

EFFECT OF SEED TREATMENT ON SEED-BORNE *ASCOCHYTA* OF LENTIL

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ABSTRACT

The effect of four fungicide seed treatments on the control of seed-borne *Ascochyta* blight of lentil, caused by *A. fabae* Speg. f. sp. *lentis* Gossen *et al.*, was investigated.

In laboratory tests seed treatment with thiabendazole and benomyl resulted in a significant reduction in the number of seeds giving rise to colonies of *A. fabae* f. sp. *lentis*, and a significant increase in seed germination.

A field trial was sown in autumn at Lincoln in 1986, using highly infected seed (71%) of 'Titore' treated with the 4 fungicides. Thiabendazole and benomyl treatments resulted in significantly greater field emergence than chlorothalonil, mancozeb and the untreated control and maintained a lower level of plant infection from the first sign of the disease (13 weeks after sowing) until 19 weeks after sowing. Plants from seed treated with thiabendazole and benomyl were more vigorous than those from seed treated with chlorothalonil, mancozeb or from untreated seed.

Seed yields were highest in the thiabendazole and benomyl treatments, both about 30% greater than the control. In laboratory tests, seed harvested from plots sown with thiabendazole-treated seed had a significantly lower level of infection than seed from plots given the other treatments.

INTRODUCTION

Ascochyta blight of lentils (*Lens culinaris* Medik.) caused by *Ascochyta fabae* Speg. f. sp. *lentis* Gossen *et al.* (formerly known as *A. lentis* (Gossen *et al.* 1986)) was first reported in Canterbury in 1985 but was not considered to be a serious problem in that season (Jermyn, unpublished). However, wet, cool weather during the 1985/86 season resulted in widespread infection of lentil crops by the pathogen. Autumn sown crops were more prone to *Ascochyta* blight than spring sown crops. Many seed lines harvested in 1986 contained discoloured and sometimes shrivelled seed (A.C. Russell, unpublished data). Cromey *et al.* (1987) isolated *A. fabae* f. sp. *lentis* from several seed lines harvested in 1985/86 and found a lower level of germination in heavily infected seedlines than in less infected seed lines. Yield losses of 40% have been reported in Canada to be due to *Ascochyta* blight of lentil (Gossen & Morrall 1983) and additional adverse effects on seed quality and marketability have been reported.

Evaluation of seed treatments for the control of seed-borne *A. fabae* f. sp. *lentis* (Morrall & Gossen 1979, 1981, Morrall 1980, Morrall & Beauchamp 1984) have shown either slight or non-significant increases in seedling emergence and yield. However, Kaiser and Hannan (1987) found that treatment of infected seed with thiabendazole reduced the incidence of *Ascochyta* in lentil seed. Under field conditions, seed treatment with thiabendazole increased emergence and yield although symptoms of *Ascochyta* blight seldom developed on the foliage of plants, even from untreated seed.

This investigation was conducted to test the effectiveness of several fungicides in controlling seed-borne *Ascochyta* blight of lentils. The effects of seed treatment on seed germination and yield were also assessed.

MATERIALS AND METHODS

The fungicides tested were benomyl (Benlate 50 WP), chlorothalonil (Bravo 500F), mancozeb (Dithane M45) and

thiabendazole (Tecto). Seed of the lentil cultivar 'Titore' which was naturally infected with *Ascochyta* (71% of infected seed), was used for all trials.

In the field trial the fungicides were applied at the rate of 3g a.i. per kg of seed two weeks before sowing. A weighed quantity of each fungicide was mixed with 10ml distilled water and applied as a slurry to 2kg seed. Seed in the control treatment were treated with 10ml distilled water. Following treatment, the seed was aired.

A sample of 200 seeds was randomly selected from each treatment and plated on agar containing 20% V8-juice (Campbell Soups Ltd), with 10 seeds per plate. Plates were incubated at approximately 18°C on a laboratory bench under near-ultraviolet light (12h photoperiod). The number of seeds giving rise to colonies of *A. fabae* f. sp. *lentis* was recorded after 7-10 days. A second sample of 200 seeds randomly selected from each treatment was placed on moistened filter paper and incubated at approximately 18°C on a laboratory bench. The number of seeds which germinated was recorded after ten days.

A field trial was conducted to investigate the effect of the fungicide seed treatments on germination, yield and control of seed-borne *Ascochyta* blight. It was sown in autumn into a Templeton silt loam on the DSIR farm at Lincoln on 1 May 1986. The trial design was a randomised complete block with six replicates. The sowing rate for all plots was equivalent to 70kg/ha. An Oyjord cone seeder was used to sow the plots with were 15m² and consisted of nine rows 15 cm apart. Weed control was achieved by application of trifluralin (Treflan) incorporated before planting at the rate of 21 kg/ha one week prior to sowing and metribuzin (Sencor) applied at the rate of 0.25 kg/ha on July 20. Counts of seedling emergence were made four and six weeks after sowing.

