Effect of seed damage and metalaxyl seed treatment on seedling blight of field pea

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Abstract

When cool, wet conditions occur at seeding, soil-bone diseases can severely reduce stand establishment in field pea. Seed that has been damaged by rough handling (augering or dropping) is particularly vulnerable to injury from *Pythium* spp. Field trials were conducted over 3 yr to assess the impact of seed rot, damping-off and seedling blight on seedling establishment and seed yield from damaged field pea seed. The effect of fungicide seed treatment was also examined. Mechanical damage to the seed reduced seedling emergence and seed yield. Seed treatment with metalaxyl (Apron) reduced the impact of seed damage, but did not always restore emergence and seed yield to the same level as from undamaged seed. Differences among cultivars were small relative to the effect of seed injury. This study showed that planting fungicide-treated, high quality field pea seed was an effective means to maximize emergence and stand establishment for commercial field pea production.

Introduction

Field pea (*Pisum sativum*) acreage has increased dramatically in the northern Canadian prairies in the past decade. In this region, planting must occur between the last week in April and the first week of June. Weather conditions during seeding and crop establishment are unpredictable. A large drop in soil temperature can slow germination and establishment of seedlings, and make them more susceptible to infection by soilborne pathogens, especially *Pythium* spp. However, even in fields where the potential for losses due to pythium diseases is high, early seeding is required to maximise yield potential (Hwang and Gossen, unpublished), so most pea crops are planted as early as possible.

Field pea is vulnerable to mechanical damage because of its large seed size and thin seed coat. Mechanical damage results in increased uptake of water and increased leakage of solutes from seeds. This often results in delayed emergence and weak plants. Nutrient leakage not only reduces the nutrients available to the seedling, but also increases seedling mortality because it triggers the growth of soilborne pathogens such as *Pythium* spp.

Pythium spp., which are ubiquitous in cultivated soils, play an important role in the seed/root rot disease complex on pea, particularly in cold, poorly drained soils. In the northern prairies, pythium seed rot and seedling damping-off is a major factor limiting the production of field pea in some years (Hwang and Chang, 1989). The objectives of this study were to examine the interaction of seed damage and fungicide seed treatments on seedling establishment and seed yield of field pea.

Materials and Methods

Two isolates of *P. irregulare* and two of *P. ultimum*, originally isolated from field pea in Alberta, were inoculated onto autoclaved grain (rye-oat mixture, 1:1 v/v). Jars of inoculated grain were incubated for 2 wk at room temperature and shaken periodically to enhance colonisation of the grain. After incubation, the infested grain was air-dried, ground and stored at 4°C until needed.

Field trials with four replications in a split-split-plot design were established at Vegreville, AB on 28 May 1996 and at Brooks, AB on 30 May 1997. The main plot treatments were cultivar (Carneval vs Montana). The sub-plots were inoculation with 40 ml/row of *Pythium*-infected grain vs. sterile grain, planted with the seed. The sub-sub-plots were six seed treatments: undamaged, auger-damaged and drop-damaged seed, with and without metalaxyl seed treatment (0.35 ml a.i./kg seed). Auger damage was induced by three cycles through a 1m-long auger. Drop-damaged seed was produced by storing the seed overnight at -20°C and then dropping it onto a hard surface from a height of 4 m. Each sub-sub-plot consisted of 4 rows, each 6m long, 25cm between rows. Seedlings were counted in 5m lengths of the two middle rows of each plot 2 wk after seeding.

A smaller version of the trial was planted at Namao, AB in on 25 May 1998 using Carneval and Profi as the main plots and drop-damaged vs. undamaged seed as sub-plot treatments. Seedlings were counted on 2m lengths of the two middle rows 2 wk later.

The mean daily soil temperature at 5cm depth for the first 10 days after planting at Vegreville ranged from 7.4° to 21°C, with a mean of 14.3°C. A shower (7 mm) occurred 2 days after planting and another rainfall (18 mm) occurred 5 days later. At Brooks, mean daily soil temperature ranged from 12.8° to 25.5°C, with a mean of 18.1°C. Two minor showers (< 5 mm) were recorded over those 10 days. At Namao, temperature ranged from 6.8° to 26°C, with a mean of 17°C; there were four minor showers during this period.

Results and Discussion

Seed treatments with metalaxyl increased seedling emergence by 10-40% (Table 1). A similar trend was noted for seed yield in 2 of 3 years, but differences were smaller, indicating that some compensation had occurred for loss of plants early in the season.

Inoculation with *Pythium* reduced seedling emergence and yield only in 1998 (Table 1). There were almost always differences between cultivars for seedling emergence and seed yield. Seed yield of cv. Carneval was higher than cv. Montana at Vegreville, equal to Montana at Brooks and higher than cv. Profi at Namao. When combined across cultivars, inoculation reduced seedling emergence and seed yield only at Namao.

Mechanical injury reduced seedling emergence in 2 of 3 field trials, when the same level of seed treatment was compared (Table 1). In general, seedling emergence was highest whereundamaged seed was treated and lowest where seed was damaged and not treated with metalaxyl. Seed yield was lower (*P* <= 0.05) for all damaged seed in 1997 and 1998, but only for untreated, auger-damaged seed in 1996. Treatment with metalaxyl improved emergence overundamaged seed without metalaxyl in all cases, but only improved seed yield overundamaged seed in all treatments in 1996 and in one of two treatments in 1998 (Table 1). Healthy seed, with or without metalaxyl, always produced higher yields than damaged seed without treatment. Clearly, damage caused by rough or repeated handling of seed can substantially reduce pea seedling establishment, especially in soils that are heavily infested with *Pythium* spp.

Table 1. The effect of seed treatment and mechanical damage on seedling emergence and seed yield of field pea in field trials, 1996–1998.

		No. of seedling (per m row)			Yield (000's kg/ha)		
Treatment	Metalaxyl	1996	1997	1998	1996	1997	1998
Damage type:							
None	+	8.9 a	9.0 a	9.7 a	1.30 a	2.00 a	1.47 a
None	-	6.6 d	7.6 b	6.5 b	1.11 b	1.90 ab	1.34 b
Drop	+	7.9 c	6.5 c	8.7 a	1.26 a	1.67 c	1.38 b
Drop	-	5.9 e	5.7 d	8.4 b	1.01 bc	1.63 c	1.25 c
Auger	+	8.1 b	6.9 c	n.d.	1.25 a	1.72 bc	n.d.
Auger	-	4.9 f	5.7 d	n.d.	0.91 c	1.62 c	n.d.
Cultivar:							
Carneval		6.9 b	7.1 a	9.5 a	1.43 a	1.75 a	1.53 a
Montana		7.3 a	6.6 b	8.7 b	0.85 b	1.76 a	1.19 b
Inoculation:							
Inoculated		7.0 a	6.9 a	8.5 b	1.11 a	1.70 a	1.29 b
Noninoculated		7.2 a	6.8 a	9.7 a	1.17 a	1.81 a	1.43 a

Means in a column followed by a common letter are not significantly different at *P* <= 0.05.
n.d. = not done.

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References

Hwang, S.F. and Chang, K.F. 1989. Root rot disease complex of field pea in north-eastern Alberta in 1988. Can. Plant Dis. Surv. 69: 139-141.