THE EFFECTS OF CULTIVAR RESISTANCE AND FUNGICIDES ON THE YIELD OF OILSEED RAPE INFECTED WITH LIGHT LEAF SPOT (*PYRENOPEZIZA BRASSICAE*)

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ABSTRACT

Cultivars of winter oilseed rape submitted for UK statutory and advisory performance trials were assessed for resistance to light leaf spot (*Pyrenopeziza brassicae*). A wide variation in disease resistance was recorded which was highly significantly correlated with overall yield response to fungicide. Cultivars exhibited similar resistance scores at widely separated sites. Adjusting fungicide inputs according to a variety's light leaf spot rating may offer growers the opportunity to reduce disease at minimum cost thereby maximising financial return.

INTRODUCTION

In 1992 measures to reform the EU Common Agricultural Policy were adopted. These included a move to world prices for oilseed rape and the introduction of area payments. As a consequence any yield response to agronomic inputs was worth less and so encouraged a closer scrutiny of variable costs including fungicide inputs. The Arable Area Payments Scheme (AAPS) has thus increased the importance of disease resistance as a factor in varietal selection in oilseed rape grown for food. Resistance is also important in industrial rape grown on set-aside land where lower crop prices render the use of fungicides even more critical.

Light leaf spot is now regarded as one of the three most widespread oilseed rape disease in the UK (Hardwick *et al*, 1991). Where this disease has been excluded through the use of fungicides yield increases of up to 1.8 t/ha^{-1} have been recorded (Sutherland *et al*, 1995). However, genetic resistance exists and has been incorporated into commercially viable material (Hardwick, *et al* 1991). Resistance to light leaf spot is routinely evaluated in statutory (National List) and advisory (Recommended List) cultivar performance trials in the UK. This information along with other varietal characteristics is published annually in the Recommended Lists produced by the National Institute of Agricultural Botany (NIAB) and the Scottish Agricultural College (SAC). As cultivars are evaluated both with and without a comprehensive fungicide programme, yield data for the Recommended Lists is expressed as both fungicide treated and untreated.

This paper reviews the levels of light leaf spot observed in cultivars submitted for trialling in the UK over the last three years and examines the contribution disease resistance could make to reducing fungicide inputs based on results from the fungicide component of these variety trials.

MATERIALS AND METHODS

Fungicide treated and untreated variety trials were sown separately or as a split lattice design at between nine and eleven sites per year from 1992 to 1994. Plot size was a minimum of 45 m^2 with three replicates. All operations including fungicide applications were carried out to a standard protocol and Light leaf spot was assessed by scoring naturally occurring infections in the untreated performance trials and small plot trials and in disease observation plots as described by Thomas and Walker (1994). Mean disease scores were derived from fitted constants analysis over sites and years using a five year period. Adjusted means were converted to a 1-9 rating using a straight line with 9 equivalent to 0% disease. The position of the line was determined annually according to the level of disease on control cultivars with fixed ratings.

RESULTS

Mean yield responses (treated less untreated yields) over all trials and cultivars were +0.40 t ha^{-1} for 1992 and 1993, and +0.512 t ha^{-1} for 1994. The number of untreated fungicide trials with light leaf spot levels exceeding 5% was 2, 3 and 10 for 1992, 1993 and 1994 respectively. Other diseases were sporadic, with *Sclerotinia* being absent from the trials considered here and stem canker occurring in one trial only in each of the years 1993 and 1994. Correlations between cultivar disease scores and overall yield responses were highly significant with r values of 0.587 in 1993 and 0.817 in 1994 ($P = 0.001$). Correlations between disease scores and yield responses for individual infected trials were significant with r ranging from 0.512 to 0.798 ($P = 0.001$). Mean yield responses in 1994 from those ten trials with light leaf spot levels more than 5% on at least 1 cultivar ranged from 1.23 t ha^{-1} for the most susceptible cultivar to 0.42 t ha^{-1} for one of the most resistant (Table 1).

TABLE 1 *Mean yields (t ha^{-1}) of cultivars from treated and untreated trials in 1994, mean % light leaf spot from untreated trials, overall resistance rating and yield responses*

Cultivar	Treated	Untreated	Light leaf spot %	Rating	Response
Nickel	4.64	4.22	1.5	9	+0.42
Express	4.17	3.83	2.0	8	+0.34
Inca	4.32	3.71	2.1	7	+0.61
Rocket	4.26	3.64	2.3	7	+0.62
Tomahawk	4.36	3.72	2.5	9	+0.64
Falcon	4.51	3.98	4.1	7	+0.53
Apex	4.23	3.50	4.3	7	+0.73
Mandarin	4.09	2.98	8.3	5	+1.11
Envol	4.20	3.20	10.4	4	+1.00
Idol	4.14	3.02	11.1	5	+1.12
Cobol	4.15	3.24	11.4	5	+0.91
Bristol	4.34	3.11	19.1	3	+1.23
SED	0.152	0.153			

In addition there were significant correlations between cultivar scores at widely separated sites eg $r = 0.615$, 0.769 and 0.813 for the trial in Hampshire versus Aberdeen, Cambridge and Edinburgh respectively, (all at $P = 0.001$).

DISCUSSION

Light leaf spot has occurred more frequently and more severely in Scotland than in England and this has been asssociated with the cool and wet Scottish autumn conditions frequently experienced (Brokenshire and Prasanna, 1994). Although variation in virulence of light leaf spot isolates has been described (Maddock *et al*, 1981) correlations between 1994 disease scores from trials in the south of England and Scotland suggest there is little difference in cultivar reaction to light leaf spot in the two areas and does not support the theory that isolates with different virulence characteristics occur in the two areas. Apparent differences between the two areas in previous years may have been associated with overall disease pressure and the greater differentiation generally seen under high disease pressure in Scotland.

The wide range of light leaf spot resistance ratings offers considerable scope for future choice of resistant material, particularly as some cultivars had untreated yields comparable to the treated yields of currently widely grown cultivars eg Bristol. Fungicide responses may include an element of yield enhancement unrelated to disease control, particularly with the multiple full rate applications used here. Though this approach is unlikely to be cost effective on the more resistant varieties, it is possible that responses of a similar order may be achieved for susceptible varieties by using the split dose applications common in commercial practice. If active ingredient levels are adjusted according to light leaf spot ratings, this may give optimum disease control and yield benefit, with consequent financial benefits.

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