS on the same site that was used for the 1988 Lettuce ringspot trial.

Design

The experiment was a randomised block design with four replicate blocks. There were 42 plants per plot spaced 40 cm x 30 cm, the centre 20 plants being used for recording.

Site details, husbandry, seedling propagation and trial details

See Appendix II

Fungicides and active ingredients (a.i.)

Table 8

<u>Product</u>	<u>ai</u>	<u>amount of a.i. per product</u>
Octave	prochloraz-manganese	500 g/kg
Captan 83	captan	830 g/kg
Topas 100 EC	penconazole	100 g/litre
HY-T	captan	375 g/kg
	thiabendazole	281 g/kg

Table 9

Treatments

These were applied at full rate on a 14 day schedule as in previous trials, at half rates on a 7 day schedule or in programmes alternating fungicides on 14 day schedule.

Treatments	Amount of product/ 1000 l water/ha	Frequency of application (days)
1. Octave I	500 g	14
2. Octave II	250 g	7
3. Captan	500 g	14
4. Topas I	200 ml	14
5. Topas II	100 ml	7
6. HY-T	1000 g	14
7. Octave I/Topas I/Octave I/Topas I		14
8. Octave I/Captan/Octave I/Captan		14
9. Topas I/Captan/Topas I/Captan		14
10. Water		14
11. Water		7

All treatments were first applied within 24 hours of planting out during the third week of April 1989. Details of subsequent spray dates are given in Table 10.

Table 10

Dates of spray application

Date	Treatment frequency (days)
21 April	7 and 14
27 April	7
4 May	7 and 14
11 May	7
18 May	7 and 14
25 May	7

Fungicide applications

Fungicides were applied using a Hills Sprayer (Spraygen).

Assessments

The trial was harvested on 2 June and assessments were made on 20 plants per plot. The total untrimmed, and trimmed weight per plot was recorded. The level of ringspot infection was assessed and categorised using the following classes.

- 0 = No infection
- 1 = Lower leaves only infected (up to 2 wrapper leaves affected on butterheads) marketable after normal trimming.
- 2 = Moderate infection requiring heavy trimming but still marketable.
- 3 = Unmarketable.

A disease index was calculated using the following equation:

$$\text{Microdochium index} = \frac{\text{number of plants in each class} \times \text{class number} \times 100}{\text{total number of plants}} \quad 3$$

Statistical analysis:

All data were subjected to an analysis of variance. The data from one replicate was entered as a missing plot because half of the plants were destroyed by Botrytis cinerea. Where the F-test was significant the means were separated using Duncan's Multiple-range test.

Results

The effect of the fungicide treatments on the disease severity and on lettuce yield are shown in table 11.

Results

Despite distribution of infected lettuce leaves through the trial area on two occasions and regular afternoon irrigation to encourage disease spread (see husbandry details Appendix II), the level of ringspot remained low throughout the trial.

Details of disease severity and harvested weights are given in table 11.

Table 11. Ringspot levels and harvested head weights (2 June 1990)

Treatment	Ringspot Index	weight ie of heads	
		untrimmed	trimmed
Octave I	14.4 ab	386 abc	274 abc
Octave II	9.8 a	449 d	343 c
Captan	16.3 ab	421 bcd	288 abc
Topas I	17.7 abc	431 cd	277 abc
Topas II	9.3 a	401 abcd	312 bc
Hy-T	12.9 ab	393 abc	295 abc
Octave/Topas	15.2 ab	399 abcd	301 bc
Octave/Captan	12.1 a	411 abcd	314 bc
Topas/Captan	19.3 abc	378 abc	256 ab
Water 14 days	24.5 bc	358 a	236 ab
Water 7 days	27.9 c	369 ab	219 a
SED (30 df)	5.02	0.02	0.03
CV (%)	43.6	8.6	17.0

* Sprays of Octave or Topas at half the standard rate applied at 7 day intervals resulted in least disease, significantly less than in the controls.

