# Effect of Placement and Rate of PCNB and PCNB + Ethoprop On The Control Of Southern Stem Rot Of Peanut[1]

A. K. Hagan*, J. R. Weeks, and K. Bowen [2]

**ABSTRACT**

Pentachloronitrobenzene (PCNB) 10G and PCNB + ethoprop 10-3G applied on 10-cm (narrow) and 25-cm (wide) band widths, respectively, were evaluated for the control of southern stem rot (*Sclerotium rolfsii*) and impact on yield of peanut. On-farm evaluations with PCNB were done in 1988 to 1990, while PCNB + ethoprop and diniconazole 25W were tested in 1989 and 1990. Narrow band width (10-cm) applications of the 5.6 kg a.i./ha rate of PCNB significantly reduced disease and increased yield all three years compared to the control; the 11.2 kg a.i./ha rate applied on the wide band width (25-cm) reduced stem rot incidence two of three years. The narrow and wide band width applications of PCNB + ethoprop at 5.6 + 1.7 kg a.i./ha and 11.2 + 3.3 kg a.i./ha resulted in reduced southern stem rot incidence and higher yields than the control. Disease control and yield response with PCNB + ethoprop were similar to those in plots treated with PCNB on the narrow and wide band widths. Diniconazole 25W, which was broadcast twice at 0.28 kg a.i./ha in 1989 and 1990, gave better disease control and higher yields than PCNB and PCNB + ethoprop only one of two years.

Key Words: *Arachis hypogaea, Sclerotium rolfsii*, groundnut, white mold, Terraclor, Terraclor + Mocap, Spotless, quintozene.

Pentachloronitrobenzene (PCNB) has been used for the control of southern stem rot caused by *Sclerotium rolfsii* L. with moderate success for nearly three decades. In previous studies (2, 3, 4, 7, 8, 12), reductions of the incidence of southern stem rot with the recommended 11.2 kg a.i./ha rate of the 10% granular formulation of PCNB have averaged about 50%. When formulated with an organophosphate insecticide/nematicide, the efficacy of PCNB for the control of southern stem rot and subsequent yield response often has been significantly improved (2, 3, 7, 12).

Recent grower concerns about efficacy, cost, and availability of this fungicide have greatly reduced the acreage of peanuts treated with PCNB or PCNB + insecticide/nematicide combination products. Concentrating the fungicide around the plant crown where infections by *S. rolfsii* usually start may decrease the rate of PCNB required for effective stem rot control, thereby greatly lowering treatment costs. Csinos (3) demonstrated that narrow band width (10-cm) applications of 5.6 kg a.i./ha of PCNB directed over the plant crown proved equally effective in controlling southern stem rot in irrigated plots inoculated with *S. rolfsii* as the recommended 11.2 kg a.i./ha rate applied on a 25-cm band width.

[1]Journal Article no. 18-912921P of the Alabama Agricultural Experiment Station. This study was funded in part by the Alabama Peanut Producers Association.

[2]Extension Plant Pathologist-Associate Professor, Department of Plant Pathology; Extension Entomologist-Associate Professor, Department of Entomology, and Assistant Professor, Department of Plant Pathology, Alabama Agricultural Experiment Station and Alabama Cooperative Extension Service, Auburn University, AL 36849.

*Corresponding author.

Similar control of southern stem rot and yield response were obtained with a narrow band width application of 5.6 + 1.7 kg a.i./ha of PCNB + ethoprop and the wide band application of the 11.2 + 3.4 kg a.i./ha rate of the same fungicide. These studies describe the results of trials conducted in commercial fields with indigenous *S. rolfsii* populations evaluating the impact of placement and rate on the efficacy of the granular formulations of PCNB and PCNB + ethoprop in controlling southern stem rot of peanut.

## Material and Methods

Plots were established in five, four, and three commercial production fields in 1988, 1989, and 1990, respectively, with a history of southern stem rot. In all fields, a rye (*Secale cereale* L.) cover crop was turned under with a moldboard plow prior to planting peanuts (*Arachis hypogaea* L.) cv. Florunner over a three-week period in late April to early May. All fields were fallowed, or planted to corn (*Zea mays* L.) or grain sorghum (*Sorghum bicolor* L.) the year before peanuts were grown. Soil types in all fields were either an Orangeburg fine sandy loam (fine-loamy, siliceous, thermic Typic Palendults) or Dothan sandy loam (fine-loamy, siliceous thermic *Plinthic Plaendults*). Tillage, fertility, weed, insect, and leafspot control recommendations of the Alabama Cooperative Extension Service were followed by all cooperators (6). Plots at each location consisted of two 15.2-m-long rows spaced 0.9 m apart. Treatments were randomized in four complete blocks.

