DRAZOXOLON AS A SEED TREATMENT FOR PEAS

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Summary

In the 1975-76 season five field trials in different areas of New Zealand tested the effectiveness of drazoxolon at different rates as a seed treatment for the prevention of "damping-off" diseases of peas *(Pisum sativum)*. The main effect of seed treatment was to prevent both pre- and post-emergence "damping-off" and to increase pea yields. The optimum rate was 50 g/100 kg. It was better than captan in two trials and as effective in the other three trials.

INTRODUCTION

"Damping-off" of pea seedlings *(Pisum sativum)*, both before and after emergence through the soil, can be a major threat to the performance of pea crops. "Damping-off" is more prevalent in garden varieties especially when seed is sown early or when cold wet conditions occur after sowing. Death of pea seedlings either before or after emergence may result from attack by one of the species of soil fungi — *Fusarium, Pellicularia* and *Pythium* — which together constitute the footrot complex (Brien *et al* 1955).

The problems of treating field soil with conventional fungicides to control soil-borne fungi are considerable. The most effective and economic control has usually been achieved by localised treatments using seed dressings or row or furrow applications. Under these circumstances the fungicides can provide protective barriers near the young plant (Torgeson 1967).

Broad spectrum fungicides such as captan and thiram have been used as seed treatments to give control of these diseases. In Europe drazoxolon has been widely used and has been found to be particularly effective against *Fusarium* and *Pythium* spp. Activity has also been reported against *Rhizoctonia solani, Gibberella Zeae* and *Rhizopus* spp (Geogheagan 1967). Work in New Zealand by Manning *et al* (Dalgety Research Report 1972) demonstrated that peas treated with drazoxolon recorded higher emergence populations which correlated with higher yields.

Since 1972 ICI New Zealand Ltd. have conducted trials utilizing a range of pea varieties in different soil types under widely ranging climatic conditions (Logan and Arnst 1974). This paper reports the results from five field trials in 1975.

METHOD

Sites in Manawatu, Hawkes Bay, Canterbury and Southland were selected, where possible, on the basis of a known pea cropping history. Both a high incidence of hollow heart, and high soluble sugar levels in the seed of peas have been reported as pre-disposing factors towards attack by "damping-off" organisms (Scott pers comm). Thus commercial seed lines were selected with either one or both of these conditions. Pea varieties used included 'Reidy C-29', 'Victory freezer', 'Scout' and 'Ajax' (Table 1).

TABLE 1: DETAILS OF 1975 TRIALS

	Trial A	*Trial B*	*Trial C*	*Trial D*	*Trial E*
Location	Clinton	Merino Downs	Seadown	Hastings	Manawatu
Soil type	Warepa yellow grey	Waikaikai	Waimakariri silt loam	Heretaunea silt loam	Te Arakura silt loam
Variety	'Victory freezer'	'Scout'	'Ajax'	'Reidy C-39'	'Victory freezer'
Sowing date	31/10/75	29/10/75	16/9/75	19/11/75	12/11/75
Sowing method	Stanhay	Stanhay	Oyjord	Seedliner	Seedliner
Area harvested	2 m^2	2 m^2	4 m^2	25 m^2	25 m^2
Pathogens isolated	*Aschochyta pisi, Mycos-phaerella pinodes*	Nil	*Fusarium solani, F. oxysporum, A. pisi*	*F. solani, M. pinodes*	*F. solani, M. pinodes*

Measured volumes of drazoxolon, formulated as a colloidal suspension containing 300g/litre, were added to weighed quantities of seed, placed inside a shaker, and even distribution of the fungicide obtained by shaking for a period of five minutes before spreading the seed out for 24 hours to dry. All drazoxolon volumes were standardized by the addition of water before being added to the seed. Control treatments were treated with similar aliquots of water, shaken and dried.

Two methods of sowing the seed were used in this trial series both incorporating standard fertilizer rates.

(i) Seed was sown using a handpushed single row Stanhay precision seeder or an Oyjord plot seeder which allowed for approximately equal numbers of seed per treatment.

(ii) A Duncan Seedliner drill was calibrated for consistency of seed flow rates between treatments and seed was sown at 220 kg/ha. This was less than the standard rate as a guard against plant mortality or reduced plant vigour being compensated for by high plant populations.

All trials were laid down in randomized block design with all treatments being replicated four times, except for trial C which was replicated twice.

At 3-4 weeks after sowing, plants in 10 one metre lengths of row, selected at random, were counted to measure emergence populations. From trials D and E diseased plants were taken from the untreated plots and pathogens identified. Soil from untreated plots in trials A, B and C was potted up and peas were planted. From the infected plants, pathogens were isolated and identified.

Four crops were harvested, as for process crops and trial E was harvested for seed by hand-pulling plants from measured areas. Total plant numbers were recorded and fresh plant weights were taken. Pea weights were obtained by shelling the pods from the pulled area.

RESULTS

A summary of trial details and pathogens isolated is shown in Table 1 and a summary of results in Table 2. Figures shown are percentages related to untreated control.