The incidence of *Ascochyta* blight was assessed weekly from the time lesions were first observed on plants until the infection approached 100% in all treatments. For each plot, two of the inner five rows were selected for assessment of disease. Fifty plants in each row were examined and the percentage of plants

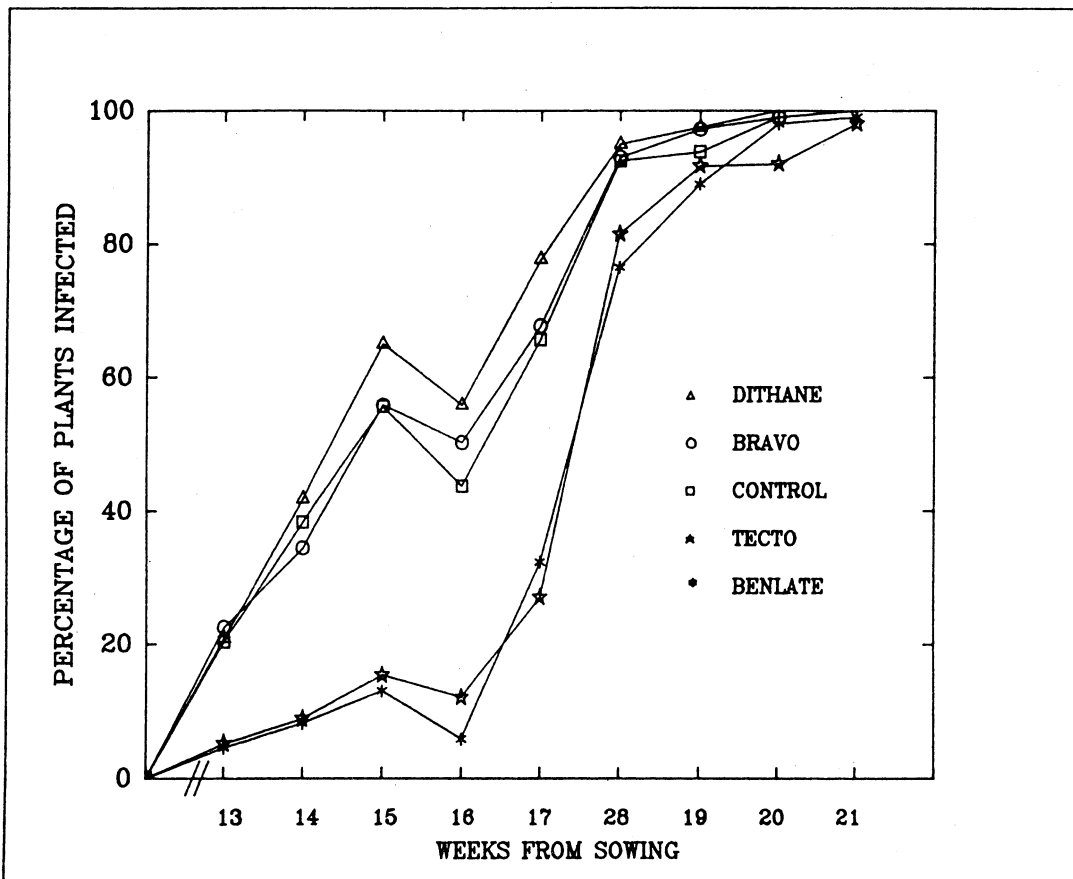


Figure 1. The effect of fungicide seed treatment on field infection of 'Titore' lentil with *Ascochyta fabae* f. sp. *lentis*.

Table 1. Effects of fungicide seed treatments on seed borne *Ascochyta fabae* f. sp. *lentis* and on germination, emergence and yield of 'Titore' lentil.

TREATMENT	LABORATORY		FIELD		LABORATORY
	GERMINATION (%)	ASCOCHYTA ISOLATED (%)	EMERGENCE (PLANTS/M ²)	YIELD (G/M ²)	ASCOCHYTA ISOLATED (HARVESTED SEED %)
Thiabendazole	36 A*	3 A	140 A	172 A	61 A
Benomyl	39 A	7 A	141 A	170 A	93 B
Chlorothalonil	30 B	45 C	111 B	131 B	97 B
Mancozeb	32 D	32 B	116 B	135 B	99 B
Nil	30 B	57 B	98 B	132 B	94 B
SEM	1	1	7	6	2

* means followed by the same letter are not significantly different ($P < 0.01$).

with lesions caused by *A. fabae* f. sp. *lentis* determined.

The trial was harvested using a Wintersteiger harvester on 14 January 1987. After harvest, seed from each plot was weighed and the six replicates for each treatment were then bulked. A 200 seed sample of seeds was then randomly selected from each treatment. Samples were surface sterilised for two minutes in a 10% solution of hypochlorite and plated on 20% V8 agar (10 seeds per plate). Plates were incubated at room temperature for 7-10 days under near ultraviolet light (12h photoperiod) to determine the level of seed-borne *A. fabae* f. sp. *lentis*. A sample of 200 seeds was randomly selected from each treatment was weighed and examined for seed discolouration.

