

**EFFICACY OF METALAXYL FOR CONTROL OF PHYTOPHTHORA
BLIGHT OF PIGEONPEA**

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EFFICACY OF METALAXYL FOR CONTROL OF PHYTOPHTHORA BLIGHT OF PIGEONPEA

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ABSTRACT : A seed dressing formulation of metalaxyl was evaluated under greenhouse and field conditions for the control of pigeonpea blight caused by *Phytophthora drechsleri* f. sp. *cajani*. Significant control of the blight (over 90 per cent) was achieved with metalaxyl (1.75 g a. i./kg seed) in a greenhouse trial for 30 days after planting. However, the fungicide was found ineffective against the disease in field tests.

Keywords : Control, *Phytophthora* blight, Pigeonpea, Metalaxyl

Phytophthora blight of pigeonpea (*Cajanus cajan* [L.] Millsp.), caused by *Phytophthora drechsleri* Tucker f. sp. *cajani* is a serious disease in India (Kannaiyan *et al.*, 1980). The blight is particularly severe during the early crop growth which normally coincides with rainy season (June to September). Some of the blight resistant genotypes identified at ICRISAT Centre (Kannaiyan *et al.*, 1981) are now being used in breeding programmes to develop blight-resistant cultivars (Sharma *et al.*, 1982). However, most of these resistant genotypes are susceptible to another isolate of the pathogen from Kanpur in northern India (Sharma *et al.*, 1982). We have already initiated a search for resistant source to this isolate. Meanwhile, we are using the systemic fungicide metalaxyl [methyl D, L-N-(2, 6-dimethyl-phenyl)-N-(2-methoxy-acetyl)-alaninate], which has been found effective against *Phytophthora* spp. (Ferrim and Mellinger, 1978; Mitchell *et al.*, 1977; Papavizas *et al.*, 1979; Urech *et al.*, 1977; and Zentmyer and Ohr, 1978), to control pigeonpea blight. In this study we report on the efficacy of a seed dressing formulation of metalaxyl against pigeonpea blight.

MATERIALS AND METHODS : A blight susceptible pigeonpea cultivar, HY-3C and *Phytophthora drechsleri* f. sp. *cajani* isolated from blighted pigeonpea at ICRISAT Centre (P2 isolate) and at Kanpur (P3 isolate) were used throughout the experiments. The seed dressing was a 35 per cent metalaxyl formulation, Apron 35 SD, produced by the Ciba-Geigy Corporation. Dry seed dressing was done by mixing the required quantity of the fungicide with the seed and shaking thoroughly in conical flasks to obtain uniformly coated seeds.

Laboratory test : To evaluate the effect of fungicide on seed germination, metalaxyl-treated (0.35, 1.05, 1.75, 3.50, 7.00, and 10.50 g a. i./kg seed) and non-treated pigeonpea seeds were plated on moist blotter paper at the rate of 10 seeds/plate and incubated in the dark at $28^{\circ} \pm 20^{\circ}\text{C}$. Each treatment had 4 replications (50 seeds/replication). Germination counts were recorded after 9 days of incubation.

Greenhouse tests : Pigeonpea seeds were treated with metalaxyl (0.35, 0.70, 1.05, 1.40, and 1.75 g a. i./kg seed), with four replications for each treatment (25 seeds/

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replication). A soil drench technique (Nene *et al.*, 1981) was followed for inoculations (P2 isolate). Mycelial suspension of the pathogen was poured around the base of seedlings when they were 5 to 10 days old and again after 15 days. Observations on blight incidence were recorded 15 days after each inoculation. The experiment was repeated once. In another experiment, we also tested the efficacy of metalaxyl as seed dresser (only 1.75 g a. i./kg seed) with P2 and P3 isolates by following the soil drench technique.

A spray inoculation (Nene *et al.*, 1981) was used to confirm the results. Seeds were treated with metalaxyl at 1.75 and 3.50 g a. i./kg. A mycelial suspension of the P2 isolate was sprayed on the foliage of two sets of 15- and 30 day-old plants which were then covered with polythene bags to ensure high humidity for 48 hrs. The final observations were taken 15 days after inoculation. Similar study was also conducted with P3 isolate.

Field tests : Field tests were conducted during the 1979, 1980, and 1981 rainy seasons at ICRISAT Centre. In the 1979 and 1980 rainy seasons, only P2 isolate was present in the experimental fields. But in the 1981 rainy season onwards P3 isolate was also present. Metalaxyl-treated and non-treated seeds were sown in plots of 4 m rows spaced 75 cm apart in naturally infested Alfisol and Vertisol fields where blight disease appears in the rainy season. In preliminary field (Alfisol) test in 1976, metalaxyl treated seeds (1.75 g a. i./kg) were tested along with non-treated seeds. In 1980 season, four rates of metalaxyl (1.75, 3.50, 7.00 and 10.50 g a. i./kg seed) were tested in both Alfisol and Vertisol fields. In 1981 we deleted the phytotoxic rate of metalaxyl (10.50 g a. i./kg seed) and included a spray treatment of metalaxyl 25 WP (at the rate of 500 ppm) 30 days after planting (DAP) in addition to seed dressing treatments (1.75, 3.50, and 7.00 g a.i./kg seed). The test was carried out in the Alfisol field only. The trials were of randomized block design with four replications. The blight incidence was recorded 30 and 60 DAP.

RESULTS AND DISCUSSION : Laboratory test : In the blotter test, metalaxyl at 0.35, 1.05, 1.75 and 3.50 g a.i./kg seed had no significant effect on germination in comparison to the check (Table 1), but at 7.00 and 10.50 g/kg rate, the germination was adversely affected.

