# REPORT OF THE COTTONSEED TREATMENT COMMITTEE FOR 2001

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## Introduction

The 2001 National Cottonseed Treatment Program evaluated cotton seedling survival for a number of fungicide seed treatment combinations over diverse environmental conditions and levels and types of cotton seedling pathogens. Sixteen fungicide seed treatments were nominated by chemical industry representatives for evaluation in the 2001 National Cottonseed Treatment Program. A standard fungicide treatment, Vitavax-PCNB + Allegiance, and a nontreated control were included to assess efficacy of the nominations and seedling disease pressure. In addition, the fungicide treatments Allegiance or PCNB were included to aid in determining the importance of *Pythium* spp. or *Rhizoctonia solani*, respectively. Disease ratings and pathogen isolations for seedlings and soil populations of selected soilborne fungi were conducted by collecting seedlings and soil from the nontreated control plots at each location. Soil temperature and plant development data also were collected for sites for the 2001 National Cottonseed Treatment Program.

## Materials and Methods

### Fungicide Treatment

Acid-delinted seed of *Gossypium hirsutum* L., 'Sure-Grow 747' or 'Paymaster 2326 RR' (PM 2326 RR), were provided by Delta and Pine Land Company, Scott, MS. Sure-Grow 747 was planted at all locations, with the exception of locations in Oklahoma and the College Station and Lubbock sites in Texas, where the cultivar PM 2326 RR was planted. Fungicide treatments and dye (DayGlo EPX seed colorant, Gustafson Inc.) were mixed with water at a rate of 2.5% water to seed weight (v/w). Water and dye also were applied to the nontreated seed treatment at the same rate. Treatments were applied to the cottonseed while the seed tumbled in a rotating drum. When two or more fungicides were applied, the fungicides were mixed and applied in a single application. The technical information for the fungicides is given in Table 1. Seed germination was evaluated for all treated and nontreated seed by rolling seed in moistened germination paper and incubating at 30°C.

### Field Experiments

Eighteen field experiments were conducted by 17 cooperators across the U.S. Cotton Belt (Table 2). Each location utilized a randomized complete block experimental design, with the number of replications ranging from 4 to 10. The stand counts used in the analyses were taken from 23 to 34 days after planting, average 29 days, depending on the location. A soil sample and seedling sample from plots containing nontreated seed were taken from 27 to 37 days after planting, average 30 days, depending on the location. Soil and seedlings were placed in insulated packages with refrigerated cool packs and mailed overnight to the University of Arkansas for processing. A subsample of soil was sent to T. L. Kirkpatrick, Southeast Research and Extension Center, Hope, Arkansas, for determination of populations of plant parasitic nematodes. Soil temperature was monitored by burying a temperature sensor, tidbit (Onset Computer Corp, Pocasset MA), 10 cm. deep at planting.

Seedlings were evaluated for growth by recording the number of nodes from five arbitrarily selected seedlings and then the aboveground portions of all seedlings were removed and discarded. Approximately 50 seedlings per location were then rinsed for 20 minutes in running tap water and rated for disease symptoms. The hypocotyl disease severity index was 1=no symptoms, 2=few pinpoint lesions or diffuse discolored areas, 3=distinct necrotic lesion, 4=girdling lesion, and 5=seedling dead. The root disease index was 1=no symptoms, 2=1-10% of the root system discolored, 3=11-25% of the root system discolored, 4=26-50% of the root system discolored, and 5>50% of the root system discolored. Seedlings were surface disinfested by immersion for 1.5 min in 0.5% NaClO, blotted dry in a paper towel, and plated on water agar (2%) amended with 10 mg and 250 mg of the antibiotics rifampicin and ampicillin, respectively, and 0.5 ml of the miticide Danitol (Valent Chemical Co.) per liter. Resulting colonies were transferred to PDA and identified to genus. Seedlings were subsequently transferred to the Thielaviopsis selective medium TB-CEN (Specht and Griffin, 1985), which was modified by adding Penicillin G (60 mg/L), to determine isolation frequency for *Thielaviopsis basicola*. An additional set of seedlings were plated on the selective medium $P_5$ARP (Jeffers and Martin, 1986) following the 20 minute water rinse for some locations as another method to examine the isolation frequency for *Pythium* species.