PCNB 10G (Uniroyal Chemical, Raleigh, NC) at 5.6 and 11.2 kg a.i./ha was evaluated for southern stem rot control from 1988 through 1990, while PCNB + ethoprop 10-3G (Uniroyal Chemical, Raleigh, NC) at 5.6 + 1.7 and 11.2 + 3.4 kg a.i./ha and diniconazole 25W (Valent USA, Richmond CA) at 0.28 kg a.i./ha were tested only in 1989 and 1990. Both granular fungicides were applied approximately 80 days after planting (growth stage R5-R6 (1) with a two-row Gandy applicator mounted on an all terrain vehicle. The 5.6 kg a.i./ha rate of both PCNB and PCNB + ethoprop were applied by centering the drop tube directly over the row center on an effective band width of 10-cm; a 12.5-cm band attachment was used to apply the full 11.2 kg a.i./ha rate of PCNB and PCNB + ethoprop on a 25-cm band width. Diniconazole 25W broadcast twice in 1989 and 1990 using a standard leafspot spray equipment with three D2-25 hollow cone nozzles (Spray Systems, Wheaton, IL) per row at a spray volume of 140 l/ha at growth stage R5 and R6 (1). The Spray adjuvant X-77 (0.25% v/v) (Valent USA, Richmond, CA) was tank-mixed with dinoconazole.

Counts of southern stem rot loci (1 locus was defined as ≤ 30 cm of consecutive stem rot damaged plants in a row (10)) were made after the peanuts were inverted. Plots were harvested 2 to 7 days later and yields adjusted to 10% moisture.

Data from treatments that were similar between sites and years were analyzed as a split plot with sites* year as the largest experimental unit. Analysis of variance was performed on counts of southern stem rot loci and yield data for all sites each year of the study and pooled for 1989 and 1990. For 1988 through 1990, the interaction between site, treatments, and year were found to be significant ($P<0.05$). Significance of treatment effects were tested with Fisher's protected least significance difference (LSD) test (11).

## Results

Incidence of southern stem rot in 1988 was sigificantly reduced by the 5.6 and 11.2 kg a.i./ha rates of PCNB applied on 10 and 25-cm band widths, respectively, as compared to the non-treated control (Table 1). Consistent differences in disease incidence did not occur between the different band width-PCNB rate treatments. Disease loci counts in all PCNB-treated plots generally were 50% of those recorded in the non-treated control.

Yields were significantly improved with all fungicide treatments in all comparisons except one (Table 1). Although no differences in disease control were obtained with the PCNB treatments, yields in the plots treated with the reduced rate of PCNB applied on a narrow band width were significantly higher than those receiving the full rate. Non-significant site* treatment interactions for disease incidence ($P<0.47$) and yield ($P<0.77$) indicate that treatments behaved similarly across all sites.

In 1989, significant reductions in southern stem rot incidence were recorded in all fungicide treatments compared with the non-treated control, except those receiving the full rate of PCNB at the wider band width (Table 1). Similar numbers of disease loci were observed in the plots treated with PCNB and PCNB + ethoprop. Differences in the numbers of stem rot loci noted between the reduced rates on a narrow band and full rates on a wide band width of both PCNB and PCNB + ethoprop were not significant. Treatment with diniconazole gave significantly better disease control than all other treatments.

That same year, yield was significantly higher in all treated plots than that of the non-treated control, with the exception of the plots receiving the full rate of PCNB on a wide band (Table 1). Similar yield was obtained in the plots treated with both rates of PCNB and PCNB + ethoprop. Treatment with PCNB + ethoprop did not result in a better yield than the corresponding rate of PCNB alone. Diniconazole yielded significantly higher than all fungicide treatments except the reduced rate of PCNB + ethoprop. The interaction term of treatment*site was not significant for disease loci ($P<0.30$) and yield ($P<0.24$), thereby permitting combination of data across sites.