TABLE 2: SUMMARY OF 1975 TRIALS RESULTS

		(expressed as percentage of control)			
Trial	*Treatment g/100 kg seed*	*Emergence population*	*Harvest population*	*Total plant weight*	*Total pea weight*
A	untreated	100 b	100 c	100 c	100 c
	captan 110	192 a	370 b	274 b	328 b
	drazoxolon 25	193 a	438 a	328 a	433 a
	drazoxolon 50	186 a	410 ab	309 a	380 a
	drazoxolon 100	188 a	420 c	323 ab	403 a
	drazoxolon 200	195 a	435 a	316 a	384 a
	CV %	6.7	10.3	14.1	18.3
	untreated yield				2370 kg/ha
B	untreated	100 b	100 b	100 b	100 b
	captan 110	98 b	111 b	124 ab	138 b
	drazoxolon 25	171 a	160 a	150 a	170 a
	drazoxolon 50	180 a	169 a	144 a	173 a
	drazoxolon 100	189 a	176 a	143 a	168 a
	drazoxolon 200	185 a	170 a	148 a	178 a
	CV %	16.2	24.7	17.7	21.5
	untreated yield				5450 kg/ha
C	untreated	100 c	100 c	100 d	100 cd
	captan 110	164 b	130 b	120 c	104 cd
	drazoxolon 50	204 a	231 a	175 a	164 a
	drazoxolon 75	224 a	182 a	140 b	94 cd
	drazoxolon 100	188 a	176 a	143 b	121 bc
	drazoxolon 200	212 a	186 a	145 b	121 bc
	CV %	14.9	16.3	11.2	13.9
	untreated yield				5380 kg/ha
D	untreated	100 c		100 b	100 b
	captan 110	183 ab		150 a	176 a
	drazoxolon 25	172 b		144 a	174 a
	drazoxolon 50	195 a		170 a	184 a
	drazoxolon 100	186 ab		147 a	199 a
	CV %	6.4		14.9	12.8
	untreated yield				710 kg/ha
E	untreated	100 b			100 b
	captan 110	151 ab			160 a
	drazoxolon 25	189 a			156 a
	drazoxolon 50	148 ab			178 a
	drazoxolon 100	173 a			169 a
	CV %	22.6			16.4
	untreated yield				750 kg/ha

All seed treatments with the exception of one (captan treatment in trial B) gave increased emergence counts over control, however not all were significant. In trials A, C and D all treatments resulted in significant increases in pea emergence. In two trials B and C emergence counts from all drazoxolon treatments were significantly higher than captan treatments at the standard rate. In no trials did increasing the drazoxolon application rate above 50 g/100 kg seed have any significant advantage.

In trials A, B and C drazoxolon treatments produced significantly higher plant numbers at harvest than the untreated, while in two of the trials (A and C) captan treatments produced significantly higher plant

numbers. There were no significant differences between drazoxolon treatments.

In all trials fungicide treatments increased fresh plant weight at harvest. Drazoxolon treatments in all trials gave significantly higher plant weights than untreated however in only three trials did captan significantly increase plant weights over untreated. In two out of four trials drazoxolon gave significantly higher yields than captan treatments.

Yields of peas for processing were significantly increased by all seed treatments apart from trial C where drazoxolon at 75 g/100 kg seed produced the lowest yield. However, except in trial C all drazoxolon treatments above 25 g/100 kg seed gave rise to higher yields than untreated. In trials A and B all drazoxolon treatments gave significantly higher yields than captan treatment. In all trials there was no significant advantage from increasing the drazoxolon rate above 50 g/100 kg seed.

DISCUSSION

The two Southland trials A and B were noticeable for the high yields recorded with fungicide treatment especially as the soil was "virgin" pea soil and was locally considered unlikely to have a high incidence of pea pathogens present. However, cool and wet conditions in Southland could have provided an ideal micro-environment for the development of such diseases.

The large relative increase in harvest population over emergence population in trial A suggested that "damping-off" of the seedlings continued to occur after emergence, and indicated that seed treatment had provided continued protection of seedlings. In the remaining trials the harvest population showed no marked difference to the emergence population.

Throughout the trial programme seed treatment was consistently effective in significantly increasing the establishment populations of peas over a range of sowing dates and under a range of differing climatic conditions.

In two out of five trials, all rates of drazoxolon provided better control of "damping-off" diseases than captan, while in the remaining three trials it was equal to captan. The results show how susceptible pea crops are to "damping-off" diseases.

Yield responses generally reflected the trends indicated in the earlier population studies, significantly better results being achieved with treatment as compared to untreated. These results also show the benefit in terms of increased yields, that may be obtained by protecting the pea seed and seedling by means of seed treatment. Increases of these magnitudes may not necessarily result in the field as the seed line and site selection in these trials favoured disease development

In three trials (B, D and E) the 50 g/100 kg seed rate was superior to the 25 g drazoxolon treatment, but these were not significant. Previous work by Logan and Arnst (1974) indicated that 25 g/100 kg seed was marginal for control of *Fusarium* spp and *Pythium* spp. In general there was no significant advantage in increasing seed application rates above 50 g/100 kg seed.

In conclusion the trials have shown that drazoxolon was not only capable of protecting the germinating seed but may also protect the growing seedling from "damping-off" diseases. The trials also showed that there was no advantage in increasing the rate above 50 g/100 kg seed, and that drazoxolon was at least as effective as captan under the conditions prevailing.

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