Project title:	Bulb onions from sets: Control of white rot
Report:	Annual Report (January 2001)
Project number:	FV 4e
Project leader:	Dr C D Paterson HRI-Kirton Kirton Boston Lincs PE20 1NN
Report author:	As above
Location:	Lincolnshire
Project Co-ordinator:	Mr D O'Connor
Date commenced:	1 February 1999
Date completed:	31 January 2000
Keywords:	Onions, white rot, sclerotium cepivorum, tebuconazole, folicur

FV 4e

CONTENTS

Practical Section for Growers

- Folicur applied on a set dip provides useful control of white rot for bulb onions grown from sets.

- Various dipping rates were used in the project. Higher rates, 1.0% solution reduced root vigour compared to the 0.5% solution. Dipping for longer periods also reduced root vigour.

- Dipping sets in Folicur at rates from 0.2% upwards reduces onion set emergence, compared with untreated sets.

- In this project, using Folicur at 0.5% proved as effective as the 1.0% dip. The addition of Benlate did not improve white rot control.

- In this project the use of Folicur as an in-furrow application for white rot control did not prove satisfactory.

- As in 1997 and 1998, dipping sets in a 0.5% solution of Folicur for 20 minutes gave good control of white rot, and consequently good yields of bulb onions.

- The addition of Benlate to Folicur dips usually, but not always, reduced total yield of bulb onions. Further work to confirm yield penalties, if any, is suggested.

- Preliminary investigations on salad onions indicate that in-furrow or foliar applications of Folicur give better control of white rot than Raxil treated seed.

Experimental Section

Introduction

White rot (*Sclerotium cepivorum*) remains a major disease affecting bulb onions and other members of the allium genus.

HDC sponsored projects FV4b and 4c in 1995 and 1996 investigated seed treatments of tebuconazole (as Raxil – UK 226) supplemented with stem base or foliar sprays of Folicur (tebuconazole). Excellent control was achieved with these treatments in salad onions in experiments carried out in North Kent whilst less effective control was obtained in experiments in Lincolnshire on bulb onions with similar treatments (Davies et al 1998). This work led to the new off-labels for tebuconazole as a seed treatment and stem-based spray.

In New Zealand, a good degree of control of white rot has been achieved from a procymidone (Sumislex) seed treatment supplemented by in-furrow sprays of tebuconazole with or without foliar sprays of procymidone, tebuconazole or triadimenol (Fullerton, Stewart & Slade, 1995). However, procymidone seed treatments are not permitted in the UK and the manufacturer, Sumitomo Chemical Company, has indicated that they do not intend to introduce this produce into the UK because of the limited market size.

In Australia, an in-furrow spray of tebuconazole at sowing was found to be the most effective treatment and was more effective than procymidone (Ryler & Obst, 1995).

In 1997 the use of Folicur as set dips, in-furrow applications and foliar sprays were tested on bulb onions from sets. On a highly infected site 95% of untreated plants developed white rot, all treatments in combination reduced the level to 45% but no treatment gave total control. The set treatment and in-furrow sprays, to a lesser extent, delayed the development of white rot considerably and reduced the final levels by about half.

In 1998 the effects of varying the rates of set dips and in-furrow sprays on white rot control were tested.

The overall level of infection was lower with only 45% of untreated plants infected with white rot at harvest. Field spray, set dip and furrow applications were equally effective individually. Set dipping at 1% was more effective than at 0.5%, and in furrow treatment at 0.5l ai/ha was more effective than at 0.25l ai/ha. Combining a low set dip rate with a low in furrow rate was nearly as effective as a high set dip. In Holland a 0.2% dip is being investigated (pers.comm. de Visser), in this trial, this was less effective than the 1% dip.

In this project (1999) three areas will be investigated for bulb onions from sets:

(1) Trial A

- to refine the rates of Folicur use with set dipping and in furrow applications
- to test the benefit of in furrow applications with dipped sets
- to ensure that there is no adverse interaction between Benlate, currently used to dip sets for neck rot control, and Folicur.