Severe drought conditions in August and September 1990 were responsible for a reduction in southern stem rot below

**Table 1. Comparison of Application Rates and Placement of PCNB on the Control of Southern Stem Rot and Impact on Peanut Yield in 1988, 1989, and 1990.**

| Treatment | Rate kg a.i./ha | Band Width | 1988 Disease Loci no./30 m row* | 1988 Yield kg/ha* | 1989 Disease Loci no./30 m row | 1989 Yield kg/ha* | 1990 Disease Loci no./30 m row | 1990 Yield kg/ha* |
|---|---|---|---|---|---|---|---|---|
| PCNB 10G | 11.2 | 25 cm | 5.8 | 3972 | 10.0 | 4158 | 4.2 | 4120 |
| PCNB 10G | 5.6 | 10 cm | 6.7 | 4385 | 7.3 | 4407 | 5.1 | 4114 |
| PCNB + ethoprop 10-3G | 11.2 + 3.3 | 25 cm | - | - | 6.2 | 4409 | 4.1 | 4120 |
| PCNB + ethoprop 10-3G | 5.6 + 1.7 | 10 cm | - | - | 6.4 | 4451 | 3.1 | 4116 |
| Diniconazole 25W | 0.28 | Broadcast | - | - | 1.3 | 4764 | 2.3 | 4250 |
| Non-treated Control | - | | 12.4 | 3567 | 14.2 | 4017 | 9.8 | 3746 |
| LSD (P=0.05) | | | 2.0 | 309 | 4.6 | 319 | 2.4 | 253 |

*Significance of treatment effects within columns were tested by Fisher's protected least significance difference (LSD) test (11).

levels seen the previous two years. In that year, stem rot incidence was significantly reduced by all fungicide treatments compared with the non-treated control (Table 1). The reduced rates of PCNB and PCNB + ethoprop proved equally effective in reducing disease as the full rates of both fungicides. The level of disease control obtained with diniconazole was similar to that noted with the reduced rate of PCNB at a narrow band width and both rates of PCNB + ethoprop but not the full rate of PCNB applied on a wide band.

Yield was significantly increased in all fungicide-treated plots compared with that of the non-treated control (Table 1). No differences in yield were recorded between the reduced and full rates of both PCNB and PCNB + ethoprop applied on a narrow and wide band width, respectively. Plots treated with the reduced and full rates of PCNB did not differ in yield from those receiving comparable rates of PCNB + ethoprop. In addition, yield in the diniconazole-treated plots were similar to those in the plots treated with PCNB or PCNB + ethoprop. Treatment mean rankings across sites for disease incidence ($P<0.11$) and yield ($P<0.22$) were similar, therefore data for both parameters were combined across all sites.

Further comparisons of disease control and yield response between the reduced and full rates of PCNB and PCNB +ethoprop can be made pooling the data collected over the final two years of this study. Across 1989 and 1990, both rates of PCNB and PCNB + ethoprop applied on a narrow and wide band width generally were equally effective in reducing the numbers of stem rot loci and increasing yield compared with the non-treated control (Table 2). Fewest numbers of disease loci and the highest yield were again recorded in the diniconazole-treated plots. Non-significant site* treatment (year) interactions for disease incidence ($P<0.08$) and yield ($P<0.25$) allow treatment comparison across years.

## Discussion

Placement of reduced rates of PCNB and PCNB + ethoprop on a narrow, 10-cm band width gave comparable control of southern stem rot each year as the recommended rates applied on the wider 25-cm band width. Our results concur with those obtained by Csinos (3) that the level of disease control obtained with reduced and recommended rates of either PCNB or PCNB + ethoprop was similar. In addition significant reductions in disease incidence were generally obtained with both treatments of PCNB and PCNB + ethoprop as compared with the controls. Csinos (3) obtained a significant reduction in the incidence of southern stem rot with the reduced or recommended rates applied on narrow and wide band widths, respectively, of PCNB + ethoprop but not with PCNB alone. Efficacy of the recommended rates of PCNB and PCNB + ethoprop for the control of southern stem rot concurred with the results obtained in previous studies (2, 4, 7, 8, 12).

Despite similar disease control, yields in the plots treated wih the reduced rate of PCNB applied on a narrow band were significantly higher two of three years than those treated with the recommended rate of the same fungicide applied on wider band width. No differences in yield response of these two treatments were seen in the pooled results. Csinos (3) also obtained significantly higher yields with the reduced rate of PCNB applied on a 10-cm band compared with the control, but not with the recommended rate of the same fungicide. However, both band widths proved equally effective in this study in increasing yield. Results of this study confirm those of Csinos (3) that both PCNB + ethoprop treatments significantly increased yield over that in the control. Similar results to those in this study with the recommended rates of PCNB + ethoprop have been previously reported (8). As noted in a previous study by Hagan *et al.* (8), the additive increases in yield obtained in other studies (2, 3, 7, 12) with PCNB plus an organophosphate insecticde/nematicide over PCNB alone again were not observed.