Soil samples were assayed for populations of *Rhizoctonia* species by using the multiple-pellet soil method (Henis et. al., 1978), and Rhizoctonia populations were quantified on a modified Ko and Hora medium (Ko and Hora, 1971). Soil populations of *Pythium* spp. and *T. basicola* were detected by diluting 25 g of soil in 0.1% water agar to a total volume of

250 ml and placing on a wrist action shaker for 20 minutes. *Pythium* spp. were quantified by the spread plate method on the selective medium $P_5$ARP, and *T. basicola* populations were quantified using the pour plate method with the selective medium TB-CEN.

**Statistics**

Data were analyzed by the GLM procedure using SAS (SAS Institute Inc., Cary NC). Percent stand was analyzed over locations and by location. Treatment means were separated by using a protected LSD at $P$=0.05. The Pearson-product correlation method was used to examine the relationship among soil temperature, percent stand, plant growth, disease, pathogen isolation frequency, and soil populations over locations.

## Results and Discussion

After the seed were treated with the fungicide treatments, seed germination ranged from 88% to 98% for Sure-Grow 747, with an average germination of 94%. Six of the fungicide treatments increased germination slightly but significantly, >96% germination, compared to the nontreated seed treatment, 91% germination. Seed germination ranged from 85% to 94% for PM 2326 RR, with an average germination of 89%, after the seed were treated with the fungicide treatments.

For the 2001 National Cottonseed Treatment Program, 3 of the 18 sites were lost due to weather related problems. For the 15 locations reporting data for 2001, there was a significant location, treatment, and location x treatment effect (Table 3), indicating that the treatment response was dependent on the environmental or pathogen pressures for a particular location. A significant difference between treatments was found for 8 of the 15 locations (Table 4). In all of these experiments, at least one of the fungicide treatments performed better than the nontreated control. The Allegiance treatment increased stands compared to the nontreated control in 4 of the 8 experiments having a significant response compared to the nontreated control (CA, LA1, MS2, and VA), indicating the importance of *Pythium* spp. in stand establishment at these sites. In 2 of these 8 experiments (CA and GA), the PCNB treatment increased stands over the nontreated control, indicating the importance of *Rhizoctonia solani* in stand establishment at these sites. The Vitavax-PCNB + Allegiance standard fungicide treatment increased stands compared to the nontreated control in 7 of the 8 experiments (AR3, CA, GA, LA1, MS2, TN, and VA). The nominated treatments increased stands over the nontreated control from 12% of the sites (1 of 8 sites) to 100% of the sites (8 of 8 sites) depending on the treatment. Treatments giving increases in stand compared to the nontreated control at all 8 sites where a stand response was found were Apron XL-LS + Maxim 4FS + Nu-flow M and HM 9906. Seven treatments gave increased stands compared to the nontreated control in 7 of the 8 sites were a stand response was found. At 3 of the 8 sites where a response was found (CA, LA2, and TN), some of the nominated fungicide treatments performed significantly better than the historical standard fungicide treatment, Vitavax-PCNB + Allegiance. Nu-Flow ND + Apron XL-TL + Nu-Flow M increased stand over the historical standard fungicide treatment at all 3 sites. Baytan 30 + Ascend 30 + Allegiance LS and RTU Baytan Thiram + Allegiance FL + L1080 + L1072 increased stand over the historical standard fungicide treatment for 2 of the 3 sites that increases were found. The number of fungicide treatments significantly increasing stands over the nontreated control ranged from 6 of the 16 nominated treatments for the MS2 site to all of the nominated treatments tested for the VA site. The mean stand for a location was not related to locations where stands were increased by fungicide treatments.