(2) Trial B

- to test for crop phytotoxicity by repeating the trial on white rot free land.

(3) Trial C

- to make preliminary investigations of the use of Folicur on salad onions.

The current off label approval rate for seed treatment is thought by growers to reduce speed and uniformity of emergence. The use of in furrow applications as an alternative method of placing the Folicur near the seed will be investigated.

There is currently an off-label approval for foliar sprays of 1 l/ha Folicur in a minimum of 200 l/ha water, maximum total dose of 2 l/ha.

TRIAL A BULB ONIONS FROM SETS WITH WHITE ROT SCLEROTIA ADDED

Materials and Methods

The site was prepared on 18 March 1999. The area was power harrowed and then bedded out into 1.83m beds. A known weight of white rot (*sclerotium cepivorum*) sclerotia was mixed with an inert carrier (sand), a set amount of this mixture was applied to each plot to give 20g/m² of plot, using a garden lawn spreader. The beds were lightly reworked to mix the sclerotia in to the top 5cm.

The trial was drilled with sets of Sturon at about 69 per m². The beds were 9m long and consisted of four rows at 38.25cm centred on the bed. There were ten treatments as outlined below, arranged as a randomised block design with six replicates.

<u>Treatments</u>

The main aim of this experiment was to investigate the effects of dipping sets in a solution of tebuconazole (Folicur) in conjunction with the use of Benlate dips for neck rot (Botrytis allii). A range of rates were used and the effects on smaller sets (10-14mm) was also investigated.

<u>Table 1 Treatments</u>

Set Size	Benlate treatment	Folicur dip	In furrow treatment
medium	nil	nil	nil
medium	yes	nil	nil
medium	nil	0.5%	nil
medium	yes	0.5%	nil
medium	yes	0.5%	starter solution
medium	yes	0.5%	Folicur at 0.5l ai/ha + starter solution
medium	yes	nil	Folicur at 0.5l ai/ha
medium	yes	0.2%	nil
medium	yes	1.0%	nil
medium	yes	0.5%	nil

Medium sets 14-21mm, small sets 10-14mm.

<u>Set dips</u>

The sets were dipped by immersion in Folicur solution for a given length of time. They were then allowed to drain, and dried by spreading them out in a tray overnight at 15-18° C.

Initially each net was tested at 10 and 20 minutes dipping. Fifty sets per treatment were planted in 308 modular trays in compost. Rooting vigour from each sample was recorded five days later.

Table 2 Mean root growth score (5=excellent, 1=poor) after 5 days, 20 out of 50 sets scored

Sets	Treatment	10 mins	20 mins
medium	water	3.75	3.5
medium	0.2% Folicur	2.95	3.1
medium	0.5% Folicur	2.5	2.15
medium	1.0% Folicur	2.3	1.7
small	0.5% Folicur	2.8	1.8

The 20 minute dip was used for 0.2% and 0.5% dips, however, this was reduced to 10 minutes for the small sets and 1.0% dip, due to reduction in rooting vigour with these treatments at 20 minutes. The sets for the experiment were dipped on 16 March and dried in two bulk bins with fan tops.

Dips were all made up in 5l of water, 0.5% solutions contained 25ml of Folicur, 1% contained 50ml and 0.2% 10ml. Where Benlate was included this was used at 0.5%, 25ml was added to the mixture.

<u>In Furrow applications</u>

Solutions containing 29.4ml Folicur in 5l water were made up and applied at 13ml per m row. With four rows per bed this gave 34ml per m² plot, this rate equates with 2l/ha Folicur (or 0.50l ai/ha) in 340l water. The starter solution was made up with 2.2l starter solution mixture (Hydro Chafer) plus 2.8l water. This provides 17 kg/ha N, 58 kg/ha P and 15 kg/ha K. Folicur and starter solution were mixed together where required.

