EFFECTS OF POWDERY MILDEW ON VINING AND SEED YIELDS OF GARDEN PEAS

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SUMMARY

Effects of powdery mildew on vining and dry seed yields of garden peas (cv. 'Bolero') were measured in a field trial. Vining yield increased by 51% and dry seed yield by 68% following applications of the fungicide penconazole to plots sown late in the season, although the fungicide did not completely control the disease. Effective powdery mildew control with chemicals or resistant cultivars should benefit productivity of late-sown garden peas for vining, and pea crops grown for grain or seed.

INTRODUCTION

Powdery mildew of garden peas (*Pisum sativum* L.), caused by the fungus *Erysiphe pisi* DC., has become increasingly important in crops grown for processing in New Zealand. The disease previously occurred late in growing seasons (late January to early February), but in the last four seasons (1986-87 to 1989-90) it has appeared in crops much earlier (late November or early December). Early occurrence and increased severity of the disease may have been due to a change to dry, warm weather conditions conducive to disease development (Falloon *et al* 1989). Powdery mildew regularly occurs in pea crops grown for seed, which have a longer growing season than processing crops, but the disease was not considered a serious problem of seed crops before the 1986-87 season.

There is little detailed field information on effects of powdery mildew on yield of garden peas. Yields and quality of green peas are of particular concern to the pea processing industry, while the seed industry is interested in factors that affect seed quality and yield from crops grown to full maturity. This paper reports a field trial designed to measure effects of sowing date and the disease on yield of garden peas at both vining and dry seed harvest stages.

METHODS AND MATERIALS

Seed of cultivar 'Bolero' was sown at Lincoln on 13 September, 11 October, 1 and 29 November, 1989, with the successive sowings adjacent to each other (not randomised). Seed was sown with a small plot drill into plots 1.35 m (nine drill rows) wide and 10.5 m long, at a rate calculated to give 140 plants/m². For each sowing, 20 plots (two spray treatments and two harvest times in five randomised replicates) were sown, with successive sowings separated by two rows of buffer plots identical to those in the trial.

The fungicide penconazole (Topas 100EC), reported to control powdery mildew (Follas and Welsh 1989), was applied to 10 of the 20 plots of each sowing, at 30 g in 340 litres water/ha with a compressed air small plot sprayer at 340 kPa pressure. The first spray was applied to the first sowing before powdery mildew was seen, but after it had been noted in adjacent trials. Sprays were then applied at intervals of 4 to 22 days (Fig. 1) depending on disease severity in plots. The final spray was applied to each sowing at the time of vining harvest. Sprayed plots in the first two sowings received three fungicide applications, the third sowing, four, and the fourth, six.

Growth stages (Knott 1987) of 10 tagged plants at 1 m intervals along the centre row of each plot were recorded at the time of the first fungicide application for each sowing. When the peas in each sowing were ready for vining, the same 10 plants were removed from each plot and assessed for powdery mildew using a 0 to 5 scale (Fig. 2A).

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All remaining plants in the central 3 x 1.35 m area of five unsprayed and five sprayed plots per sowing were then removed and passed through a stationary viner. Pea yield and tenderometer readings (TR) were recorded for fresh peas from each vined plot, and yields were corrected to TR 105 (Wraight 1976). The remaining plots (five unsprayed and five sprayed) were left until plants were fully mature, and then completely harvested with a small plot header. Total weight (corrected to 8% moisture) and thousand seed weights of five subsamples were recorded for seed from each plot. Dates of vining and seed harvests are shown in Fig. 1.

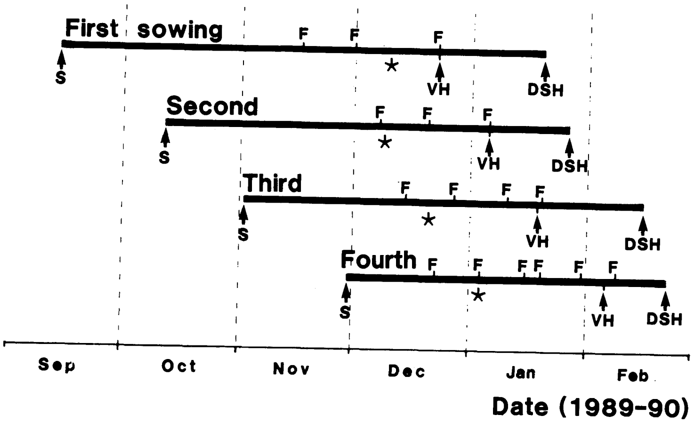

Fig. 1: **Schedule of sowing dates (S), fungicide applications (F), vining harvests (VH) and dry seed harvests (DSH) for pea crops sown on four occasions. * indicates when powdery mildew was first seen in crops.**

RESULTS

Growth stages at first spray

Mean growth stages (Knott 1987) of pea plants at the first fungicide application (Fig. 1), and dates of these applications were : first sowing, 201 (reproductive, enclosed buds), 16 November (9 weeks after sowing (a.s.)); second sowing, 203 (reproductive, first flowers open), 7 December (8 weeks a.s.); third sowing, 109 (vegetative, nine nodes), 14 December (6 weeks a.s.); fourth sowing, 103 (vegetative, three nodes), 22 December (3 weeks a.s.).

