Use of fungicides to control early and late epidemics of stem canker (*Leptosphaeria maculans*) in winter oilseed rape in England

Peter Gladders[1*], Sam McDonough[1], Bruce D. L. Fitt[2], Julie M. Steed[2] and Jonathan S. West[2]

[1]ADAS Boxworth, Boxworth, Cambridgeshire CB3 8NN, UK, peter.gladders@adas.co.uk,
[2]Rothamsted Research, Harpenden, Hertfordshire AL5 2JQ, UK, bruce.fitt@bbsrc.ac.uk

ABSTRACT

Good control of canker was demonstrated in 1999 and 2000 using difenoconazole + carbendazim fungicide sprays applied during the period October to March on the moderately resistant cv. Apex. There was an early phoma leaf spot epidemic in 1998/99 and a late phoma epidemic in 1999/2000 and this contrast highlighted the importance of early epidemics for yield loss. At least a two-spray programme was required to achieve consistent yield responses when stem canker was severe. Light leaf spot (*Pyrenopeziza brassicae*) was also present in some experiments and its control resulted in yield responses to fungicides (c.1 t/ha) larger than to stem canker alone (0.7 t/ha). In both years, there was some flexibility in the timing of both first and second sprays, but this was attributed to plants being well established (at least six true leaves) when phoma leaf spot appeared. Producing large plants in autumn therefore appears to be a useful component of stem canker management.

Key words: stem canker – control – fungicides – epidemics

INTRODUCTION

Stem canker (*Leptosphaeria maculans*) is the most important disease of winter oilseed rape in the UK (Fitt *et al*., 1997). Fungicides are widely used in autumn and winter on commercial crops of winter oilseed rape in England, but they have generally not provided good control of canker (Gladders *et al*., 1998). Good control of stem canker with various fungicides has been demonstrated experimentally, but spray timing was critical (Gladders *et al*., 1998). Improved guidance on fungicide use in relation to the development of disease epidemics and crop development is required by advisers and growers. Several applications of fungicides are often required to achieve a high degree of stem canker control, but economically optimised programmes based on yield response rather than disease control must be defined for farm use. In addition to stem canker, many crops are also affected by light leaf spot (*Pyrenopeziza brassicae*) and strategies must be able to manage both diseases where appropriate. This paper provides new understanding about targeting fungicide treatments, so that they are likely to be cost-effective.

MATERIALS AND METHODS

Field experiments were carried out with a standard design at three sites (ADAS Boxworth, Cambs, ADAS High Mowthorpe, North Yorks and Rothamsted Research, Herts) for the two cropping years 1998/99 and 1999/2000 on winter oilseed rape cv. Apex (disease resistance rating 6 for both canker and light leaf spot resistance in 1998). The fungicides difenoconazole (as Plover) at the rate of 0.0625 g a.i./ha and carbendazim (as Bavistin DF) at 0.125 g a.i./ha were used as a tank mixture for all treatments. Treatments were organised as a full factorial with four dates of fungicide application from disease onset in autumn until the early stem extension stage in spring. The interval between spray applications was 4-6 weeks. Treatments were applied by OPS hand-held spraying equipment in 200-225 litres of water/ha. A randomised block design with a double untreated control was used with 3 (Rothamsted) or 4 (ADAS sites) replicates (Table 1).

The incidence and severity of leaf, stem and pod diseases was recorded at each spray application and at 4-6 week intervals thereafter until crop maturity. Ten plants per plot were sampled during the growing season and 25 plants per plot were examined pre-harvest. Stem canker severity was assessed using a 0-4 index (1 <50% stem circumference affected; 2 >50% stem circumference affected; 3 severe canker, stem weakened; 4 dead). Yields were obtained with a plot combine harvester and adjusted to 90% dry matter.

RESULTS

Both canker and light leaf spot were recorded in all experiments, but light leaf spot severity was very low at Boxworth. Phoma leaf spot was first recorded in late October in autumn 1998 and in late September (Boxworth and Rothamsted) or early November (High Mowthorpe) in autumn 1998. Incidence peaked at 88-100% plants affected except at High Mowthorpe (52% and 64% respectively). Stem cankers developed in May in 1999 and in March in 2000 and large differences in pre-harvest severity were apparent between years (Table1).

Table 1. Summary of yield canker and light leaf spot data from experiments 1998-2000.

Site	Year	Canker index pre-harvest		Yield (t/ha)		Light leaf spot pre-harvest
		Untreated	Treated (lowest)	Untreated	Treated (max.)	Untreated (% area)
Boxworth	1998/1999	1.05	0.00	4.34	4.47	1 (stem)
High Mowthorpe	1998/1999	0.00	0.00	2.71	3.56	3 (stem)
Rothamsted	1998/1999	0.78	0.00	4.64	5.37*	8 (stem) 16 (pod)
Boxworth	1999/2000	2.84	0.75	3.07	3.76*	traces
High Mowthorpe	1999/2000	0.74	0.00	3.32	4.35*	6 (stem) 23 (pod)
Rothamsted	1999/2000	2.87	0.13	3.75	4.64*	18 (stem) 19 (pod)

