Southern Stem Rot Suppression On Peanut With The Insecticide Chlorpyrifos[1]

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ABSTRACT

Chlorpyrifos 15G (2.24 kg a.i./ha), PCNB 10G (11.2 kg a.i./ha), and PCNB 10G + chlorpyrifos 15G (11.2 + 2.24 kg a.i./ha) were compared for the suppression of southern stem rot caused by *Sclerotium rolfsii* Sacc. on peanut in on-farm trials on nine farms over three years (1982-1984). Chlorpyrifos, PCNB, and PCNB + chlorpyrifos significantly reduced loci counts all three years. PCNB + chlorpyrifos generally gave the best stem rot suppression and yield response, but there was little difference in disease loci counts between chlorpyrifos and PCNB. PCNB significantly increased yield over the control two years while chlorpyrifos increased yield only one year.

Key Words: *Arachis hypogea,* groundnut, white mold, Lorsban, Terraclor.

Non-target antifungal activity of insecticides against the soilborne fungus *Sclerotium rolfsii* Sacc. which causes southern stem rot of peanut has been documented (1, 4, 8, 9). The insecticide/nematicide ethroprop and fensulfothion inhibited growth of *S. rolfsii,* but did not provide effective season-long protection from southern stem rot on peanut in field trials (8, 9). The combination of the fungicide PCNB with either ethroprop or fensulfothion did significantly reduce stem rot damage and increased yield over PCNB alone (5, 11).

Backman and Hammond (1) noted that insecticidal rates of the emulsifible concentrate (4EC) formulation of chlorpyrifos reduced stem rot damage as effectively as recommended fungicides. Suppression of *S. rolfsii* growth *in vitro* with the formulated product, but not the active or inert ingredients alone, suggested a synergism between the two components of the 4EC chlorpyrifos formulation. Csinos (3) reported that 3, 5, 6-trichlor-2-pyridinol, a hydrolysis product of chlorpyrifos, was more active *in vitro* against *S. rolfsii* than technical or commercial formulations of chlorpyrifos. In field trials, granular (15G) and emulsifible concentrate chlorpyrifos failed to significantly reduce disease activity on peanut (3). Shew (10) also did not observe a reduction in stem rot loci counts in plots treated with granular chlorpyrifos alone or in combination with oxycarboxin, propiconazole, or PCNB.

Results of a preliminary study (6) have shown that granular chlorpyrifos not only reduced southern stem rot damage on peanut but also increased yield. This report describes results of on-farm trials designed to further evaluate southern stem rot suppression on peanut with chlorpyrifos and compare its activity with that of PCNB and PCNB + chlorpyrifos.

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Materials and Methods

Field plots were established at three locations per year for three years, each with a history of southern stem rot. The peanut variety Florunner was planted at each site in early May. Fertility, insect, weed, and leafspot control recommendations of the Alabama Cooperative Extension Service were followed at all sites. The experimental design was a split-plot with each location as whole plots and individual treatments as sub-plots. Treatments were arranged in a randomized complete block with a full four to six replications at each location. Plots were two rows 0.9 m apart by 24.7 m long.

Chemicals evaluated for southern stem rot control at each site were PCNB 10G at 11.2 kg a.i./ha, chlorpyrifos 15G at 2.24 kg a.i./ha, and PCNB 10G + chlorpyrifos 15G at 11.2 + 2.24 kg a.i./ha applied separately to the same plots. Chlorpyrifos 15G and PCNB 10G were supplied by Dow Chemical USA, Midland, Mich., and Uniroyal Chemical, Raleigh, N.C., respectively. Treatments were applied approximately 80 to 90 days after planting with a tractor mounted 4-row Gandy applicator delivering a 25-cm band centered over the row. Counts of disease loci (1 locus 27< 30 cm of dead or stem rot damaged plants in a row) were made after the peanuts were inverted as described by Rodriguez-Kabana *et al.* (7). Plots were dug about 140 days after planting and harvested with a field combine five to seven days later. Pod yields were adjusted at 10% moisture. The significance of treatment effects across all locations for a single year was tested by analysis of variance and Duncan's Multiple Range Test.

Results

Southern stem rot of peanut was significantly reduced by all treatments compared to the untreated control in 1982 (Table 1). However, significant differences in the number of disease loci between chemical treatments were not detected. Fewest disease loci were noted in the PCNB and PCNB + chlorpyrifos-treated plots. Yield in the PCNB and chlorpyrifos-treated plots, although higher than the control, were not significantly different. The PCNB + chlorpyrifos combination yielded significantly higher than chlorpyrifos or PCNB alone. Non-significant site x treatment interactions for disease loci ($P<0.12$) and yield ($P<0.36$) indicated that the treatments behaved similarly at all 1982 locations.