Disease assessments

Powdery mildew was first noted in unsprayed plots of all sowings after fungicides were first applied to sprayed plots (Fig. 1). At the time of vining harvests, the disease was least severe in plots from the first sowing and was progressively more severe in plots from later sowings (Fig. 2A). Powdery mildew was not completely controlled by the fungicide applications, but at the time of vining harvests, disease severity in sprayed plots was lower ($P<0.05$) than in corresponding unsprayed plots (Fig. 2A). In the last two sowings, sprayed plants had about 20% of leaf area affected by the disease, while unsprayed plants were almost completely covered with powdery mildew.

Vining yield

Weight of fresh peas harvested was greatest from the second sowing (10,400 kg/ha), and least from the last sowing (3,300 kg/ha; Fig. 2B). Plants in plots from the later sowings were probably water stressed during the dry conditions that prevailed later in the trial. There was a trend for increasing improvement in yields from sprayed plots compared with unsprayed plots in the last three sowings, although only in the fourth sowing was this effect significant ($P<0.05$). The yield from sprayed plots was 16% more than from unsprayed plots in the third sowing, while in the fourth sowing the equivalent increase was 51%.

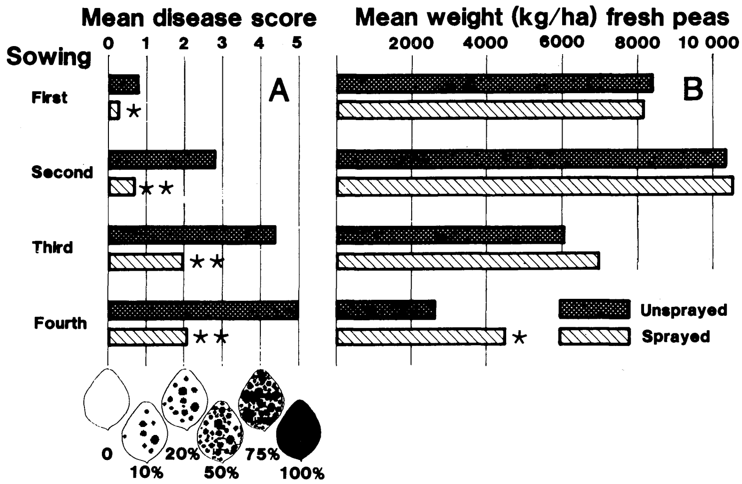

Fig 2: **Mean disease scores of pea plants (A) and weight of fresh peas harvested at vining (B) from unsprayed and fungicide sprayed plots sown on four occasions. Leaf area diagrams and percent leaf area affected for each disease score are indicated. * and ** indicate means for sprayed plots different (P<0.05 and 0.01 respectively) from unsprayed plots.**

Dry seed yield

Mean weight of dry seed harvested from both treatments was greatest from the first two sowings (about 5,000 kg/ha), and least from the fourth sowing (1,500 kg; Fig. 3A). Increases in seed yield following fungicide treatment were 8% in the second sowing (P<0.05), 26% in the third sowing (P<0.01), and 68% in the fourth sowing (P<0.01). Increases (P<0.05) in thousand seed weight following fungicide treatments were recorded for seed harvested from the second (8%), third (26%) and fourth (17%) sowings (Fig. 3B).

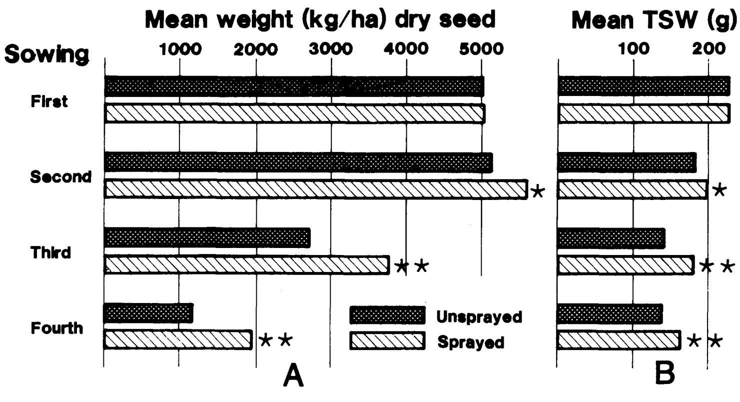

Fig 3: **Mean weight (A) and thousand seed weight (TSW,B) for dry seed harvested from unsprayed and fungicide sprayed plots of peas sown on four occasions. * and ** indicate means for sprayed plots different (P<0.05 and 0.01 respectively) from unsprayed plots.**

DISCUSSION

This trial has demonstrated that powdery mildew can cause considerable reductions in both vining and dry seed yields of garden peas, particularly in late-sown crops. Although the fungicide used to control the disease was not totally effective, it considerably reduced disease severity, and increased both vining and seed yields. The results suggest that vining yields will be reduced if more than 75% of leaf surfaces on plants are affected by the disease, and that severity of about 50% of leaf surface area affected at the vining stage is necessary before dry seed yields are adversely affected (Figs 2 and 3). However, time of disease onset, rate of disease development, and disease duration are also likely to affect yields. Detailed studies on epidemiology and crop loss assessment are necessary to accurately correlate disease severity with yield reductions.

Powdery mildew, if present, is likely to reduce production of pea crops grown for seed or grain. In the present study, effects of the disease on seed yield were only partly due to reduced seed weight in heavily infected plots, suggesting that the disease may adversely affect other yield components (numbers of pods, numbers of peas).

The large amounts of fungicide used in this trial (up to six applications) did not completely control powdery mildew. This suggests that where there is much inoculum, more effective control methods are needed, perhaps with better timed application of more active fungicides. Suitable cultivars resistant to powdery mildew will soon result from current plant breeding programmes, and these should reduce the need for chemical control of the disease in pea crops.

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