Plots receiving in furrow applications first received a pass with the Stanhay drill (press wheels removed) which delivered the solution approximately 4cm below the soil surface. The sets were then drilled at approximately 2.5cm depth in four rows above the starter solution in a second pass. The drill was calibrated in the yard and the surplus solutions were measured to confirm the delivery rate.

<u>Assessments</u>

Crop emergence was monitored and a preliminary count carried out on 6 April. Subsequent counts were made on 2m stretch of each row selected at random and marked with blue canes. Emergence counts, in the blue caned areas, were made on 14 and 26 April and 12 May. White rot assessments were made on the same areas on 3-4 June, 14-15 June, 1-2 July and 26-27 July. Plants showing foliar symptoms of white rot were lifted and the roots were examined for white mycelium or black sclerotia to confirm the presence of white rot. All lifted plants were removed from the plot to prevent double counting.

At harvest on 4 August all bulbs from the blue caned areas were lifted, any white rot infected bulbs were counted and discarded. The remains of the plot, minus 0.5m at the front and back of each plot, was lifted separately, again

white rot bulbs were counted and discarded. The bulbs were dried, in potato chitting trays, following ADAS stage II drying techniques (HORIS 1999).
At grading the trays from the two areas were treated separately. Unmarketable bulbs were removed and the number, weight and type of defect recorded, including white rot, soft rots, pest damage and other unmarketable. Sound bulbs were then passed over the grading line with circular riddles in the following size grades, <25mm, 25-40mm, 40-50mm, 50-60mm and >80mm, the number and weight in each size grade was recorded.

Fifty sound bulbs were returned to the store and assessed for rots on 19 January and 21 February.

<u>Statistical analysis</u>

Data were subjected to analysis of variance using Genstat 5 programs. Least significant differences are quoted when $p<0.05$ NS=not significant where $p>0.05$.

Results

<u>Emergence</u>

Table 3 shows emergence counts on 12 May. The first emergence was seen on 6 April when all plots had a few sets emerged. By 14 April about two thirds of the eventual total were emerged rising to 80-90% by 26 April. The final emergence count was on 12 May.

The emergence was highest on the small sets but this was probably due to the planter planting more small sets than any improved emergence. The highest emergence for medium sized sets was for the untreated sets, dipping in Folicur, whichever rate, reduced emergence. Folicur is known to be phytotoxic to onions and this is demonstrated here, dipping at the 1% level resulted in the lowest emergence. Dipping in Benlate with Folicur in furrow significantly reduced emergence compared with the untreated sets. The use of the starter solution did not advance emergence, nor did it compensate for the reduced emergence with the Folicur dips.

Table 3 Emergence Counts

Set treatment	In furrow treatment	Number of plants emerged per m row 12 May	% of final emergence on 14 April
nil	nil	18.8	71.1
Benlate only	nil	15.5	78.9
Folicur only (0.5%)	nil	13.4	77.6
Benlate + Folicur 0.5%	nil	14.5	76.3
Benlate + Folicur 0.5%	SS	15.2	76.2
Benlate + Folicur 0.5%	SS + Folicur	15.7	79.3
Benlate only	Folicur	16.3	79.1
Benlate + Folicur 0.2%	nil	14.9	79.8
Benlate + Folicur 1%	nil	12.1	72.4
Benlate + Folicur 0.5% (Small sets)	nil	21.3	77.5
LSD 5%		2.07	8.29 NS

NB SS = Starter Solution

White Rot Assessments

White rot was calculated as number of infected plants as a percentage of plants emerged. Results are presented for each count (table 4) and as a cumulative total (table 5). Percentage white rot in untreated sets was 29.3%, 20.1%, 30.3% and 2.8% resulting in a cumulative total of 82.8% by 26 July. Cool and wet conditions in May and June allowed white rot to develop. July was warm and dry (only 12.6mm of rain, only 6 days with rain) as was early August, these conditions do not favour the development of white rot.

