Control of Sclerotinia Blight of Peanut with Procymidone

D. M. PORTER, Plant Pathologist, Agricultural Research, Science and Education Administration, U.S. Department of Agriculture, Tidewater Research and Continuing Education Center, Suffolk, VA 23437

ABSTRACT

PORTER, D. M. 1980. Control of Sclerotinia blight of peanut with procymidone. Plant Disease 64:865-867.

Mycelial growth of *Sclerotinia minor* Jagger was minimal on potato-dextrose agar containing procymidone at 0.25 μg/ml after 288 hr of incubation and was completely inhibited on agar containing procymidone at 4 μg/ml. Procymidone (four applications of 0.56 kg a.i./ha) applied directly to peanut foliage almost completely controlled Sclerotinia blight in fields where the disease was severe in untreated plots. Peanut pod yield and value in procymidone-treated plots were almost twice those obtained in the untreated control plots. *S. minor* was not isolated from seed from plants treated with procymidone, and sclerotial populations of *S. minor* were several times greater in soil from untreated control plots than in soil from procymidone-treated plots.

Additional key words: chemical control, fungicides, *Sclerotinia sclerotiorum*, soilborne fungus

Sclerotinia blight of peanut (*Arachis hypogaea* L.), caused by the soilborne pathogen *Sclerotinia minor* Jagger (2), was first observed in Virginia in 1971 (5). The disease has since become widespread and in 1978 reduced pod yields in Virginia about 7%. Pod yield losses can be correlated with disease severity (7). Injury predisposes plants to infection by *S. minor* (8). All peanut varieties currently planted are susceptible to *S. minor* (6), and available fungicides provide only partial control (1).

This investigation was conducted to obtain laboratory and field data on the efficacy of procymidone (3-(3,5-dichlorophenyl)-1,5-dimethyl-3-azabicyclo [3.1.0]hexane-2-4-dione) against *S. minor*. The effects of procymidone on seed transmission of *S. minor* and sclerotial populations in soil were also determined. Preliminary reports have been published (3,4).

Cooperative investigations of Agricultural Research, Science and Education Administration, U.S. Department of Agriculture, and the Department of Plant Pathology and Physiology, Virginia Polytechnic Institute and State University. Contribution 393.

This paper reports the results of research only. Mention of a pesticide does not constitute a recommendation by the USDA nor does it imply registration under FIFRA.

MATERIALS AND METHODS

The toxicity of procymidone to *S. minor* was measured by comparing mycelial growth on potato-dextrose agar (PDA) and on procymidone-amended PDA. Desired quantities of stock solutions of procymidone in water were pipetted into flasks containing an appropriate volume of partially cooled PDA. The contents of each flask were stirred continuously during the addition of procymidone and then poured into sterile plastic petri plates (85 × 15 mm). When the medium solidified, plates were inoculated with 5-mm agar plugs containing mycelium taken from the periphery of a 3-day-old colony of *S. minor* grown on PDA. Plates were incubated at 22 C, and radial growth was measured at 24-hr intervals.

Field experiments were done at farms with histories of severe Sclerotinia blight. In 1977 and 1978, peanuts (VA 72R) were planted in May in accordance with recommended agronomic practices. A randomized block design with four replicate plots, each with four 12.1-m rows spaced 0.9 m apart, was used in all experiments.

Procymidone was applied to leaves

with a CO_2 pressure-regulated sprayer with three spray nozzles with D2-13 tips/row and calibrated to deliver 186 L of water/ha at 206,844 kPa on the following dates: 19 July and 4, 19, and 31 August 1977; 20 July, 3, 17, and 31 August, and 14 September 1978 (Field A); 19 July and 2, 16, and 30 August 1978 (Field B); and 24 July, 7 and 21 August, and 4 September 1978 (Field C).

During the first week of August of each year, plants were monitored for evidence of infection by *S. minor*. Disease indices, based on a scale from 1 (no disease) to 5 (death of plant), were estimated for each plot by rating plants in 40 selected sites in the two center rows. Peanut pods were harvested at the end of the growing season, dried according to recommended practices, and graded by standard procedures (9) to determine yield and value.

Dried peanut pods from untreated control plots and procymidone-treated plots (2.24 kg a.i./ha) from Fields B and C of the 1978 tests were stored in an unheated building, where pod moisture stabilized at about 7%, to determine the survival of *S. minor* in peanut seed. Subsamples of pods were selected monthly from each replication of each treatment of each field test and hand-shelled. After surface disinfestation in 0.5% NaOCl for 3 min, seeds (100/plot) were placed on PDA and incubated for 10 days at 25 C. The percentage of seed from which *S. minor* grew was then determined and recorded as the isolation frequency of *S. minor*.