TABLE 1 : Germination of pigeonpea seed treated with six rates of metalaxyl as determined in a blotter test

Metalaxyl (g a. i./kg seed)	Germination** %
0.35	98 ^a
1.05	98 ^a
1.75	99 ^a
3.50	94 ^b
7.00	54 ^c
10.50	11 ^d
Non-treated	98 ^a

*Average of four replications (50 seeds were kept per replication).

**Germination recorded after 9 days of incubation.

^aSquare root ($x + 1$) transformation used. Treatment with the same letter are not significantly different (0.05, 0.01).

Greenhouse tests : The blight (P2 isolate) was effectively reduced (< 10 per cent blight) with metalaxyl seed dressing at 0.70, 1.05, 1.40 and 1.75 g a.i./kg seed (Table 2). After the second inoculation, effective control was achieved only at the higher rates of metalaxyl (1.05, 1.40 and 1.75 g a.i./kg seed). Satisfactory control (< 10 per cent blight) of the disease was also achieved with metalaxyl seed treatment when inoculated with the P3 isolate (Table 3). However, after the second inoculation, 26 per cent blight was recorded with the P3 as compared to only 6 per cent with the P2 isolate.

TABLE 2 : Efficacy of metalaxyl seed treatment in controlling *Phytophthora* blight (P2 isolate) of pigeonpea under greenhouse conditions

Metalaxyl (g a. i./kg seed)	Per cent blight*	
	1st inoculation**	2nd inoculation**†
0.35	20 ^b	40 ^b
0.70	7 ^c	22 ^c
1.05	5 ^c	12 ^d
1.40	2 ^d	12 ^d
1.75	2 ^d	9 ^d
Non-treated	99 ^a	100 ^a

*Average of 2 tests and in each test 4 replications were kept/treatment.

**The seedlings were inoculated with the fungus by soil drench inoculation. Observations on the disease were recorded after 15 days of inoculation.

†Includes per cent plants blighted in 1st inoculation.

*Square root ($x + 1$) transformation used. Treatment with the same letter are not significantly different (0.05, 0.01).

TABLE 3 : Efficacy of metalaxyl seed treatment in controlling *Phytophthora* blight (P2 and P3 isolates) of pigeonpea under greenhouse conditions

Metalaxyl (g a. i./kg seed)	Per cent blight*			
	P2 isolate		P3 isolate	
	1st inoculation**	2nd inoculation**†	1st inoculation**	2nd inoculation**†
1.75	0 ^b	6 ^b	8 ^b	26 ^b
Non-treated	97 ^a	100 ^a	100 ^a	100 ^a

*Average of 4 replications.

**Seedlings were inoculated with the fungus by soil drench inoculation. Observations on the disease were recorded after 15 days of inoculation.

†Includes per cent plants blighted in 1st inoculation.

*Square root ($x + 1$) transformation used. Treatment with the same letter are not significantly different (0.05, 0.01).

A good control (< 10 per cent blight) of the disease (with P2 and P3 isolates) was also achieved with metalaxyl at 1.75 and 3.50 g a.i./kg seed by following spray

inoculation technique in 15- and 30-day-old plants. The results show that metalaxyl at the higher rates was effective in protecting pigeonpea seedlings from the blight for over a month under greenhouse conditions.

Field tests : The metalaxyl treatment at 1.75 g a.i./kg seed, which was effective in greenhouse tests (Table 2), failed to control the blight in preliminary field test in 1979 season. Therefore, in 1980 season, we tried higher rates of metalaxyl both in Alfisol and Vertisol fields. The blight incidence was recorded 60 DAP when the non-treated check plots showed above 80 per cent disease (Table 4). Metalaxyl failed to control the disease in the Alfisol field even at 10.50 g a.i./kg seed, while a moderate control (25 per cent blight only) was accomplished at this rate in the Vertisol field. Generally, more blight occurs in pigeonpea grown in Alfisol than in Vertisol, which may explain the lower level of control in the Alfisol. However, metalaxyl at 10.50 g a.i./kg seed, reduced seed germination to about 50 per cent and produced phytotoxic symptoms such as stunting and chlorosis during early crop growth. During the 1981 season, the natural disease incidence was 47 per cent and 99 per cent in non-treated plots at 30 and 60 DAP, respectively (Table 5). Satisfactory control of blight was achieved with 7.00 g a.i./kg seed treatment without spray at 30 DAP. However, all the treatments with and without spray failed to control the blight at 60 DAP. Elsewhere good control of soybean root rot and damping off (Papavizas *et al.*, 1979) and tobacco black shank (Kannwischer and Mitchell, 1978) was achieved with metalaxyl in the greenhouse and plant growth room, but the fungicide was ineffective in field tests. The possible reason for the failure of metalaxyl in controlling the disease under field conditions may be accounted for by the following (i) insufficient persistence (15 days) of the fungicide applied to the seed (Kotwal *et al.*, 1981) and (ii) reduction in efficacy of the fungicide over time or changes in the physiology of the plant (Kannwischer and Mitchell, 1978).

TABLE 4 : Efficacy of metalaxyl seed treatment in controlling *Phytophthora* blight of pigeonpea under field conditions during 1980 rainy season

Metalaxy (g a. i./kg seed)	Per cent blight*	
	Alfisol [†]	Vertisol [‡]
1.75	76	67 [§]
3.50	93	66 [§]
7.00	77	55 [§]
10.50 [¶]	67	25 [§]
Non-treated	95	82 [§]

*Average of 4 replications. Blight incidence recorded 60 days after planting.

†Moderate germination with mild toxicity.

‡There is no significant difference between any of the above means.

§Square root ($x + 1$) transformation used. Treatment with the same letter are not significantly different (0.05).

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