The treatments with lowest infection throughout were 0.5% Folicur dip alone and 1.0% Folicur plus Benlate dip, the cumulative white rot percentage at the first count was 3.5% and 3.2% respectively. At all counts (except 26 July) and at all cumulative counts untreated sets, Benlate only sets and Benlate only sets with in furrow, had significantly higher percentages of white rot infected plants.

Using only 0.2%Folicur plus Benlate in the dip was less effective than 0.5% Folicur alone or 1.0% Folicur plus Benlate at cumulative counts from 14 June. Applying 0.5% Folicur plus Benlate to small sets was less effective than to medium sets at the final cumulative count.

Using 0.5% Folicur plus Benlate was not significantly worse than using 0.5% Folicur alone, except at the 26 July count, this did not affect the cumulative white rot percentages. Using the sets dipped in 0.5% Folicur plus Benlate did not affect the level of white rot at any of the counts.

Table 4 % Plants infected with White Rot at each count

Set treatment	In furrow treatment	White rot infected plants as % of emerged plants on 12 May			
		3 June	14 June	1 July	26 July
nil	nil	29.3	20.1	30.5	2.8
Benlate only	nil	30.1	24.2	25.8	4.7
Folicur only 0.5%	nil	1.5	0.3	1.3	0.4
Benlate + Folicur 0.5%	nil	5.0	1.6	1.6	5.3
Benlate + Folicur 0.5%	SS	4.2	1.7	1.5	1.2
Benlate + Folicur 0.5%	SS + Folicur	2.4	2.3	2.6	2.3
Benlate only	Folicur	19.2	18.7	22.2	5.6
Benlate + Folicur 0.2%	nil	9.7	4.6	6.0	1.1
Benlate + Folicur 1%	nil	1.3	0.7	0.8	0.4
Benlate + Folicur 0.5% (Small sets)	nil	2.3	2.6	4.9	5.5
LSD 5%		8.82	5.49	7.81	4.46

Table 5 Cumulative total of % plants with White Rot

Set treatment	In furrow treatment	Cumulative % white rot infected plants			
		to 3 June	to 14 June	to 1 July	to 26 July
nil	nil	29.3	49.4	80.0	82.8
Benlate only	nil	30.1	54.2	80.0	84.7
Folicur only 0.5%	nil	1.5	1.8	3.1	3.5
Benlate + Folicur 0.5%	nil	5.0	6.6	8.3	13.6
Benlate + Folicur 0.5%	SS	4.2	5.9	7.4	8.6
Benlate + Folicur 0.5%	SS + Folicur	2.4	4.7	7.3	9.6
Benlate only	Folicur	19.2	37.9	60.1	65.7
Benlate + Folicur 0.2%	nil	9.7	14.3	20.2	21.3
Benlate + Folicur 1%	nil	1.3	2.0	2.8	3.2
Benlate + Folicur 0.5% Small sets	nil	2.3	4.9	9.7	15.3
LSD 5%		8.82	9.30	10.39	10.87

<u>Yield Assessments</u>

Yield measurements at harvest were made on the whole plot minus the areas recorded for white rot. The results are shown in table 6.

The plant population at harvest on the plots least affected by white rot was 46 plants/m². There were significant treatment affects on plant population, for example the population was higher with small sets. This reflects the higher emergence on these plots due to more sets being planted by the planter. Treatments with high levels of white rot had low plant populations suggesting that the level of white rot seen was severe enough to cause plant death. Even the 0.2% Folicur plus Benlate dip which had a cumulative white rot percentage of 21.3 had a significant lower population at harvest. At emergence the 0.5% Folicur dip had a slightly lower emergence, at harvest the plant population of the 0.2% Folicur dip was only 79% of it.

Plant population was also low on the 1% Folicur plus Benlate dip treatment, this reflects a slightly reduced emergence but may also indicate that some of emerging plants failed to establish due to phytotoxicity.

