MORLEY RESEARCH CENTRE

Management of light leaf spot and canker in winter oilseed rape, 1997
(HGCA sponsored,OS07/1/94).

J B S Freer

Summary

Two cultivars with differing resistance to light leaf spot (*Pyrenopeziza brassicae*) and phoma or stem canker (*Leptosphaeria maculans*), Bristol with a NIAB rating of 2 for light leaf spot and Nickel with a rating of 4 for phoma were treated with a range of fungicides. The active ingredients used were flusilazole plus carbendazim (as Punch C), carbendazim (as Bavistin), tebuconazole (as Folicur), difenconazole (as Plover), prochloraz (as Sportak 45) and a development product NAS 201. Treatments were applied as split doses in the autumn and at stem extension in the spring, or as a single dose in the autumn (or in the spring in the case of NAS 201). A full dose of Punch C was applied in the autumn and spring as an additional treatment.

Disease levels were low due mainly to a dry autumn period. By March, phoma leaf spot was widespread. Autumn applications did not control disease that infected the crop during the winter. Spring applications of Plover or NAS 201 reduced phoma leaf spotting in the spring and Punch C, Folicur, Plover and NAS 201 reduced the stem canker index in the summer. Due to the late infection yield losses were not expected and there were no significant responses to treatments.

Object

To develop a scheme for the management of light leaf spot and canker in contrasting varieties of oilseed rape and identify the most appropriate fungicides for the control of these diseases.

*Not for publication without the consent of both the Director of Morley Research Centre. This report deals with only one year's work, so any conclusions given are provisional.

Method

Two cultivars showing different disease resistance characteristics to light leaf spot and stem canker were selected from the NIAB Recommended and Descriptive Lists of Oilseed Crops.

Table 1. *NIAB disease resistance ratings*

Cultivar	Light leaf spot	Stem canker
Bristol	2	5
Nickel	8	4

The fungicides were selected from those which would control both diseases and applications were designed to provide data on the efficacy of different active ingredients at two timings.

Plots were drilled on 4 September 1996. All treatments were applied according to Morley's standard operating procedures details of which appear in the Appendix.

The autumn treatments were applied on 8 November 1996 and the stem extension treatments on 21 March 1997.

Foliar disease assessments were made by assessing ten plants per plot. Disease was assessed on a whole plant basis. A record of the percentage area infected for a given disease on an individual plant (severity) and the proportion of plants with symptoms (incidence) was made. The autumn samples were incubated for 24h in polythene bags at room temperature before assessment to encourage the development of symptoms of light leaf spot.

Table 2. *Fungicide programmes applied, products used and dose applied*

Fungicide programme		Application rate (l or kg/ha) and timing	
Product	Active ingredient (concentration g ai/l or kg)	Autumn	Stem extension
Untreated	-	-	-
Punch C	flusilazole (250) + carbendazim (125)	0.8	0.8
Punch C		0.8	-
Punch C		0.4	0.4
Bavistin DF	carbendazim (500)	1.0	-
Bavistin		0.5	0.5
Folicur	tebuconazole (250)	1.0	-
Folicur		0.5	0.5
Plover	difenoconazole (250)	0.5	-
Plover		0.25	0.25
Sportak 45	prochloraz (450)	1.1	-
Sportak 45		0.55	0.55
NAS 201		*	*
NAS 201		-	**

* = split dose of development product, ** = full dose of development product

Stem disease was assessed at pod ripening. Ten plants per plot were examined for light leaf spot, recording the percent area of the stem affected. Stem cankers were recorded on a 0-4 scale where 0 = no disease, 1 = less than half stem girdled by a lesion, 2 = more than half stem girdled by a lesion, 3 = whole stem girdled by a lesion and 4 = plant dead. A disease index on a 0 to 100 scale was calculated using the formula:

$$\frac{b + 2 \times c + 3 \times d + 4 \times e}{a + b + c + d + e} \times 100/4$$

where a, b, c, d & e were plants in each category of the scale.

Crop height and inter raceme distance was assessed by measuring plants after swathing but including stubble height.

