# Suppression of *Thielaviopsis basicola* by Two Fungicides Applied to Sandy Loam Soils in New Mexico

DAVID C. H. HSI, Professor of Plant Pathology, New Mexico State University, Middle Rio Grande Branch Station, Los Lunas 87031; and MELCHOR ORTIZ, JR., Assistant Professor of Experimental Statistics, New Mexico State University, Las Cruces 88003

**ABSTRACT**

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Populations of *Thielaviopsis basicola* in soil were suppressed by adding benomyl (1.7 kg a.i./ha) or thiophanate-methyl (3.2 kg a.i./ha) to alkaline sandy loam soils near Portales, NM. Both fungicides suppressed *T. basicola* but not *Fusarium* spp. Recoveries of *T. basicola* did not differ by month during the growing season. There was also no appreciable seasonal buildup of inoculum in any of the four fields during 1974-1976. Populations of *T. basicola* were higher in 1975 and 1976 than in 1974, but those of *Fusarium* spp. did not differ during the 3 yr. The incidence of blackhull (defined as more than 25% of the shell area discolored) was reduced from 55% to 16–31% in 1974 and from 28–44% to 10–25% in 1975 and 1976 by treatment with the fungicides.

The hulls of Valencia peanut plants (*Arachis hypogaea* L. subsp. *fastigiata* Waldron var. *fastigiata*) growing near Portales in eastern New Mexico have commonly been discolored since 1963 (3,7). Isolations from the affected fruit have repeatedly and predominantly yielded *Thielaviopsis basicola* (Berk. & Br.) Ferraris and *Fusarium* spp. (3,7).

Applications of benomyl or thiophanate-methyl to the planting row during seeding have been effective against the black root rot of citrus, tobacco, poinsettia, and beans and the blackhull of peanuts (1,2,4,6,8–10). Papavizas et al (8) found that several fungicides were effective against black root rot of beans and tobacco. In their tests (8) MSNB (2-methylsulfonyl-VI-nitrobonzothiazole) reduced the inoculum potential of the pathogen in soil, but benomyl did not change its density appreciably. Although considerable work has been done with benomyl and thiabendazole on other pathogens, little if anything is known of the mechanism of these materials on *T. basicola*. Determination of the persistence of *T. basicola* in the fruiting zone of peanuts is essential to understanding the incidence of infection. Furthermore, such understanding of population dynamics of *T. basicola* is helpful in predicting disease losses.

The purpose of this work was to determine the persistence of *T. basicola* in field soil where peanuts are grown and to evaluate the role of benomyl and thiophanate-methyl in suppressing *T. basicola* populations and the occurrence of blackhull.

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## MATERIALS AND METHODS

During 1974 to 1976, four experiments were conducted with fungicides on fields known to be infested with *T. basicola* near Portales, NM. The soils were sandy loams with pH slightly above 8.0 and were irrigated by furrow before and during the growing season, so that plants were never exposed to moisture stress. The fields were divided into four-row plots extending the length of the field (101 or 202 m). The soil was treated either with benomyl at 1.7 kg a.i./ha or with thiophanate-methyl at 3.2 kg a.i./ha applied in-furrow as a spray at planting time. Other plots were left untreated. Three to six replicates of each treatment were randomized in each block, depending on the width of the field.

Soil samples (approximately 100 g) were removed by a trowel to a depth of 10 cm from the center of each four-row plot toward the lower end of the irrigation flow. Samples were collected approximately each month from the time of planting (late May to June) until harvest in September and October. Samples from each row of each plot were mixed thoroughly and air-dried before sieving to assure a uniform blend. Fungal populations were assayed by the dilution plate technique, employing rose bengal M-2 agar (5,12).

Estimation of the incidence of blackhull was based on the percentage of fruits with more than 25% discoloration. Five random samples of 150 or more fruits each were taken from each plot at harvest and classified as discolored or free of infection.