The marketable yields reflect the same trends as the plant population. The yields were very low on those plots with very high levels of white rot; nil treatment, Benlate only dip, Benlate only dip with Folicur in furrow, and high levels of white rot; 0.2% Folicur plus Benlate dip.

The small sets also produced a low yield with many onions in the 25-40mm size grade and few over 60mm due to the high plant population.

The highest total yield, 40 – 80mm, was from the 0.5% Folicur dip (35 t/ha), this being greater, but not significantly so, than the 1% Folicur plus Benlate dip (32.2 t/ha). The addition of Benlate to Folicur in set dips resulted in a drop in yield for all treatments (compared to Folicur only), except the 1% Folicur dip.

The highest plant population (at harvest) figures were from sets treated with Folicur at 0.5%, with or without the addition of Benlate.

Conclusions

- As in 1997 and 1998 dipping sets in 0.5% Folicur for 20 minutes gave good control of white rot and as a result also gave good yields of onions.
- Applying Benlate to the Folicur dip usually but not always, reduced the total yield. Further work to confirm this is suggested.
- The level of white rot control was very good with 0.5% dip from 83% untreated to 3.5%, applying in furrow Folicur or as a 1.0% dip did not improve the level of control in this case.
- The sets were planted on 19 March and the main period of white rot activity was in late May and June when the air temperatures were low and the soil was moist. The set dip was effective for this period, up to 15 weeks post planting.

Table 6 Effect of treatment on plant population (bulbs m² at harvest) and marketable yield t/ha in size grades

Set treatment	In furrow treatment	Total Population	Marketable Yield t/ha			Total
			25-40mm	40-60mm	60-80mm	40-80mm
nil	nil	14.5	1.07	4.77	2.60	7.36
Benlate only	nil	15.0	0.92	5.69	2.69	8.39
Folicur only 0.5%	nil	46.0	1.99	18.44	16.59	35.02
Benlate + Folicur 0.5%	nil	41.4	2.33	16.85	12.02	28.87
Benlate + Folicur 0.5%	SS	41.4	2.73	15.81	9.27	25.08
Benlate + Folicur 0.5%	SS + Folicur	43.2	2.48	18.07	10.86	28.94
Benlate only	Folicur	22.0	1.65	7.58	4.57	12.15
Benlate + Folicur 0.2%	nil	36.3	2.28	13.81	10.08	23.89
Benlate + Folicur 1%	nil	38.4	1.64	15.47	16.76	32.23
Benlate + Folicur 0.5% Small sets	nil	55.5	5.82	15.36	2.44	17.80
LSD 5%		5.89	0.85	3.20	3.64	4.52

TRIAL B BULB ONIONS FROM SETS: PHYTOTOXICITY OF TEBUCONAZOLE TREATMENTS

Introduction

This trial was carried in order to test for phytotoxicity effects of Folicur dips, with or without Benlate, on onion emergence and yield. The trial was grown without added sclerotia in order to distinguish between loss of yield due to white rot and loss yield due to phytotoxicity effects.

Methods

The trial was set up and carried out as Trial A with only two major variations. No sclerotia were added to the trial site pre-planting. This trial was placed beside Trial A with two untreated guard beds plus an uncropped bed between.

This trial was laid out as a randomised block design with three replicates, the replicates were double banked to fit neatly beside Trial A in the yield field.

For the application of treatments, carrying out of assessments etc, Trial A was always done first and then Trial B, later the same day or on subsequent days, except at harvest. Trial B was harvested eight days later than Trial A.

Results

Trial B had high levels of white rot in untreated plots, there were comparable levels of white rot in Trial A and Trial B for all treatments (table 7). There was no positional affect of plots on levels of white rot i.e. it was not higher on the side nearer Trial A. It appears that either the site was originally uniformly infected with white rot or that by spreading the sclerotia on one trial site, sclerotia were blown or transferred across on to the neighbouring site. Due to the uniformity of infection in Trial B it seems likely that some sclerotia may have been blown from Trial A to B site during incorporation.