Results

Table 3. *Phoma leaf spot infection on 31 January 1997 (% leaf area infected)*

Fungicide programme (rate of product/ha)		Variety		
8 Nov 1996	21 Mar 1997	Bristol	Nickel	Mean
Untreated		0.77	0.93	0.85
Punch C	Punch C	0.67	0.43	0.55
Punch C		0.83	0.67	0.75
Punch C (0.4 l)	Punch C (0.4 l)	0.33	0.63	0.48
Bavistin (1.0 kg)		1.03	1.33	1.18
Bavistin (0.5 kg)	Bavistin (0.5 kg)	0.60	1.17	0.88
Folicur (1.0 l)		0.20	0.83	0.52
Folicur (0.5 l)	Folicur (0.5 l)	1.93	2.10	2.02
Plover (0.5 l		0.83	0.30	0.57
Plover (0.25 l)	Plover (0.25 l)	1.10	0.57	0.83
Sportak (1.1 l)		1.13	0.57	0.85
Sportak (0.55 l)	Sportak (0.55 l)	0.77	0.43	0.60
NAS 201	NAS 201	-*	-	-
	NAS 201	-	-	-
LSD			1.100	0.797
Mean		0.83	0.89	
LSD			NS	
SE per plot (52 df)				±0.688
CV (%)				80.1

LSD = least significant difference at 95% probability level. NS = not significant at 95% probability level
* development product, details not available.

Levels of disease were very low in January. Whilst a half dose of Folicur appeared to increase the level of disease significantly above the untreated this was probably an artefact of the difficulty in assessing such low levels of the disease.

Table 4. *Phoma leaf spot incidence on 31 January 1997 (% plants affected)*

Fungicide programme (rate of product/ha)		Variety		
8 Nov 1996	21 Mar 1997	Bristol	Nickel	Mean
Untreated		43.3	40.0	41.7
Punch C (0.8 l)	Punch C (0.8 l)	36.7	30.0	33.3
Punch C (0.8 l)		26.7	46.7	36.7
Punch C (0.4 l)	Punch C (0.4 l)	20.0	50.0	35.0
Bavistin (1.0 kg)		53.3	59.0	56.2
Bavistin (0.5 kg)	Bavistin (0.5 kg)	40.0	73.3	56.7
Folicur (1.0 l)		13.3	50.0	31.7
Folicur (0.5 l)	Folicur (0.5 l)	43.3	69.3	56.3
Plover (0.5 l		53.3	13.3	33.3
Plover (0.25 l)	Plover (0.25 l)	52.0	36.7	44.3
Sportak (1.1 l)		70.0	43.3	56.7
Sportak (0.55 l)	Sportak (0.55 l)	50.0	43.3	46.7
NAS 201	NAS 201	-	-	-
	NAS 201	-	-	-
LSD			29.70	21.09
Mean		41.9	46.3	
LSD			NS	
SE per plot (52 df)				±18.2
CV (%)				41.3

The incidence of phoma leaf spotting was quite high but there were few differences between treatments. This was probably due to the time of infection which occurred after the November applications had lost efficacy. There was no sign of the disease at the time of spraying on the 8th of November.

Table 5. *Phoma leaf spot on 22 April 1997 (% leaf area)*

Fungicide programme (rate of product/ha)		Variety		
8 Nov 1996	21 Mar 1997	Bristol	Nickel	Mean
Untreated		1.3	4.8	3.1
Punch C (0.8 l)	Punch C (0.8 l)	0.9	1.9	1.4
Punch C (0.8 l)		1.2	4.4	2.8
Punch C (0.4 l)	Punch C (0.4 l)	0.5	1.3	0.9
Bavistin (1.0 kg)		2.2	2.4	2.3
Bavistin (0.5 kg)	Bavistin (0.5 kg)	1.7	1.4	1.6
Folicur (1.0 l)		1.8	3.1	2.4
Folicur (0.5 l)	Folicur (0.5 l)	1.9	2.1	2.0
Plover (0.5 l		3.5	3.1	3.3
Plover (0.25 l)	Plover (0.25 l)	0.8	0.4	0.6
Sportak (1.1 l)		1.8	2.1	2.0
Sportak (0.55 l)	Sportak (0.55 l)	0.8	0.8	0.8
NAS 201	NAS 201	-	-	-
	NAS 201	-	-	-
LSD			1.89	1.38
Mean		1.4	2.0	
LSD			0.37	
SE per plot (52 df)				±1.19
CV (%)				69.0

Nickel was more prone to phoma leaf spot than Bristol. Treatments which included a stem extension application, with the exception of Folicur, significantly reduced the amount of phoma leaf spotting.

