TIMING OF EPIDEMICS OF FUNGAL DISEASES IN RELATION TO YIELD LOSS IN OILSEED RAPE (*BRASSICA NAPUS* L.)

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ABSTRACT

Preliminary analysis of a series of field experiments on the effects of disease epidemic timing on the yield of winter oilseed rape in the UK is presented. The timing of epidemics was manipulated by applying fungicide sprays. The results suggest that disease in the autumn may be important because it lays the foundation for the development of damaging epidemics later in the year.

INTRODUCTION

For the foreseeable future the control of foliar diseases of oilseed rape (*Brassica napus*) crops will continue to rely on the use of fungicides. The development of efficient and environmentally acceptable disease-control strategies based on fungicides requires an understanding of the interactions between pathogens and the crop, including knowledge of the effects of disease intensity and the timing of epidemics on crop growth and yield. We report preliminary results of a series of three field experiments at Rothamsted that investigated the effects of disease epidemics during different periods on the growth and yield of oilseed rape crops.

MATERIALS AND METHODS

The experiments were done with winter sown oilseed rape (var. Envol) crops grown on the experimental farm at Rothamsted in the 1991/92, 1992/93 and 1993/94 seasons, using a randomised block design in four replicates. The timing of epidemics was manipulated by applying fungicide sprays at different times during the season

TABLE 1: Spray treatments, disease assessment and harvest dates.

Treat. code	Spray Programme*	Disease Assessment and Harvest Dates			
A	- - -		1991-2	1992-3	1993-4
B	AuSpSm	Autumn	8Nov	26Nov	13Jan
C	Au - -	Spring	4Mar	6Apr	26Apr
D	AuSp -	Summer	30Jun	8Jun	28Jun
E	- SpSu	Harvest	17Jul	28Jul	1Aug
F	- - Su				
G	Au - Su				

*Au - autumn, prochloraz; Sp - spring, prochloraz; Sm - summer, iprodione.

TABLE 2: Disease incidence at the end of the autumn, spring and summer periods and seed yield at harvest for the 1991-92, 1992-93 and 1993-94 seasons.

Treat.	Disease Incidence (% plants infected)						Yield @ 90% DM (tha^{-1})
	Autumn		Spring		Summer		
	Llps	Dlps	Llps	Dlps	Llps	Dlps	
1991-92							
A	0-a	55-a	45-a	23-a	95-a	98-a	2.87-c
B	0-a	5-b	0-b	5-c	28-bc	45-c	3.46-a
C	0-a	3-b	0-b	8-bc	28-bc	70-b	3.33-ab
D	0-a	3-b	3-b	5-c	5-c	89-ab	3.34-ab
E	0-a	55-a	23-ab	5-c	30-bc	30-cd	3.38-ab
F	0-a	38-a	46-a	58-a	40-b	35-cd	3.11-bc
G	0-a	8b	3-b	3-c	28-bc	15-d	3.56-a
1992-3							
A	67-a	20-a	100-a	0-a	100-a	40-a	3.53-c
B	0-b	3-a	17-b	0-a	7-d	7-b	4.76-ab
C	0-b	0-a	17-b	0-a	33-c	7-b	4.56-b
D	0-b	0-a	10-b	0-a	0-d	7-b	4.56-b
E	77-a	13-a	97-a	0-a	80-b	0-b	4.41-b
F	70-a	7-a	100-a	0-a	93-ab	7-b	3.58-c
G	0-b	0-a	27-b	0-a	27-c	3-b	5.10-a
1993-4							
A	0-a	3-a	87-a	0-a	77-a	10-a	3.15-a
B	0-a	0-a	0-c	0-a	13-a	7-a	3.16-a
C	0-a	0-a	13-c	7-a	83-a	3-a	3.39-a
D	0-a	0-a	0-c	3-a	67-a	13-a	3.56-a
E	0-a	0-a	53-b	0-a	23-a	13-a	3.65-a
F	0-a	0-a	100-a	0-a	50-a	3-a	3.03-a
G	0-a	0-a	43-b	3-a	43-a	7-a	3.50-a

Llps - light leaf and pod spot; Dlps - dark leaf and pod spot.
Shared letters denote values that are *not* significantly different.

(Table 1). The spray treatments were designed to limit disease epidemics to the "autumn" (Oct.-Jan), "spring" (Feb.-Apr.) or "summer" (May-Jul.) periods, or to various combinations of these (Table 1). Each treatment consisted of three or four fungicide sprays applied about four weeks apart. The timing and combinations of sprays applied are given in Table 1. Foliar disease and plant growth were assessed regularly, at about 6 week intervals, during the growing season and grain yields were obtained for each plot at harvest.

RESULTS AND DISCUSSION

The incidence of light leaf and pod spot (*Pyrenopeziza brassicae*) and dark leaf and pod spot (*Alternaria brassicae/A. brassicicola*) at the end of the "autumn", "spring" and "summer" periods for each treatment and each experiment are shown in Table 2. The incidence of other pathogens was also assessed but is not shown here. Spray treatments had the intended effect of producing different patterns of disease incidence during the growing season. For example, disease incidence for treatment D (sprayed in autumn and spring) was highest in summer . The highest disease incidence was found for treatment A (no fungicides) and the lowest for treatment B (full spray programme). Disease incidence was highest overall in 1991-92 and lowest in 1993-94. At the end of the 1993-94 experiment, there were no significant differences in disease incidence between treatments, although there were similar trends to the other experiments.

Grain yields for the three experiments are also shown in Table 2. In all three experiments the lowest yield was found in unsprayed plots (A) or in plots in which disease had been allowed to develop in autumn and spring (F). Apart from 1993-94, when there were no significant differences in yield between treatments, the highest yields were for treatments B (full spray) and G, for which disease was controlled in autumn and summer. There were no significant differences in yields between treatments in which disease had been allowed to develop in autumn (E) or summer (D) or spring and summer (C) in any of the experiments. In 1991-92 and 1993-4, yields were generally similar despite lower disease incidence in 1993-4. In 1991-92, disease appeared to reduce yield by up to 20% and in 1992-3, by up to 30%.

Preliminary analysis of the results of the these experiments suggests that, in winter oilseed rape, disease control in autumn probably limits epidemic development during the rest of the year. Treatments that gave the highest yield usually included an autumn spray programme. The apparently small effect of allowing disease in spring (G) on yield was probably related to the relatively low levels of disease that developed. Sprays in autumn probably limited the inoculum available for the continuation of epidemics in spring. The importance of disease in summer is less clear. Some of the lowest yields occurred in plots that had received only a summer spray treatment (F), suggesting that the crop had been damaged by disease in the autumn and spring. However, yields from plots that had been sprayed in autumn and spring (D) were also reduced compared to the "fully protected" treatment (B). But the spectrum of disease tended to be different in D and F plots: for example, the incidence of dark pod spot tended to be higher and that of light pod spot lower in plots which were not sprayed in summer.

These results agree with the findings of other studies (e.g. Figueroa *et al.*, 1994), in which controlling disease in autumn was shown to be important. They also suggest that some of the yield lost if disease is not controlled in autumn can be recouped by controlling disease in spring and summer.

REFERENCES

Figueroa, L, Shaw, M.W., Fitt, B.D.L, McCartney, H.A. and Welham, S.J (1994) Effects of previous cropping and fungicide timing on the development of light leaf spot (*Pyrenopeziza brassicae*), seed yield and quality of winter oilseed rape (*Brassica napus*). *Annals of Applied Biology*, **124**, 221-239.