The least significant differences between means were calculated for all factors having a significant F-value in the analysis of variance. A partial correlation coefficient was calculated to determine the degree of association between percentage of blackhull and number of propagules per gram of soil adjusted for

**Table 1.** Effect of in-furrow fungicidal soil treatment and time of sampling on populations of *Thielaviopsis basicola* and *Fusarium* spp., Portales, NM, 1974–1976

| Soil treatment | Rate (kg/ha) | Blackhull (%) | Propagules (no./g of soil)[a] | |
|---|---|---|---|---|
| | | | *T. basicola* | *Fusarium* spp. |
| Baker, 1974 | | | | |
| None | 0 | 58 | 557 | 2973 |
| Benomyl | 1.7 | 16 | 371 | 3078 |
| Thiophanate-methyl | 3.2 | 31 | 347 | 3334 |
| Gibson, 1974 | | | | |
| None | 0 | 51 | 569 | 2736 |
| Benomyl | 1.7 | 18 | 353 | 2782 |
| Thiophanate-methyl | 3.2 | 21 | 331 | 2820 |
| Gibson, 1975 | | | | |
| None | 0 | 28 | 649 | 2272 |
| Benomyl | 1.7 | 19 | 493 | 2944 |
| Thiophanate-methyl | 3.2 | 25 | 500 | 3143 |
| Baker, 1976 | | | | |
| None | 0 | 44 | 989 | 2678 |
| Benomyl | 1.7 | 11 | 578 | 2520 |
| Thiophanate-methyl | 3.2 | 10 | 657 | 2394 |
| Average | | | | |
| None | 0 | 45 | 691 | 2777 |
| Benomyl | 1.7 | 16 | 449 | 2831 |
| Thiophanate-methyl | 3.2 | 22 | 459 | 2925 |
| LSD $P = 0.05$ | | 15 | 103 | N.S. |

[a] Average of five monthly samplings from June to October. Each figure is an average of 450–900 plates or 15–30 replications of 30 plates each.

differences in year of observation, ie, the linear association was measured between these two variables each year (11).

## RESULTS

The populations of *T. basicola* and *Fusarium* spp. did not change significantly as the season progressed in each field. The monthly results for each treatment in a field were in such close agreement that all observations were pooled and the single figure was used as the record of population intensity for the treatment.

In individual plots, the populations of *T. basicola* ranged from 0 to 7,000 propagules per gram of soil and the *Fusarium* spp. from 0 to 9,000 propagules per gram of soil. Both fungicides consistently reduced the populations of *T. basicola* to about 60% of the control in all experiments (Table 1), but there was no evidence that either suppressed the *Fusarium* spp. Suppression of *T. basicola* propagules was significantly correlated with a reduction in blackhull ($r = 0.89$). No differences were observed between fungicides in different fields and different seasons. There was also no significant difference in number of propagules in different months or in treatments by months interaction. There were differences ($P<0.005$) in the fields, primarily in different years, and in the effect of treatment of *T. basicola* ($P<0.005$).

In-furrow chemical soil treatments at planting time had no effect on population of *Fusarium* spp. compared with the untreated plots. Monthly soil samplings during the growing seasons showed no significant changes in mean populations within the same treatment. Soil populations of *Fusarium* spp. in 1975 and 1976 were significantly higher than those in 1974. The two fields in 1974 had essentially the same number of propagules of *Fusarium* spp.

## DISCUSSION

Results from this study indicate that benomyl and thiophanate-methyl applied as in-furrow treatments reduced populations of *T. basicola* in field soils and lessened blackhull severity. These results substantiate previous work on benomyl soil drenches for control of *Thielaviopsis* root rot of poinsettia in greenhouse tests (6). Papavizas et al (8), however, reported that benomyl suppressed *T. basicola* root rot of bean without appreciably reducing inoculum density in soil and that MSNB drastically reduced both disease severity and inoculum. Citing previous findings, they suggested that benomyl might be converted in plants to methyl-2-benzimidazolecarbamate, a fungitoxic compound.

The soil populations of *T. basicola* differed among years. However, increases in mean populations in 1975 and 1976 did not result in higher incidences of blackhull than that in 1974 within the same treatment.

Benomyl and thiophanate-methyl effectively reduced blackhull severity and inoculum density of *T. basicola* but had no effect on soil populations of *Fusarium* spp. The role of *Fusarium* spp. on the peanut blackhull, if any, was insignificant.

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