* Significant yield increases (*P*>0.05) recorded in these experiments

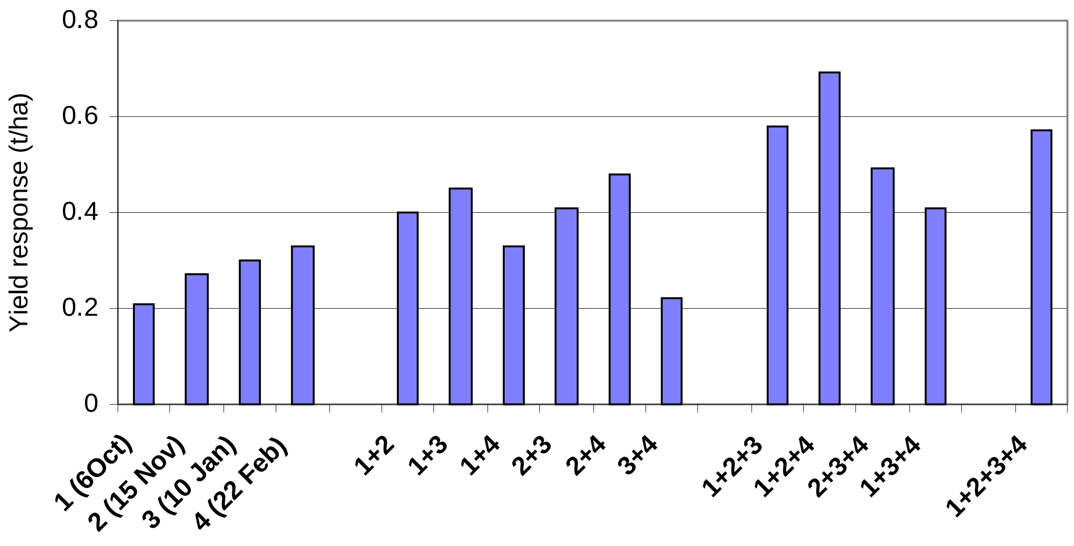

Figure 1. Yield response (t/ha) to fungicide treatments at Boxworth in 2000 (SED 0.112, 61df).

Control of stem canker generally required more than a single spray under high disease pressure. The best three spray programmes reduced canker indices from 2.8 in the untreated to 0.9 at Boxworth and 0.4 at Rothamsted in 2000.There were significant yield responses to fungicide treatments in four experiments, but no yield responses at Boxworth and High Mowthorpe in 1999. Summary yield and disease data are presented in Table 1. There were significant yield responses to individual sprays applied from 6 October to 22 February at Boxworth in 2000 (Fig. 1) and these effects appeared to be largely additive in programmes, apart from the January and February timings. Mean yield responses at Boxworth were 0.28, 0.38, 0.54 and 0.52 t/ha for one, two, three or four applications (respectively). This contrasted with an absence of yield responses at Boxworth in 1999 when canker severity was low (index 1.05). Light leaf spot control was rather more effective in 1998/99 when spray timings were about a month later than in 1999/2000. The last spray at Rothamsted in 2000 was on 20 January and most programmes did not give 50% control of light leaf spot on pods.

DISCUSSION

These results demonstrate that fungicides can give cost-effective control of canker and light leaf spot on moderately resistant cultivars. There was a large difference in yield response between years, particularly at Boxworth. This was consistent with the different timing of phoma epidemics (West *et al*., 1999). Each fungicide treatment costs the equivalent of 0.1 t/ha of yield at current prices. The yield responses attributable to canker were 0.4-0.7 t/ha and most of this could be obtained with a two-spray programme. There were larger yield responses to fungicides where light leaf spot was present and similar two spray programmes gave responses of c. 1 t/ha. There were yield responses to single sprays at all four timings in 1999/2000 at Boxworth, despite the early onset of phoma leaf spotting. This may be related to large plant size (in this case, plants reached the 10-leaf stage by mid-October) as previous work has suggested that fungicides may only be effective when applied soon after phoma leaf spots appeared (Gladders *et al*., 1998). The 1998/99 phoma leaf spot epidemic was late and developed mainly from late November when plants were large (at the 10 leaf stage). Subsequently, small stem cankers developed and control of them did not produce a yield response. In years with late phoma epidemics, fungicide treatments may not be cost-effective if crops have large plants in autumn. It is envisaged that plant size will be manipulated by date of sowing and plants should be at the 6-7 leaf stage at epidemic onset (Sun *et al*., 2000). Further work is required to quantify risk of yield loss in relation to timing of phoma epidemics, plant size and cultivar resistance.

ACKNOWLEDGEMENTS

Funding from the Home-Grown Cereals Authority and Defra is gratefully acknowledged.

REFERENCES

Fitt, B.D.L., P.Gladders, J.A. Turner, K.G. Sutherland, S.J. Welham and J.M.Ll.Davies, 1997: Prospects for developing a forecasting scheme to optimise use of fungicides for disease control on winter oilseed rape in the UK. Aspects of Appl. Biol. 48, Optimising pesticide applications, 135-142.

Gladders, P., B.V. Symonds, N.V. Hardwick and C.E. Sansford, 1998: Opportunities to control canker (*Leptosphaeria maculans*) in winter oilseed rape by improved spray timing. IOBC Bulletin 21, 111-120.

Sun, P., B.D.L. Fitt, P. Gladders and S.J. Welham, 2000: Relationships between phoma leaf spot and development of stem canker (*Leptosphaeria maculans*) on winter oilseed rape (*Brassica napus*) in southern England. Ann. appl. Biol. 137, 113-125.

West, J.S., J.E. Biddulph, B.D.L. Fitt and P. Gladders,1999: Epidemiology of *Leptosphaeria maculans* in relation to forecasting stem canker severity on winter oilseed rape in the UK. Ann. appl. Biol., 135, 535-546.