Table 6. *Phoma leaf spot incidence on 22 April 1997(% plants affected)*

Fungicide programme (rate of product/ha)		Variety		
8 Nov 1996	21 Mar 1997	Bristol	Nickel	Mean
Untreated		36.7	83.3	60.0
Punch C (0.8 l)	Punch C (0.8 l)	40.0	50.0	45.0
Punch C (0.8 l)		50.0	80.0	65.0
Punch C (0.4 l)	Punch C (0.4 l)	40.0	43.3	41.7
Bavistin (1.0 kg)		60.0	73.3	66.7
Bavistin (0.5 kg)	Bavistin (0.5 kg)	50.0	53.3	51.7
Folicur (1.0 l)		60.0	90.0	75.0
Folicur (0.5 l)	Folicur (0.5 l)	53.3	46.7	50.0
Plover (0.5 l		83.3	80.0	81.7
Plover (0.25 l)	Plover (0.25 l)	30.0	30.0	30.0
Sportak (1.1 l)		53.3	80.0	66.7
Sportak (0.55 l)	Sportak (0.55 l)	30.0	56.7	43.3
NAS 201	NAS 201	-	-	-
	NAS 201	-	-	-
LSD		31.57		19.26
Mean		46.4	59.0	
LSD		NS		
SE per plot (52 df)				±16.62
CV (%)				31.5

A split application of Plover in March significantly reduced the number of plants affected by the leaf spot stage of the disease. This data shows that the autumn applications were no longer effective when the disease appeared in the spring.

Table 7. *Stem canker on 8 July 1997 (index)*

Fungicide programme (rate of product/ha)		Variety		
8 Nov 1996	21 Mar 1997	Bristol	Nickel	Mean
Untreated		94.2	86.9	90.5
Punch C (0.8 l)	Punch C (0.8 l)	75.0	65.6	70.3
Punch C (0.8 l)		74.1	84.5	79.3
Punch C (0.4 l)	Punch C (0.4 l)	73.3	71.0	72.2
Bavistin (1.0 kg)		92.5	79.8	86.1
Bavistin (0.5 kg)	Bavistin (0.5 kg)	85.0	93.6	89.3
Folicur (1.0 l)		78.9	95.8	87.3
Folicur (0.5 l)	Folicur (0.5 l)	63.1	71.9	67.5
Plover (0.5 l		84.2	72.0	78.1
Plover (0.25 l)	Plover (0.25 l)	80.6	64.2	72.4
Sportak (1.1 l)		86.0	76.2	81.1
Sportak (0.55 l)	Sportak (0.55 l)	83.0	98.8	90.9
NAS 201	NAS 201	-	-	-
	NAS 201	-	-	-
LSD		23.49		16.90
Mean		79.1	79.3	
LSD		NS		
SE per plot (52 df)				±14.58
CV (%)				18.4

Split doses of Punch C, Folicur or Plover significantly reduced the canker index as did the autumn and spring full dose of Punch C. The split dose of Bavistin or Sportak did not reduce the canker index significantly. The autumn applications were not effective in reducing cankers. This was probably due to the late infection which occurred in December after the efficacy of the early November applications had declined.

There were no effects on plant height in this experiment despite the effects on crop height reported elsewhere from the spring application of tebuconazole.

Table 8. *Crop height and internode length on 29 July(mm).*

Fungicide programme (rate of product/ha)		Plant height		1st internode		2nd internode		3rd internode		4th internode	
8 Nov 1996	21 Mar 1997	Bristol	Nickel	Bristol	Nickel	Bristol	Nickel	Bristol	Nickel	Bristol	Nickel
Untreated		2150	2167	930	957	93.3	90.0	86.7	80.0	103.3	76.7
Punch C (0.8 l)	Punch C (0.8 l)	1817	2077	867	917	106.7	110.0	90.0	93.3	83.3	86.7
Punch C (0.8 l)		2197	2110	997	813	110.0	66.7	90.0	96.7	80.0	80.0
Punch C (0.4 l)	Punch C (0.4 l)	1967	2077	800	1043	90.0	73.3	60.0	120.0	110.0	73.3
Bavistin (1.0 kg)		2180	2087	1087	930	83.3	123.3	93.3	90.0	70.0	93.3
Bavistin (0.5 kg)	Bavistin (0.5 kg)	1973	2197	893	880	113.3	100.0	83.3	73.3	66.7	83.3
Folicur (1.0 l)		1967	1907	890	767	83.3	73.3	120.0	90.0	80.0	90.0
Folicur (0.5 l)	Folicur (0.5 l)	2133	2190	873	950	103.3	100.0	93.3	100.0	106.7	83.3
Plover (0.5 l		2293	1970	983	587	76.7	93.3	83.3	70.0	96.7	93.3
Plover (0.25 l)	Plover (0.25 l)	1910	2140	770	940	70.0	100.0	96.7	83.3	86.7	83.3
Sportak (1.1 l)		1817	2110	750	917	66.7	76.7	73.3	80.0	56.7	93.3
Sportak (0.55 l)	Sportak (0.55 l)	1933	1917	940	833	70.0	93.3	66.7	70.0	60.0	83.3
NAS 201	NAS 201	-	-	-	-	-	-	-	-	-	-
	NAS 201	-	-	-	-	-	-	-	-	-	-
LSD		NS		NS		NS		NS		NS	
Mean		2039	2061	906	862	89.0	89.3	86.4	88.1	83.8	87.1
LSD		NS		NS		NS		NS		NS	
SE per plot (52 df)		± 195.5		± 221.8		± 27.65		± 26.89		± 26.83	
CV (%)		9.5		25.1		31.0		30.8		31.4	