RESULTS

In the laboratory tests treatment with thiabendazole or benomyl resulted in a marked reduction in the percentage of seeds giving rise to colonies of *A. fabae* f. sp. *lentis* compared with the untreated control (Table 1). In contrast, mancozeb or chlorothalonil resulted in only a slight reduction. Germination of seed treated with thiabendazole or benomyl was also significantly greater than that of the other treatments. Mancozeb and chlorothalonil had no significant effect on germination.

Treatment with thiabendazole or benomyl resulted in an increase in field emergence of approximately 40% compared with the control. Chlorothalonil or mancozeb had no significant effect on emergence (Table 1). Disease symptoms were first observed approximately 13 weeks after sowing as small, circular, purple to tan lesions with a light margin, and were located on the lower leaves and stem only. Stunting and poor vigour were associated with infected seedlings, and lesions on the stem frequently resulted in seedling death. Infection increased rapidly in the chlorothalonil, mancozeb and control treatments over the next two weeks, reaching approximately 60% infected plants by week 15 (Figure 1). Fewer plants with visible lesions were recorded in week 16, due to the shedding of the lower leaves of many plants, particularly those with *A. fabae* f. sp. *lentis* lesions. At that stage, lesions were still confined predominantly to these lower leaves. Numbers of infected plants increased rapidly until at 21 weeks from sowing there was 100% infection. There were no significant differences in percentage infection between chlorothalonil, mancozeb and control treatments at any scoring date.

The progress of the disease was delayed considerably more in plots treated with thiabendazole or benomyl than in plots given the other treatments. The number of plants with lesions remained below 15% in these two treatments over the first four weeks of scoring while infection in plots treated with mancozeb, chlorothalonil, or untreated, increased rapidly to 50-60% over the same period. After this time, a sharp increase in infection was recorded in all treatments, but the percentage of infection remained significantly lower in plots treated with either thiabendazole or benomyl until 19 week after sowing. Weekly assessments continued until 21 weeks after sowing when no significant differences were recorded between any treatments for two consecutive weeks. Disease severity remained lower in plots treated with thiabendazole and benomyl, where plants were more vigorous and had fewer lesions than in plots of the other treatments.

Treatment with either thiabendazole or benomyl resulted in significantly higher yields than the other treatments, with yields of 30% more than the control (Table 1.). There was no significant difference between the thiabendazole and benomyl treatments. Yields from the chlorothalonil and mancozeb treatments were not

significantly different from the control.

Results of the tests for seed-borne infection made after the harvest are presented in Table 1. Seed originally treated with thiabendazole produced seed with significantly less seed-borne infection than did the other treatments which all had over 90% infection.

DISCUSSION

Cool weather is conducive to the development and spread of *A. fabae* f. sp. *lentis* on lentils (Cromey *et al.* 1987). Such conditions prevailed during much of the field trial and led to the establishment and extensive spread of the disease, especially in control plots and those treated with chlorothalonil (Bravo) and mancozeb (Dithane). In contrast, in a trial in the United States in hot, dry conditions, Kaiser and Hannan (1987) seldom observed disease symptoms on lentil foliage. However, they observed stunting and poor vigour in plants developing from seed naturally infected with the fungus. In the absence of significant foliar infection, they attributed yield in thiabendazole-treated plots to improvements in emergence.

In our trial, yield increases following seed treatment with thiabendazole (Tecto) or benomyl (Benlate) resulted from a combination of better seed germination, field emergence and seedling vigour, and a reduction in the incidence and severity of disease symptoms. Spread of inoculum from neighbouring plots into those treated with thiabendazole and benomyl may have contributed to their increases in disease incidence from approximately 16 weeks after sowing. If so, the effectiveness of seed treatment may be even greater in a commercial field, where spread from highly infected neighbouring plots would not occur.

Post-harvest laboratory tests demonstrated that the percentage of infected seeds from thiabendazole-treated plots was significantly less than from plots of the other treatments. The percentage of infected seeds from the benomyl treated plots was not significantly different from that of the control. Although no differences were found between thiabendazole and benomyl treatments in the percentage of plants infected with *A. fabae* f. sp. *lentis* in the field trial, this result suggests that the severity of foliar infection may have been lower with thiabendazole than with benomyl seed treatment.

Treatment of lentil seed to control seed-borne *A. fabae* f. sp. *lentis* is recommended in New Zealand, especially among heavily infected seed lines such as those from the 1986 harvest. In this study thiabendazole gave the best control, although benomyl was almost as effective. If conditions favoured the development of *Ascochyta* blight, the cost of treating seed lines with a high level of seedborne *Ascochyta* would be compensated for by potentially large increases in yield. However, seed treatment alone is unlikely to give complete control in highly infected seed lines. Although seed treatment with either thiabendazole or benomyl produced a significant increase in yield in this study, all plots had approximately 100% infection 20 weeks after sowing, and there were no differences in seed weight or seed discolouration between seed harvested from the different treatments. This indicates the need for an integrated approach to the control of *Ascochyta* blight with crop rotation to reduce spread from infected crop debris (Beauchamp *et al.* 1986), use of uninfected seed lines or those with a low level of infection, seed treatment, and foliar fungicides (Beauchamp *et al.* 1986) where necessary to control the disease in post-seedling stages.

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