Untreated and procymidone-treated (receiving a minimum of 2.24 kg a.i./ha) plots were assayed at three field sites (1978 A, B, and C). Forty cores (2.54 × 10 cm) of soil were collected from the center two rows of each plot shortly after planting (June) and after harvest (October). Soil was mixed thoroughly and allowed to air dry to about 6% moisture content. Subsamples of 100 g of soil were wet-sieved, and the number of sclerotia retained on a 40-mesh sieve was determined.

Data in all tests were subjected to mean comparisons with Duncan's multiple range test at the 5% level of significance.

RESULTS

Mycelial growth of *Sclerotinia minor*. Within 96 hr, mycelium of *S. minor* covered the surface of petri plates containing nonamended PDA; no growth was observed on agar containing 0.25 μg/ml procymidone. After 288 hr of incubation, the mean colony diameter in plates containing procymidone at 0.25, 0.50, 1.0, 2.0, and 4.0 μg/ml was 31, 26, 15, 7, and 0 mm, respectively. Similar growth was recorded for 20 isolates of *S. minor* collected from several different locations.

Severity of Sclerotinia blight. At all test sites, Sclerotinia blight was severe in the untreated control plots (Table 1). Severity at harvest (October) was about four times greater in the untreated control plots than in procymidone-treated plots. Lower rates of procymidone also significantly reduced disease severity, especially when applied preventively (Table 2). Disease at harvest was almost nonexistent in plots receiving preventive sprays of procymidone totaling 2.24 kg a.i./ha or more. Procymidone applied on demand or when symptoms of Sclerotinia blight were readily discernible was less effective than preventive applications but was significantly superior to no treatment. Demand applications of procymidone at 1.12 kg a.i./ha were no more effective in reducing disease severity than preventive applications at 0.56 kg a.i./ha.

Peanut pod yield and value. Peanut pod yields were significantly greater in all procymidone-treated plots than in untreated control plots (Tables 1 and 2). Yields at three locations were 88% higher and value per hectare was 95% greater in plots receiving procymidone at a minimum of 2.24 kg a.i./ha than in control plots (Table 1). Yields in plots receiving procymidone at 0.84–1.68 and 2.24–4.48 kg a.i./ha were 91.5% and 153% higher, respectively, than those in control plots (Table 2). Crop value in the untreated control plots in Field C was $795/ha; value was 86% and 144% greater in plots receiving procymidone at 0.84–1.68 and 2.24–4.48 kg a.i./ha, respectively.

Isolation frequency of *Sclerotinia minor* from stored peanut seed. *Sclerotinia*

Table 1. The effect of procymidone on Sclerotinia blight of peanut at three locations in 1977 and 1978

Treatment	Disease index[v,w]			Crop[w]	
	August	September	October	Yield (kg/ha)	Value ($/ha)
1977 Field A					
None (control)	1.3 a	3.4 a	3.9 a	3,157 a	1,363 a
Procymidone[x]	1.0 a	1.1 b	1.1 b	5,987 b	2,727 b
1978 Field A					
None (control)	1.6 a	2.4 a	3.9 a	2,173 a	982 a
Procymidone[y]	1.0 b	1.0 b	1.0 b	4,466 b	2,033 b
1978 Field B					
None (control)	1.5 a	2.5 a	3.8 a	2,478 a	1,124 a
Procymidone[z]	1.0 b	1.1 b	1.0 b	4,258 b	1,988 b

[v] Disease index on a scale of increasing severity from 1 (no disease) to 5 (death of plant).
[w] Within each field and column, means followed by a common letter do not differ significantly at the 5% level according to Duncan's multiple range test.
[x] Four applications of 1.12 kg a.i./ha (total 4.48 kg a.i./ha).
[y] Five applications of 1.12 kg a.i./ha (total 5.60 kg a.i./ha).
[z] Four applications of 0.56 kg a.i./ha (total 2.24 kg a.i./ha).

Table 2. Effect of various rates and times of application of procymidone on Sclerotinia blight of peanuts in Field C in 1978

Treatment	Procymidone (kg a.i./ha)		Disease index[x,y]				Crop[y]	
	Per application	Total[w]	7 August	28 August	15 September	27 September	Yield (kg/ha)	Value ($/ha)
None (control)	0.00	0.00	1.5 b	3.1 a	3.8 a	4.3 a	1,669 a	795 a
Procymidone	0.28	0.84	1.2 c	1.5 d	1.5 d	1.8 d	3,493 cd	1,635 cd
Procymidone	0.28	1.12	1.1 c	1.4 d	1.8 c	2.1 c	3,171 c	1,465 c
Procymidone	0.56	1.68	1.0 d	1.2 e	1.4 e	1.9 d	3,461 c	1,591 c
Procymidone	0.56	2.24	1.0 d	1.0 f	1.1 f	1.2 e	4,394 f	2,035 e
Procymidone (demand)[z]	0.56	1.12	1.5 b	1.7 c	2.0 b	2.8 b	2,660 b	1,223 b
Procymidone	1.12	3.36	1.0 d	1.0 f	1.0 f	1.1 f	4,298 ef	1,956 e
Procymidone	1.12	4.48	1.0 d	1.0 f	1.0 f	1.0 f	4,262 ef	1,924 e
Procymidone (demand)[z]	1.12	2.24	1.7 a	1.9 b	1.3 e	1.8 d	3,905 de	1,840 de

[w] In two, three, or four applications.
[x] Disease index on a scale of increasing severity from 1 (no disease) to 5 (death of plant).
[y] Within each column, means followed by a common letter do not differ significantly at the 5% level according to Duncan's multiple range test.
[z] Demand applications made 7 August and 4 September.