In 1983, significantly fewer disease loci were recorded in the treated plots than the untreated control (Table 1). Chlorpyrifos and PCNB were equally effective in reducing stem rot damage. However, PCNB + chlorpyrifos provided significantly better disease suppression than either PCNB or chlorpyrifos used alone. Yield was significantly higher in the treated than untreated plots. PCNB + chlorpyrifos clearly provided the best yield response. Yields in the PCNB-treated plots were quite similar to those in plots treated with chlorpyrifos. A significant location x treatment interaction for disease loci ($P<0.023$) showed that treatments did not respond similarly across all 1983 locations. The location x treatment interaction for yield ($P<0.77$) was not significant.

The number of stem rot loci in 1984 was significantly reduced by all treatments (Table 1). Once again, the PCNB + chlorpyrifos combination more effectively suppressed

Table 1. On-farm evaluation of chlorpyrifos, PCNB, and PCNB + chlorpyrifos for suppression of stem rot caused by *S. rolfsii* on peanut.

Treatment	1982 Rate (kg a.i./ha)	Disease Loci (no./30.4 m row)	Yield (kg/ha)
chlorpyrifos 15G	2.24	10.7 B*	4161 B
PCNB 10G	11.2	8.4 B	4163 B
PCNB 10G + chlorpyrifos 15G	11.2 + 2.24	8.6 B	4494 A
control	--	16.9 A	3883 B

Treatment	1983 Rate (kg a.i./ha)	Disease Loci (no./30.4 m row)	Yield (kg/ha)
chlorpyrifos 15G	2.24	6.2 B	4745 B
PCNB 10G	11.2	5.8 B	4690 B
PCNB 10G + chlorpyrifos 15G	11.2 + 2.24	3.1 C	5025 A
control	--	12.1 A	4308 C

Treatment	1984 Rate (kg a.i./ha)	Disease Loci (no./30.4 m row)	Yield (kg/ha)
chlorpyrifos 15G	2.24	10.5 B	3296 B
PCNB 10G	11.2	9.3 B	3650 A
PCNB 10G + chlorpyrifos 15G	11.2 + 2.24	5.3 C	3842 A
control	--	17.8 A	3225 B

*Mean separation within columns according to Duncan's Multiple Range Test (P = 0.05).

stem rot than either material alone. Little difference in disease loci counts were found between chlorpyrifos and PCNB. However, chlorpyrifos failed to increase yield over the untreated control despite effective stem rot suppression. PCNB alone or in combination with chlorpyrifos significantly outyielded both chlorpyrifos and the untreated control. A significant location x treatment interaction for disease loci ($P<0.04$) and yield ($P<0.002$) shows that the treatments were not ranked the same across all locations.

Discussion

Chlorpyrifos consistently reduced southern stem rot damage on peanut. Numbers of disease loci were significantly lower each year in the chlorpyrifos treated plots compared to the control from 1982 through 1984. Stem rot suppression noted in these trials with the granular formulation of chlorpyrifos was similar to that reported by Backman and Hammond (1) using the emulsifible concentrate formulation. These results clearly contradict Csinos (3) and Shew *et al.* (10) who have found no significant reduction of disease activity with either chlorpyrifos formulation. No explanation other than experimental design account for the different results obtained with chlorpyrifos in each of these studies.

Yield response in the chlorpyrifos-treated plots was erratic despite a reduction of stem rot damage each year. Only in 1983 did chlorpyrifos significantly increase yield over the control. Sizable but not significantly yield differences between chlorpyrifos and the control were observed in 1982. Csinos (3) also reported slight but non-significant yield increase with granular and emulsifible concentrate chlorpyrifos applied at pegging compared to the control. Shew *et al.* (10) working in North Carolina noted that significant stem rot suppression with fungicides did not always translate into significantly higher yield.

Generally, stem rot suppression with chlorpyrifos and PCNB was quite similar. Disease loci counts did not differ significantly between these two treatments at any time. Backman and Hammond (1) obtained similar results with 4EC chlorpyrifos and PCNB. Except for 1984, yield in PCNB and chlorpyrifos-treated plots were also quite similar. PCNB provided more consistent stem rot suppression and yield response than previously reported (3, 10, 11).

Fungicide-insecticide combinations have always been quite effective against stem rot, and the PCNB + chlorpyrifos combination has proven to be no exception (3, 5, 11). This combination not only reduced disease damage but also increased yield significantly over PCNB or chlorpyrifos alone. Similar results with this fungicide-insecticide combination have been reported by Csinos (3).

In summary, chlorpyrifos suppressed southern stem rot on peanut as effectively as the fungicide PCNB but did not always significantly increase yield. No unusual problems were found in the chlorpyrifos-treated plots to account for its failure to increase pod yields. Inconsistent yield response with chlorpyrifos reduces its values to peanut producers facing severe southern stem rot problems. However, granular chlorpyrifos remains an attractive alternative to PCNB on dryland peanuts due to its lower cost per acre and unique combination of activity against lesser corn stalk borer (2) and other soil insects as well as southern stem rot.

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