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Field evaluations of effect of seed fungicide treatment on seedling establishment

R E Falloon, S L H Viljanen-Rollinson, E L Parr & R C Butler

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New Zealand Institute for Crop & Food Research Limited
Private Bag 4704, Christchurch, New Zealand

Contents

1 Executive summary

This report outlines the project “Epidemic development of ascochyta blight”, which completes the third and last year of work in the MAF Sustainable Farming Fund project “Improved pea production for sustainable arable farming”. Four field trials were carried out in Canterbury during the 2006–07 growing season to measure the effects of a commonly used fungicide seed treatment on the establishment of seedlings of 2 pea cultivars – a processing cultivar and a cultivar designed for grain production (Falloon et al. 2007). The study included laboratory assessment (prior to sowing) of seed viability, sowing of known numbers of seeds in the field, and detailed determination of the numbers of established seedlings.

No benefit to seedling establishment from seed treatment was demonstrated in these 4 trials. However, previous research has shown that considerable improvement in establishment and crop yield can result from seed treatments as a result of controlling *Pythium* spp. and *Fusarium oxysporum* as well as preventing downy mildew epidemics. We recommend that fungicide seed treatments should continue to be routinely used for peas because they provide worthwhile insurance against soilborne seedling diseases that can harm seedling establishment, and provide some protection against epidemics of downy mildew in young crops.

2 Introduction

Fungicide treatments are applied to pea seed for several reasons. They prevent transmission of seedborne or seed-carried fungal pathogens and control soilborne fungi (*Pythium* and *Fusarium* spp. and *Rhizoctonia solani*) that induce seed rots and pre- and post-emergence root and stem diseases of young seedlings. All of these diseases cause poor seedling establishment. As well, seed treatments with appropriate systemic fungicides control downy mildew (caused by *Peronospora viciae*) in young seedlings, which can reduce plant survival and growth.

These effects of fungal pathogens (poor seedling establishment, reduced plant survival, reduced plant growth) can harm grain yield from pea crops. A detailed study (Falloon et al. 2000) demonstrated the efficacy of combination fungicide seed treatments for managing all of these types of seedling diseases. Seed treatment with a product containing 3 active ingredients increased seedling establishment, controlled downy mildew and resulted in large improvements in grain yields.

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3 Materials and methods

3.1 Cultivars, and trial "treatments"

The 2 cultivars used in these trials were Durango (a processing cultivar) and Midichi (a grain cultivar). Commercial seedlines of these cultivars were obtained for the trials. Two seed "treatments" were used for each seedline – 1 for which the seedline was left untreated and the other where a fungicide seed treatment was applied to the seed.

3.2 Seed treatment

For each cultivar, a weighed amount of seed was placed in a 2 L capacity glass conical flask. An accurately measured amount of the commercial fungicide Wakil® XL (active ingredients: 17.5% metalaxyl-M, 10% cymoxanil, 5% fludioxonil) was added to the flask to give the equivalent of 2.0 g product per kilogram seed, the recommended label rate for the product (Anon. 2007). The liquid formulation was allowed to run down the inside surfaces of the flask, and the flask was then vigorously shaken for several minutes until all of the fungicide was coated on to the seed and the inside surfaces of the flask were completely clear. This procedure follows that recommended by Hansing (1974) for effective and accurate application of fungicide treatments to small samples of seed.

3.3 Seed germination assessment

A seed germination assessment was carried out for each of the 4 lines of seed (untreated or Wakil® XL-treated Durango, untreated or Wakil® XL-treated Midichi). For each line, 10 seeds were placed on to moistened (reverse osmosis purified water) filter paper into each of 5 glass Petri plates (total 50 seeds). The plates containing seeds were placed on a laboratory bench (temperature, approx. 22°C) and numbers of germinated seeds were counted at intervals over the following 11 days. Seeds were classified as germinated when radicles were fully emerged from seed coats.

3.4 Field trials

Four field trials were carried out, 2 at the property of Mr Rob MacIllraith at St Andrews, South Canterbury, and the other 2 at the Foundation for Arable Research site at Chertsey, Mid-Canterbury (Figure 1). All of the trials were established on 27 October 2006.

At each site, 2 trials of randomised block design (6 replicates) were established – one for cv. Durango and the other for cv. Midichi. The soil at each site was prepared as a fine tilth seed bed. Each trial consisted of 12 adjacent rows, each 2.5 m long, with 0.5 m spacings between rows. The rows were sown with either untreated or Wakil® XL-treated seed, with these two "treatments" applied in the 6 randomised blocks. The trials were each bounded by 2 outside rows sown with untreated seed. Fifty seeds were sown by hand into each row at approx. 2–3 cm spacings between seeds, and the seeds were then covered by approx. 3–5 cm depth of soil. Numbers of emerged seedlings were counted in each row of the 4 trials on 3 occasions – at 17, 27 and 38 days after sowing. For statistical analyses, the maximum of the 3 counts of emerged seedlings were analysed using a binomial generalised linear model, with data for the 4 trials analysed separately. Comparisons between untreated and Wakil® XL-treated seed were tested as part of the analysis, using F-tests in an analysis of deviance.