Hypocotyl disease indices ranged from 2.1 at TN to 3.3 at OK1, average 2.5 (Table 5). Root disease indices ranged from 2.0 at TX1 and VA to 3.8 at MS2, average 2.8. *R. solani* was isolated from seedlings from the nontreated plots at 12 of 15 locations (Table 5). *R. solani* was isolated from over 20% of the seedlings at 6 locations (AL, AR3, LA1, LA2, MS2, and TN). *Pythium* spp. were isolated from seedlings at all locations (Table 5). Isolation frequencies for *Pythium* spp. were 20% or greater for 2 sites (LA1 and TX1). Isolation frequencies were increased dramatically by plating roots without surface disinfestation on the selective medium $P_5$ARP (Table 5). *Thielaviopsis basicola* was isolated from seedlings at 8 of the 15 locations on the modified TB-CEN medium (Table 5). *T. basicola* was isolated from over 50% of the seedlings for the AL, AR3, MS1, OK1, and TX2 sites. *Fusarium* spp. were isolated from seedlings at all locations (Table 5). Isolation frequencies for *Fusarium* spp. ranged from 42% to 96%.

Soil populations of *R. solani* were detected at 2 of the 15 sites, range 6 to 18 CFU/100 g of soil (Table 6). *Pythium* spp. were detected in soils from 14 of 15 sites, range 18 to 483 CFU/g of soil. *T. basicola* was detected in 6 of the 15 soils assayed, range 2 to 493 CFU/g soil. *Meloidogyne incognita*, the root-knot nematode, was detected in the soil sample from the LA2 site and *Rotylenchulus reniformis*, the reniform nematode, was detected in the soil sample from the MS2 site.

The percent stand for the nontreated seed treatment for the locations was negatively correlated, –0.52 ($P$=0.05), with soil populations of *Pythium* spp. The hypocotyl disease index and the root disease index were positively correlated, 0.65 ($P$=0.01). *T. basicola* recovery from seedlings was positively correlated with soil populations of *T. basicola,* 0.85 ($P$=0.0001). Isolation frequency of *R. solani* and *Pythium* spp. were weakly positively correlated with soil assays for populations for each genus, 0.49 ($P$=0.06) and 0.50 ($P$=0.07), respectively.

## Conclusions

The results from the 15 locations where data was collected for the 2001 National Cottonseed Treatment Program indicated that seed treatment fungicides improved stands of cotton compared to a nontreated control for the majority of the sites. All of the nominated fungicide combinations improved stands over the nontreated seed at one or more of the sites where a response was found. Allegiance alone increased stands for 4 of the 8 sites where a stand response was found, indicating an important role for *Pythium* spp. in these tests. This is supported by the negative correlation between mean stand for the nontreated seed treatment and soil populations of *Pythium* spp. Isolation frequencies of *T. basicola, R. solani*, and *Pythium* spp. from seedlings were positively correlation with soil populations for each of these genera.

## Disclaimer

This paper reports the results of research only. Mention of a pesticide in this paper does not constitute a recommendation by the University of Arkansas, Department of Plant Pathology, nor does it imply registration under FIFRA.

## References

Henis, Y., A. Ghaffar, R. Baker, and S. L. Gillespie. 1978. A new pellet soil-sampler and its use for the study of populations dynamics of *Rhizoctonia solani* in soil. Phytopathology 68:371-376.

Jeffers, S. N., and S. B. Martin. 1986. Comparison of two media selective for *Phytophthora* and *Pythium* species. Plant Dis. 70:1038-1040.

Ko, W., and F. K. Hora. 1971. A selective medium for the quantitative determination of *Rhizoctonia solani* in soil. Phytopathology 61:707-710.

Specht, L. P., and G. J. Griffin. 1985. A selective medium for enumerating low populations of *Thielaviopsis basicola.*Can. J. Plant Pathol. 7:438-441.

Table 1. Fungicides, formulations and the active ingredients included in the 2001 National Cottonseed Treatment Program.