As Trial B was infected with white rot, it was not possible to determine any further phytotoxicity effects other than those already commented on for Trial A.

Table 7

Set treatment	In furrow treatment	Emergence 12 May		Cumulative white rot to 26 July		Marketable yield 40-80mm t/ha	
Trial		A	B	A	B	A	B
nil	nil	17.8	16.0	82.8	86.2	7.36	6.89
Benlate only	nil	15.6	15.9	84.7	80.6	8.39	8.19
Folicur only 0.5%	nil	13.4	14.7	3.5	3.2	35.02	33.78
Benlate + Folicur 0.5%	nil	14.5	13.9	13.6	7.0	28.87	29.26
Benlate + Folicur 0.5%	SS	15.2	14.2	8.6	11.1	25.08	30.26
Benlate + Folicur 0.5%	SS + Folicur	15.7	13.9	9.6	7.2	28.94	27.49
Benlate only	Folicur	16.3	15.5	65.7	45.4	12.15	18.36
Benlate + Folicur 0.2%	nil	14.9	14.4	21.3	29.8	23.89	18.07
Benlate + Folicur 1%	nil	12.1	12.6	3.2	5.2	32.23	27.33
Benlate + Folicur 0.5% Small sets	nil	21.3	17.2	15.3	7.2	17.80	20.44
LSD 5%		2.07	2.94	10.87	19.39	4.52	8.45

A = Trial A – added sclerotia

B = Trial B – no added sclerotia, intended low white rot infection, but presumed contamination

SS = Starter Solution

APPENDIX 1 CROP DIARY BULB ONIONS TRIALS A & B

Soil type:	Newland 1 - sandy silt loam	
Previous cropping:	1997 - onions/winter barley 1998 - various brassicas	
Soil analysis:	pH 8.0, P index 4, K index 2 and Mg index 3	
Fertiliser:	50kg/ha P as triple superphosphate, 25 February 150kg/ha K as sulphate of potash, 24 February 90kg/ha N as Nitram, 18 March	
Cultivation:	ploughed November 1998 power harrowed per-planting in to beds to allow spreading of sclerotia	
Planted:	19 March 1999, cv Sturon	
Herbicides:	26 March	pendimethalin as 1.65l/ha Sovereign plus propachlor as 5l/ha Brasson in 450l/ha
	19 April	ioxynil as 0.2l/ha Totril plus cyanazine as 0.2l/ha Fortrol in 350l/ha
Fungicides:	12 June, 22 June	chlorothalonil as 2l/ha Clortosip in 600l/ha
	12 July	chlorothalonil plus metalaxyl as 2l/ha Folio in 600l/ha
Harvest:	4-8 August (Trial B 16 August)	

TRIAL C SALAD ONIONS

Treatments

The aim of this experiment was to investigate the most effective method of applying tebuconazole to salad onions without reducing vigour or yield. Tebuconazole may currently be used as a seed dressing (Raxil) applied at 0.4g ai per 100,000 seeds (SOLA 0937/97) or as a foliar spray; maximum dose 1.0l/ha, maximum total dose 2.0l/ha (SOLA 1447/99). Both these treatments have been shown to be effective (Fv4b and 4c) in experiments and have been used by growers, however growers have reported delayed and more extended emergence with the seed treatment and as a result are reluctant to use it. This trial aims to test the use of Folicur placed alongside the seed using the technology developed to deliver a nutrient starter solution.