Table 9. *Seed yield (t/ha at 91% dm)*

Fungicide programme (rate of product/ha)		Variety		
8 Nov 1996	21 Mar 1997	Bristol	Nickel	Mean
Untreated		3.10	2.84	2.97
Punch C (0.8 l)	Punch C (0.8 l)	3.15	3.34	3.25
Punch C (0.8 l)		3.34	3.09	3.21
Punch C (0.4 l)	Punch C (0.4 l)	3.18	3.26	3.22
Bavistin (1.0 kg)		3.15	3.10	3.12
Bavistin (0.5 kg)	Bavistin (0.5 kg)	3.15	3.17	3.16
Folicur (1.0 l)		3.17	3.25	3.21
Folicur (0.5 l)	Folicur (0.5 l)	3.71	3.25	3.48
Plover (0.5 l		3.29	3.11	3.20
Plover (0.25 l)	Plover (0.25 l)	3.33	3.18	3.25
Sportak (1.1 l)		3.57	2.99	3.28
Sportak (0.55 l)	Sportak (0.55 l)	3.27	3.09	3.18
NAS 201	NAS 201	-	-	-
	NAS 201	-	-	-
LSD		NS		NS
Mean		3.26	3.16	
LSD		NS		
SE per plot (47 df)				±0.248
CV (%)				7.7

Although most treatments resulted in yields above the untreated, none of the differences reached significance at the 95% level of probability. Phoma leaf spot came into the crop late and levels of disease remained low until close to harvest when a high proportion of plants showed moderate to severe stem cankers. These cankers developed late and no early senescence was observed.

Discussion

Disease levels were low in the 1996/7 season mainly due to low rainfall and this resulted in no significant yield responses to fungicide programmes. The weather conditions that are conducive for light leaf spot and phoma infection are:

Light leaf Spot
Cool, wet conditions favour the spread of this disease and although associated with northern Britain in recent years, recent dry seasons have meant that whilst this disease can be found in early spring the crop grows away from the disease. Early autumn infections can be very damaging but are unusual in East Anglia.

Phoma leaf spot
Periods of high humidity or rainfall that cause spores to be released from rape stubble debris. Symptoms can appear rapidly in warm conditions but can take 4-6 weeks to develop when temperatures are nearer 0°C. After initial infection from airborne spores, local infection is spread by water splash.

Significant rainfall to trigger the release of phoma spores did not occur until mid to late November. Assessments of disease at the time of autumn application on 8 November showed no trace of the disease. However, with wet conditions soon after application good protection should have been achieved, as the fungicides are only active as protectants. Levels of disease were so low that even by 31 January the untreated plots had only modest levels of infection.

By mid-March levels of phoma had developed but there was still no sign of light leaf spot. With two thirds of untreated plants showing symptoms of phoma there were significant reductions as a result of treatment.

Had the level of disease observed in April (Table 5) occurred in January (Table 3) then a considerable yield reduction could have been expected. The relatively late infection, in common with the previous two seasons, meant that whilst cankers had formed, their effect was reduced because by the time they were capable of restricting crop development the plants were senescing naturally.

March applications of Plover or NAS 201 reduced disease levels significantly. Cankers formed during the summer and Punch C at 0.8 l or 0.4 l , Folicur, Plover and NAS 201 all reduced the disease index, the time of infection resulted in yield responses being small and not significant.

It was noted that the cankers tended to form higher up the stem rather than at the base which is explained by the late infection period when the stem was beginning to extend. Fungicide applications had no effect on crop architecture.

Conclusion

Assessing the risk from phoma infection needs to start in the autumn soon after drilling. Dry autumns similar to the previous two years are not conducive to disease attack. Consequently applications of fungicide applied routinely in October have often lost their potency by the time of disease infection. In 1997 this was the case even later as the applications in early

November were not effective. Yield loss from phoma declines if the disease does not infect early in the autumn. In these situations a fungicide application applied when the disease does become apparent even when this is not until the spring may be more cost effective. This would also target light leaf spot which tends to move up the plant during stem extension.