| Common or registered name[1] | Formulation | Active ingredient (% ) |
|---|---|---|
| ALLEGIANCE -FL(Metalaxyl) | Flowable | 28.35% *N*-(2,6-dimethylphenyl)-*N*-(methoxyacetyl) alanine methyl ester |
| ALLEGIANCE -LS(Metalaxyl) | Liquid | 17.7% *N*-(2,6-dimethylphenyl)-*N*-(methoxyacetyl) alanine methyl ester |
| APRON XL-LS (Mefenoxam) | Liquid | 33.3% (R)-[(2,6-dimethylphenyl)-methoxyacetylamino]-propionic acid methyl ester |
| APRON XL-TL (Mefenoxam) | Liquid | 33.3% (R)-[(2,6-dimethylphenyl)-methoxyacetylamino]-propionic acid methyl ester |
| ASCEND 30 (TCMTB) | Liquid | 30% 2-(thiocyanomethylthio)benzothiazole |
| BAYTAN 30 (Triadimenol) | Flowable | 30% Beta-(4-Chlorophenoxy)-alpha-(1,1-dimethylethyl)-1*H*-1,2,4-triazole-1-ethanol |
| CGA301940 | | Syngenta Crop Protection, Inc. |
| DIVIDEND XL (Difenoconazole & CGA-329351) | Liquid | 16.5% 1H-1,2,4-Triazole, 1[[2-[2-chloro-4-(4-chlorophenoxy)phenyl]-4-methyl-1,3-dioxolan-2-yl]methyl]-, 1.38% (R)-[(2,6-dimethylphenyl)-methoxyacetylamino]-propionic acid methyl ester |
| HM 011501-A | | Helena Chemical Company |
| HM 2049 | | Helena Chemical Company |
| HM 9906 | | Helena Chemical Company |
| HM 9703 | | Helena Chemical Company |
| L1072 | | Gustafson Incorporated |
| L1080 | | Gustafson Incorporated |
| MAXIM 4FS (Fludioxonil) | Liquid | 42% 4-(2,2-difluoro-1,3-benzdioxol-4-yl)-1*H*-pyrrole-3-carbonitrile |
| NU-FLOW M (Myclobutanil) | Wettable powder | 40% A-butyl-a-(4-chlorophenyl)-1*H*-1,2,4-triazole-1-propanenitrile |
| NU-FLOW ND (Chloroneb & TCMTB) | Flowable | 23.5% 1,4-dichloro-2,5-dimethoxy-benzene<br>9.0% 2-(thiocyanomethylthio)benzothiazole |
| PROTÉGÉ 70WP (Azoxystrobin) | Wettable powder | 70% methyl (*E*)-2-{2-[6-(2-cyanophenoxy) pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate |
| RTU BAYTAN-Thiram | Flowable | 5% Beta-(4-Chlorophenoxy)-alpha-(1,1-dimethylethyl)-1*H*-1,2,4-triazole-1-ethanol,<br>15.3% Tetramethylthiuram disulfide |
| RTU PCNB | Flowable | 24% Pentachloronitrobenzene |
| VITAVAX (Carboxin) - PCNB | Flowable | 17% 5,6-dihydro-2-methyl-N-phenyl-1,4-oxathiin-3-carboxamide, 17% Pentachloronitrobenzene |
| WECO 0118 | | Wilbur-Ellis Company |
| WECO 01B50 | | Wilbur-Ellis Company |

[1] Registered chemical name, all capital letters.

Table 2. List of cooperators and procedures used in the 2001 National Cottonseed Treatment Program.