Table of Treatments

Seed Treatment g/100,000 seed	In-furrow Application	Foliar Sprays
Untreated	Nil	Nil
Untreated	0.5l ai/ha **	Nil
Untreated	0.5l ai/ha ** + starter solution	Nil
Untreated	Starter solution only	Nil
Untreated	Nil	2 x 0.25l ai/ha **
Tebuconazole* @ 0.4g ai	Nil	Nil
Tebuconazole* @ 0.4g ai	0.5l ai/ha **	Nil
Tebuconazole* @ 0.4g ai	0.5l ai/ha ** + starter solution	Nil
Tebuconazole* @ 0.4g ai	Starter solution only	Nil
Tebuconazole* @ 0.4g ai	Nil	2 x 0.25l ai/ha **

*Applied as UK226 by Elsoms Seeds
**Applied as Folicur

Materials and Methods

The site was prepared in Spring 1999. The area was power harrowed and then bedded out on 1.83m beds. White rot sclerotia were added at the same rate as for the bulb onion trial.

The trial was drilled with variety White Lisbon at a target of 150 seeds per m row, in five rows per bed. The beds were 8m long. There were ten treatments, outlined below, arranged as a randomised block design with six replicates.

The crop was drilled on 16th June, and emergence counts (5 x 1m rows per plot) were made on:

a) 29 June 13 days after drilling
b) 15 July 29 days after drilling
c) 22 July 35 days after drilling
d) 3 August 47 days after drilling

White rot assessments were made on:

25th August 49 days after drilling
22nd September 77 days after drilling
20 October 105 days after drilling

In-furrow applications were made at the same rate as for bulb onions in trial A.

Results

Table 8 Effect of field and seed treatment on emergence (number per m row)

Treatment	1st Emergence Count 29/6/99	2nd Emergence Count 15/7/99	Healthy at Count 3 22/7/99
Field Treatments (mean of treated and untreated seed)			
Untreated	170.8	222.3	229.2
0.5l ai/ha in-furrow	181.8	246.8	254.7
0.5l ai/ha in-furrow + starter solution	177.3	222.8	228.1
starter solution only	159.8	231.2	224.1
2x 0.25 l/ha foliar sprays	150.0	215.3	222.9
Seed Treatments			
Mean Untreated	146.6	221.0	227.1
Mean Raxil	189.3	234.3	236.5
LSD 5% Field	34.36	25.95	23.00
Seed	21.73	16.41	14.55

Results from Table 8 indicate that there were no significant differences in emergence counts between field treatments (mean of treated and untreated seed). However, untreated seed had significantly lower stand counts at the first emergence count date compared to Raxil treated seed. By the third emergence count, the number of healthy plants was very similar across all treatments.

Table 9 Effect of field and seed treatments on % crop infected with white rot (NB infected plants removed at each count)

Treatment	W Rot at 25/8/99	W Rot at 22/9/99	W Rot at 20/10/99	Cumulative Total
Field Treatments (mean of treated and untreated seed)				
Untreated	0	4.5	9.2	13.7
0.5l ai/ha in-furrow	0	0.4	2.9	3.2
0.5l ai/ha in-furrow + ss	0	0.9	4.0	4.9
ss only	0	10.6	12.1	22.7
2 x 0.25l/ha foliar	0	1.1	3.2	4.2
Seed Treatments				
Mean Untreated	0	5.0	8.2	13.2
Mean Raxil	0	2.0	4.4	6.3
LSD 5% Field	-	4.29	3.23	4.17
Seed	-	2.72	2.05	2.64

Results from Table 9 indicate that the levels of white rot increased during the trial, the highest amounts being recorded in the untreated and starter solution treatment only. There was little difference between the 0.5l ai/ha applied in-furrow and the 2 x 0.25l/ha foliar spray. The addition of a starter solution to the in-furrow application did not bring any benefit in terms of white rot control. When meaned, results indicate that Raxil treated plots had significantly lower levels of white rot, compared to untreated seed.