Acknowledgements

Help from colleagues who did much of the field work is acknowledged. This trial was funded by the HGCA.

Appendix

The following information is presented as an appendix which is available on request.

Method
Field details
Experiment diary
Figure 1. Rainfall from establishment to spring assessment

Appendix

Method

This is an abbreviated version of the standard operating procedures used at Morley Research Centre.

1 Plot layout

1.1 Plots were sown with an Oyjord drill. The drilled plots were 18 m long and 1.56 m wide from outside row to outside row (14 rows at 12.0 cm spacing). Plots were separated by a buffer of the same size with a 54 cm gap between successive plots and buffers. This gave an effective plot width of 2.10 m, which was used for harvest yield calculations. Treatments were applied to the plot and to half of the buffer at each side.

1.2 Common treatments such as insecticides and herbicides were applied across all plots with farm machinery using wheelings, 18 m apart. For harvest purposes, plot length was reduced to 15 m.

2 Weather records

2.1 Weather data were obtained from a Hardi Metpole. Recordings are taken every thirty minutes.

3 Harvest details

3.1 Plots were swathed using a Haldrup swather designed for plot work.

3.2 Plots were harvested using a Sampo 2010 combine which was modified for plot work and used electronic weighing (Novatech M864 Loadmeter). Trials were harvested by replicate.

4 Post harvest determinations

4.1 Moisture content was determined by taking a 100 g sub sample, oven drying for 24 hours at 100 - 102° C, and weighing at ambient temperature.

Field details

Site	Felix Thornley Cobbold Agricultural Trust Farm, Otley, Suffolk
Field reference	Swiss Farm
Crop	Winter oilseed rape
Variety	Bristol and Nickel
Previous crop	1996 winter wheat 1995 sugar beet 1994 winter wheat 1993 winter oilseed rape
Soil type and series	Clay loam over chalky boulder clay (Hanslope/Ashley series)

Soil analysis (index)	pH	P	K	Mg
September 1997	7.8	1	2-	2

Seed	C1 generation		
Seedrate	5 kg/ha		
Date sown	4 September 1996		
Nutrients applied	Date	Fertiliser	Rate (kg/ha)
Nitrogen	9 September 1996	Ammonium nitrate	29 kg/ha N
	14 February 1997	Ammonium sulphate	44 kg/ha N
	3 March	Urea	75 kg/ha N
	20 March	Urea	71 kg/ha N
Phosphate	17 October 1996	Triple super phosphate	50 kg/ha P_2O_5
Sulphur	14 February 1997	Ammonium sulphate	51 kg/ha S
Cultivations	1 September	Ploughed and pressed	
	3 September	Power harrowed and rolled	

Applications to crop

Date	GS	Item	Dose/ha
8 September 1996	pre-em	Butisan S (metazachlor 500 g) Treflan (trifluralin 480 g)	1.0 l 2.0 l
24 September	cotyledon	Cyperkill (cypermethrin 100g) *Mini Slug Pellets (metaldehyde 6%w/w)*	0.21 l 6.87 kg
14 November	rosette	Laser (cycloxydim 200g) Cyperkill (cypermethrin 100g) oil	0.75 l 0.21 l 1.41 l
13 March 1997	early stem extension	Fusilade 250 EW (fluazifop-P-butyl 125g)	0.25 l
2 April	yellow bud	Cyperkill (cypermethrin 200g)	0.258 l
1 May	flowering	Fastac (alpha-cypermethrin 100g) Bavistin (carbendazim 500g)	0.10 l 0.5 kg

Treatment applications

Autumn

Date	*GS*	
8 November 1996	rosette	Treatments 2 +3, 4, 5, 6, 7, 8, 9, 1, 11, 12, 13

Weather conditions at time of application:

Cloud: 1/8 Air temperature: 10°C Humidity 87% Wind: SW 4-7 m/s.

Stem extension

Date	*GS*	
21 March 1997	stem extension	Treatments 2, 4, 6, 8, 10, 12, 13, 14

Weather conditions at time of application:

Cloud: 6/8 Air temperature: 11°C Humidity 78% Wind: N 5 m/s.

Experiment diary

Date	Treatments applied or action
4 September 1996	Experiment sown
8 November	Autumn treatments applied
8 November	Autumn disease assessment on untreated
29 January 1997	Full disease assessment
21 March	Spring treatments applied
22 April	Full disease assessment
8 July	Canker assessment
26 July	Experiment swathed. Some general leaning but this was not treatment related.
29 July	Crop height and internode distance
4 August	Harvested

Figure 1. *Rainfall from establishment to spring assessment 4 September 1996 to 22 April 1997*