* Alternate sprays of Octave and Captan (full rate) applied at 14 day intervals gave equally significant control of ringspot.

- * No fungicide treatment had an adverse effect on untrimmed head weight.
- * Octave at the lower rate, applied every 7 days resulted in the highest untrimmed head weight, significantly higher than control. Full rate Topas and Captan also gave significant yield increases.
- * Only Octave or Topas, both applied every 7 days gave significantly heavier trimmed heads but the alternative programmes, Octave with Topas or Octave with Captan also tended to increase trimmed head weight.

CONCLUSIONS

- * Prochloraz and Captan when applied at full rate every 14 days controlled ringspot, confirming earlier findings (tables 4 and 11).
- * Topas and HyT applied fortnightly controlled ringspot (table 11).
- * Reduced rates of either Topas or Octave applied every 7 days gave good disease control (table 11).
- * Programmes, alternating Octave with either Topas or Captan at full rates on a 14 day schedule reduced ringspot (table 11).
- * Corbel (full rate) applied fortnightly controlled ringspot, cv. Saladin, and had no phytotoxic effects (tables 4 and 5). When applied to cv. Clarion growth was severely reduced (table 6).
- * Ringspot did not reach serious proportions at any of the 3 trial sites and disease control, even by the most effective fungicides was not outstanding.

RECOMMENDATIONS

These results should be used to support Registration for the use of Octave on lettuce.

[Emergency Off-label Approval for its use was granted in 1989: 0204190. An application for Captan use was rejected]

Further work should be done on choice, timing, rates of fungicide and fungicide programmes.

REFERENCES

1. Jones, D.R. (1986) Tests of Agrochemicals and Cultivars
(Annals of Applied Biology 108, Supplement)
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APPENDIX I

Details of trial sites - fungicide applications 1988

Table A. Soils and soil management at trial sites

Details	Sites	
	Hesketh	Rosewarne
Soil series		Rosewarne
Soil texture	loamy peat	silty clay loam
Drainage	moderate-good	good
Soil Analysis:		
pH	6.2	6.8
P index	7	4
K index	3	1
Mg index	3	2
Previous cropping		
1987	lettuce	Grass (infected lettuce incorporated with soil pre-planting.)

Table B. Details of crops on trial plots 1988

Details	Sites	
	Hesketh	Rosewarne
Cultivar	Saladin (Iceberg type)	Clarion (Butterhead type)
Transplant date	10 August	9 August
Nitrogen (kg/ha)	125 kg/ha	100 kg/ha
	NPK	135 kg (P) + 100 (K)
Herbicides	Gramoxone	
	CIPC (pre-planting)	Kerb 50W 9 Sept
Insecticides	Dimethoate + Ambush	None
	15 August	
	24 August	
	3 September	
	14 September	
	24 September	
	5 October	
Harvest	14 October	19 October

APPENDIX II

Site details and husbandry at Rosewarne 1989

Drainage	Free draining
Soil analysis	No analysis was done during 1989
Fertiliser	100 kg N/135 kg P, 100 kg K on 4 April 1989
Herbicide	Kerb 50W, 2.2 kg/ha in 675 l water on 26 April 1989
Pesticide	Draza pellets were used for slug control.

Seedling propagation

24 February 1989	2000 Glarion pills were sown into 3.8 m ² blocks
6 March 1989	Fubol 58WP applied at 5 g/70 m ² block area
15 & 31 March 1989	Fubol 58WP applied at 5 g/50 m ² block area

Trial details

20 April 1989	Trial planted. Treatments commenced within 24 hours
1 May 1989	2 kg of lettuce leaves known to be infected with <u>Microdochium panattonionum</u> was distributed throughout the trial.
8 May 1989	A further 4 kg of infected lettuce leaves were a distributed throughout the trial.
2 June 1989	Harvest

During May, $\frac{1}{4}$ inch of irrigation was given on every weekday after 15.00 hrs.