Table 10 Records at Harvest 26-27 October 1999

Treatment	Healthy av. plant wt (g)	Percentages Healthy	White Rot
Field Treatments (mean of treated and untreated seed)			
Untreated	15.6	75.0	25.0
0.5l ai/ha in-furrow	18.4	82.8	17.2
0.5l ai/ha in-furrow+ss	20.5	66.8	33.2
ss	21.7	67.1	32.9
2 x 0.25l/ha foliar	21.2	88.1	11.9
Seed Treatments			
Mean Untreated	19.8	72.9	27.1
Mean Raxil	19.1	79.0	21.0
LSD 5% Field	6.54	13.00	13.00
Seed	4.14	8.21	8.21

Table 10 shows crop details at harvest. The heaviest mean plant weight was lowest for the untreated plots, but not significantly. The percentage plants healthy at harvest were highest for the in-furrow and the foliar application of Folicur. The addition of a starter solution reduced the efficacy of in-furrow Folicur.

Although the statistics are not presented, the cumulative total % white rot infected at harvest was lowest for the in-furrow plus Raxil treated seed (1.2%), this being better than the foliar application plus Raxil treatment 3.4%, but not significantly. The use of Raxil treated seed improved white rot control when used in combination with an in-furrow or a foliar application, but not significantly. The best method of controlling white rot was by using either an in-furrow application, or foliar sprays, as a minimum.

Discussions and Conclusions

Folicur applied to onion sets as tebuconazole has shown effective control of white rot, although it is unclear what the potential yield loss would be due to dipping. It is suggested that where growers are concerned about white rot then set dipping would make an obvious solution. However, if growers are certain that white rot will not prove a problem, then perhaps dipping would result in possible yield penalties compared with untreated sets. From this and previous work, it would appear that a dipping rate of 0.5% Folicur, for 20 minutes, followed by drying would provide good control, without too much reduction in root vigour (and therefore potential yield).

In this trial, sets planted after a Folicur in-furrow application had high levels of white rot, almost as great as untreated plots. It is suggested that in-furrow applications, as in this trial where the product was applied under the planting furrow, is not a viable technique. In-furrow applications (as a drench) made at planting to the sets before they are covered with soil may prove more effective. From an environmental and operational point of view it could be argued that set dipping is easy, safer and can be achieved by skilled operators.

Rather perversely for salad onion’s, controlled manner in-furrow applications proved more successful at controlling white rot than seed treating. This may be due to the fact that at a seed application rate of 0.4g ai per 100,000 seeds, approximately 16g ai/ha is applied at 1 million seeds/ha, less than half the rate of the 0.5l ai/ha in-furrow application.

In this trial, Raxil treated seed alone was not as good as in-furrow application only, although the two treatments in combination lowered white rot infection but not significantly. It would seem unreasonable that higher application of tebuconazole to the seed is a practical solution as phytotoxicity problems would start to rise.

Recommendations are that:

1) Off label approval for onion set dipping treatments are sought as soon as possible.

2) The application of Folicur as in-furrow drench before sets are covered perhaps needs further investigation.

3) The use of in-furrow applications of Folicur to salad onions has worked well in this project, and as equally as good as foliar applications. This needs to be confirmed from a further years work.

Acknowledgements

The authors thank support staff at HRI Kirton and HRI Wellesbourne for their assistance in this project.

APPENDIX 1 Crop Diary - Salad Onions

Soil Type	Newland 1; sandy silt loam
Previous cropping	1997: Onions/winter barley 1998: Various brassicas
Soil Analysis	pH 8.0 P index 4, K index 2 and Mg index 3
Fertiliser	50 kg/ha P as triple superphosphate, 25 Feb 150 kg/ha K as sulphate of potash, 24 Feb 50 kg/ha N as Nitram, 19 June
Cultivation	Ploughed November 1998 Power harrowed pre-sowing into beds to allow spreading of sclerotia.
Sown	16 June - with old Stanhay drill with starter solution kit
Herbicides	22 June – pendimethalin as 1.65l/ha Sovereign plus propachlor as 9l/ha Brasson in 450l/ha
Insecticides	6 Sept – Malathion as 2.1l/ha Malathion 60 in 600l/ha
Fungicides	13 Sept – Chlorothalonil plus metalaxyl as 2l/ha, Folio in 600l/ha
Harvest	26 – 27 October