Diniconazole was included in this study in order to compare its effectiveness with that of reduced rates of PCNB and PCNB + ethoprop applied on narrow band widths. Results of this study generally agree with others (3, 5, 9) that foliar applications of diniconazole have excellent efficacy against southern stem rot of peanut and offer better yield potential than registered fungicides.

In summary, reduced rates of PCNB and PCNB + ethoprop applied on a narrow band width consistently reduced the incidence of southern stem rot on peanuts as effectively as recommended rates of both products at the wide band width, compared with the control. Yield response with these two treatments was also similar to those obtained with the recommended rates of PCNB and PCNB + ethoprop at the wide band. Based on the results of these and a second study (3), a 24c label for narrow band width (10-cm) aplications of 5.6 kg a.i./ha rate of the granular formulation (10G) of PCNB for Alabama was approved in 1990.

**Table 2. Effect of Rates and Placement of PCNB and PCNB + ethoprop, and diniconazole on Southern Stem Rot Incidence and Peanut Yield in Alabama from 1988 to 1990.**

| Treatment | Rate (kg a.i./ha) | Band Width | Disease Loci no./30 m row | Yield Kg/A* |
|---|---|---|---|---|
| PCNB 10G | 11.2 | 25 cm | 7.3 | 4340 |
| PCNB 10G | 5.6 | 10 cm | 6.2 | 4304 |
| PCNB + ethoprop 10-3G | 11.2 + 3.3 | 25 cm | 5.1 | 4307 |
| PCNB + ethoprop 10-3G | 5.6 + 1.7 | 10 cm | 4.8 | 4327 |
| Diniconazole 25W | 0.28 | Broadcast | 1.8 | 4726 |
| Control | | | 12.0 | 4067 |
| LSD (P = 0.05) | | | 2.3 | 181 |

*Significance of treatment effects were tested by Fisher's protected least significance difference (LSD) test. (11).

## Literature Cited


1. Boote, K. J. 1982. Growth stages of peanut (*Arachis hypogaea* L.). Peanut Sci. 9:35-40.
2. Csinos, A. S. 1984. Evaluation of the insecticide chlorpyrifos for activity against southern stem rot of peanut. Peanut Sci. 11:98-102.
3. Csinos, A. S. 1989. Targeting fungicides for control of southern stem rot on peanut. Plant Dis. 73:723-726.
4. Csinos, A. S., D. K. Bell, N. A. Minton, and H. D. Wells. 1983. Evaluation of *Trichoderma*, fungicides, and chemical combinations for control of southern stem rot on peanut. Peanut Sci. 10:75-79.
5. Csinos, A. S., C. S. Kvien, and R. H. Littrell. 1987. Activity of diniconazole on foliar and soil-borne diseases of peanut. Appl. Agric. Res. 2:113-116.
6. French, J. C., J. R. Weeks, A. K. Hagan, and J. W. Everest. 1990. Peanut Pest Management. Ala. Coop. Ext. Ser. Cir. ANR-360, 11 pp.
7. Hagan, A. K., J. R. Weeks, and R. B. Reed. 1986. Southern stem rot suppression on peanut with the insecticide chlorpyrifos. Peanut Sci. 13:36-37.
8. Hagan, A. K., J. R. Weeks, and J A. McGuire. 1988. Comparison of soil insecticides alone and in combination with PCNB for suppression of

southern stem rot of peanut. Peanut Sci. 15:35-38.

9. Kvien, C. S., A. S. Csinos, L. F. Ross, E. J. Conkerton, and C. Styer. 1987. Diniconazole's effect on peanut (*Arachis hypogaea* L.) growth and development. J. Plant Growth Regul. 6:233-244.
10. Rodriguez-Kabana, R., P. A. Backman, and J. C. Williams. 1975. Determination of yield losses to *Sclerotium rolfsii* in peanut fields. Plant Dis. Rep. 59:855-858.
11. SAS Institute. 1987. SAS/STAT Guide for Personal Computers, Version 6 Edition. Cary, N. C.: SAS Institute Inc. 987. 1028 pp.
12. Thompson, S. S. 1978. Control of southern stem rot of peanuts with PCNB plus fensulfothion. Peanut Sci. 5:49-52.

Accepted July 13, 1991