Table 3. Number of sclerotia of *Sclerotinia minor*[a] in 100 g of soil at three locations

Treatment	Field A		Field B		Field C	
	June	Oct.	June	Oct.	June	Oct.
None (control)	1.2	10.5	2.1	10.5	1.6	12.8
Procymidone[b]	1.2	2.5	2.1	2.7	1.6	1.8

[a]Number retained on a 40-mesh sieve.
[b]2.24 kg a.i./ha.

minor was isolated from 1.3 to 3.0% of seeds from untreated control plants during a 6-mo storage period. The fungus was not isolated from seeds from plants treated with procymidone (2.24 kg a.i./ha).

Populations of sclerotia in the soil. Sclerotia of *S. minor* were isolated infrequently (about 2 sclerotia/100 g of soil) from soil from all field sites during the early part (June) of the growing season (Table 3). However, by the end of the growing season (October), the number of sclerotia isolated from soil of untreated control plots had increased about fivefold, whereas the number isolated from soil of procymidone-treated (2.24 kg a.i./ha) plots remained almost constant.

DISCUSSION

Procymidone gave excellent control of Sclerotinia blight of peanuts under severe disease conditions, especially when applied preventively (Tables 1 and 2). This fungicide, applied directly to peanut foliage at low pressure (206,844 kPa), thus can control a soilborne fungus that is most active at the soil surface (5). Such application eliminates the need for special application equipment, because control does not depend on direct placement of the fungicide on the soil surface.

Procymidone has other desirable properties. First, *Sclerotinia minor* was isolated from about 2% of the seed from untreated control plants but was not isolated from seed from procymidone-treated plants, suggesting that use of procymidone can minimize *S. minor* contamination of peanut fields. Second, because the number of sclerotia in procymidone-treated areas did not increase during the growing season, continued use of this fungicide could conceivably reduce the threshold of sclerotia for more than 1 yr to levels at which disease severity would be minimal even without fungicide treatment.

Losses actually caused by a single plant disease are usually difficult to assess. Overall losses due to Sclerotinia blight of peanut in 1978 in Virginia were estimated at 7%. Losses can be estimated from the weight of pods left in the soil after harvest of plants severely infected with *S. minor*. Where peanut fields had severe Sclerotinia blight, actual pod losses sometimes exceeded 2,000 kg/ha (7). In this study, procymidone almost completely controlled Sclerotinia blight of peanuts and could be used in estimating actual losses from this disease. Yields in plots treated preventively with procymidone averaged 2,218 kg/ha, or 112% more than yields from untreated plots (Tables 1 and 2). In view of the potential damage to peanuts from *S. minor*, the lack of resistant varieties (6), and the lack of effective fungicides (1), attempts should be made to make procymidone or closely related fungicides available to growers.

LITERATURE CITED

1. BEUTE, M. K., D. M. PORTER, and B. A. HADLEY. 1975. Sclerotinia blight of peanut in North Carolina and Virginia and its chemical control. Plant Dis. Rep. 59:697-701.
2. KOHN, L. M. 1979. A monographic revision of the genus *Sclerotinia*. Mycotaxon 9:365-444.
3. PHIPPS, P. M., and D. M. PORTER. 1979. Control of Sclerotinia blight of peanut in Virginia with fungicides, 1978. Fungicide and Nematicide Tests 34:94.
4. PORTER, D. M. 1978. Control of Sclerotinia blight of peanuts with DPX 4424. (Abstr.) Proc. Am. Peanut Res. Educ. Assoc., Inc. 10:52.
5. PORTER, D. M., and M. K. BEUTE. 1974. Sclerotinia blight of peanuts. Phytopathology 64:263-264.
6. PORTER, D. M., M. K. BEUTE, and J. C. WYNNE. 1975. Resistance of peanut germplasm to *Sclerotinia sclerotiorum*. Peanut Sci. 2:78-80.
7. PORTER, D. M., N. L. POWELL, and P. R. COBB. 1977. Severity of Sclerotinia blight of peanuts as detected by infrared aerial photography. Peanut Sci. 4:75-77.
8. PORTER, D. M., and N. L. POWELL. 1978. Sclerotinia blight development in peanut vines injured by tractor tires. Peanut Sci. 5:87-90.
9. U.S. DEP. AGRIC., AGRIC. MKTG. SERV. 1973. Farmers stock peanut inspection instructions. Washington, DC. 37 pp.