Figure 1: Seed treatment trial at the FAR Arable site at Chertsey on 13 November 2006.

4 Results

4.1 Seed germination

In the laboratory assessment, all 4 seedlines gave 50 germinated seeds (100% germination) after 11 days.

4.2 Seedling establishment in field trials

Numbers of established seedlings in the trials are summarised in Figure 2. There were no statistically significant differences in plant establishment between untreated and fungicide-treated seed in any of the 4 trials (Durango at St Andrews, P = 0.58; at Chertsey, P = 0.15. Midichi at St Andrews, P = 0.44; at Chertsey, P = 0.37). Numbers of established plants varied more between plots of Midichi than of Durango. Overall mean levels of establishment were: for Durango, 96% at St Andrews, 97% at Chertsey; for Midichi, 93% at St Andrews, 95% at Chertsey.

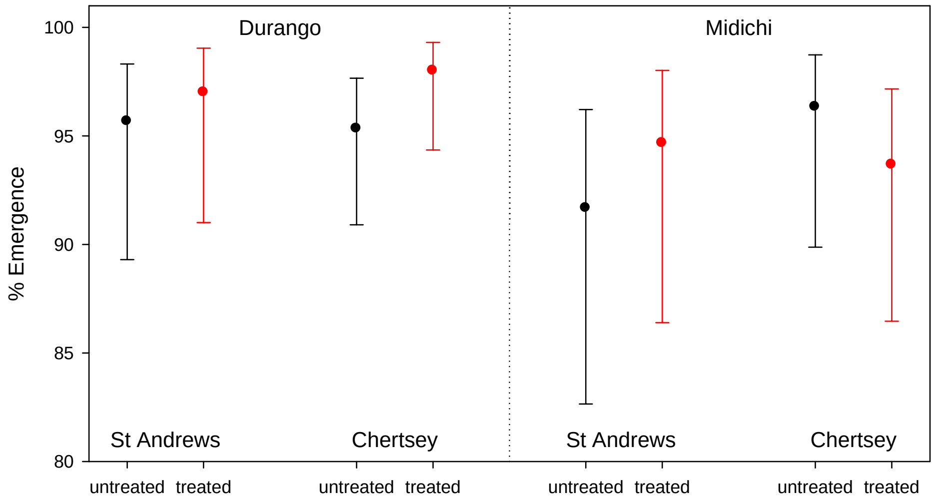

Figure 2: Mean maximum numbers of established seedlings (expressed as proportion of seed sown; "% Emergence"), for 2 pea cultivars (Durango and Midichi) sown with either untreated or Wakil® XL-treated seed in field trials at 2 sites (St Andrews and Chertsey). Bars indicate the 95% confidence limits of each mean.

4.3 Discussion

These 4 trials failed to demonstrate any effect of a commonly used seed treatment fungicide product on the establishment of seedlings of 2 pea cultivars. The level of establishment recorded in the trials was uniformly high, for both untreated and fungicide-treated seed (93–97% of the seeds sown produced seedlings). The seed used in the trials was of very good quality, as indicated in a laboratory germination assessment (100% viability), and the results suggest that soilborne seedling pathogens were not active at the 2 trial sites.

Although these trials showed that applying seed treatment had no effect on seedling establishment, previous research by Falloon et al. (2000) has shown that seed treatments can considerably improve establishment and crop yield. In a field trial they recorded a 170% increase in seedling establishment of cv. Bolero as a result of a combination fungicide seed treatment where *Pythium* spp. and *Fusarium oxysporum* were shown to be active on seedlings grown from untreated seed. Furthermore, this was accompanied by complete prevention of downy mildew epidemics in plots sown with fungicide-treated seed compared with 95% downy mildew incidence in plots sown with untreated seed. These 2 effects of the seed treatment chemicals resulted, at harvest, in an average seed yield increase of greater that 200% (from 1800 to 5800 kg/ha).

We conclude that fungicide seed treatments should continue to be routinely used for peas because they provide worthwhile insurance against soilborne seedling diseases that can reduce the rate of seedling establishment and protect against epidemics of downy mildew in young crops. Combination seed treatment products are the best for this purpose because they include ingredients active against soilborne pathogens as well as systemic compounds that are active against the downy mildew pathogen. Use of these products will ensure good crop establishment and productivity wherever unpredictable seedling diseases may occur.

5 Acknowledgements

We would like to acknowledge Rob McIlraith for the use of his land, Bruce Snowdon of Heinz-Wattie's, and Adrian Russell of Plant Research for providing the seed for the trial. MAF Sustainable Farming Fund and the Pea Industry Development Group funded this trial.

6 References

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