| Cooperator | Location | | Date | | | Reps. | Row length Counted (ft) | Seed planted | Soil temperature[1] |
|---|---|---|---|---|---|---|---|---|---|
| | | | Planted | Sampled | Counted | | | | |
| K. McLean | Auburn, AL | (AL) | 4/11 | 5/9 | 5/9 | 5 | 25 | 125 | 25(21) |
| T. L. Kirkpatrick | Hope, AR | (AR1) | 4/27 | -[2] | | - | - | - | - |
| R. Benson | Keiser, AR | (AR2) | 4/17 | 5/14 | 5/15 | 4 | 80 | 300 | 17(7) |
| C. S. Rothrock | Clarkedale, AR | (AR3) | 5/1 | 5/30 | 5/30 | 6 | 50 | 250 | 23(19) |
| R. B. Hutmacher | Shafter, CA | (CA) | 4/6 | 5/10 | 5/10 | 8 | 25 | 125 | 15(13) |
| K. Seebold | Tifton, GA | (GA) | 4/12 | 5/11 | 5/11 | 4 | 20 | 100 | 24(21) |
| P. D. Colyer | Bossier City, LA | (LA1) | 4/6 | 5/8 | 5/4 | 5 | 25 | 100 | 21(19) |
| B. Padgett | Winnsboro, LA | (LA2) | 4/17 | 5/17 | 5/17 | 4 | 25 | 100 | 17(13) |
| W. E. Batson Jr. | Mississippi State, MS | (MS1) | 4/10 | 5/10 | 5/10 | 4 | 40 | 120 | 22(20) |
| G. L. Sciumbato | Stoneville, MS | (MS2) | 4/6 | 5/9 | 5/4 | 5 | 40 | 200 | 23(20) |
| L. Verhalen & | Tipton, OK | (OK1) | 5/10 | 6/11 | 6/11 | 4 | 22 | 100 | 24(19) |
| B. E. Greenhagen | Altus, OK | (OK2) | 5/11 | - | | - | - | - | - |
| | Perkins, OK | (OK3) | 5/10 | | - | | - | - | - |
| A. Y. Chambers | Jackson, TN | (TN) | 4/26 | 5/29 | 5/29 | 10 | 24 | 100 | 21(16) |
| P. M. Thaxton | College Station, TX | (TX1) | 4/10 | 5/8 | 5/3 | 8 | 30 | 100 | - |
| H. W. Kaufman | Lubbock, TX | (TX2) | 5/1 | 5/29 | 5/29 | 4 | 35.5 | 178 | - |
| T. S. Isakeit | Weslaco, TX | (TX3) | 4/17 | 5/24 | 5/15 | 4 | 18 | 100 | 18(16) |
| P. M. Phipps | Suffolk, VA | (VA) | 4/26 | 5/24 | 5/24 | 4 | 60 | 180 | 16(10) |

[1]Mean (Minimum) soil temperature; 3-day average following planting.
[2] Information not available.

Table 3. Mean squares for combined analysis of variance across locations, 2001 National Cottonseed Treatment Program.

| Source | Degrees of freedom | Mean squares |
|---|---|---|
| Location | | 14 |
| 48417[**1] | | |
| Replication(Location) | 64 | 220[**] |
| Treatment | 19 | 1654[**] |
| Location*treatment | 266 | 238[**] |
| Error | 1215 | 85 |

[1] ** = significant *F*-test, *P*=0.0001.

Table 4. Cotton seedling stands for locations of the 2001 National Cottonseed Treatment Program.

| | | Plant stand (%) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Treatment** | **Rate (oz/cwt)** | **AL** | **AR2** | **AR3** | **CA** | **GA** | **LA1** | **LA2** | **MS1** | **MS2** | **OK1** | **TN** | **TX1** | **TX2** | **TX3** | **VA** | **Mean** |
| Nu-Flow ND + Apron XL-TL + Nu-Flow M | 7.5 + 1.0 + 0.84 | 41 | 39 | 77 | 65 | 56 | 66 | 27 | 80 | 56 | 66 | 86 | 15 | 8 | 48 | 73 | 54 |
| Baytan 30 + Ascend 30 + Allegiance LS | 0.5 + 1.5 + 1.2 | 36 | 40 | 75 | 69 | 69 | 61 | 24 | 84 | 44 | 56 | 77 | 20 | 10 | 34 | 72 | 51 |
| RTU Baytan Thiram + Allegiance FL | 3.0 + 0.75 | 42 | 44 | 72 | 64 | 65 | 65 | 18 | 82 | 44 | 55 | 78 | 14 | 12 | 45 | 70 | 51 |
| Protégé 70 WP + Ascend 30 + Allegiance LS + Baytan 30 | 0.07 + 1.5 + 1.2 + 0.25 | 45 | 30 | 76 | 61 | 62 | 59 | 8 | 84 | 56 | 57 | 82 | 18 | 16 | 40 | 65 | 51 |
| Apron XL-TL + WECO 01B50 + Nu-Flow M | 1 + 0.5 + 0.84 | 40 | 35 | 72 | 66 | 62 | 59 | 20 | 84 | 44 | 63 | 81 | 17 | 6 | 45 | 66 | 51 |
| Apron XL-LS + Maxim 4FS + Nu-Flow M | 0.32 + 0.08 + 0.84 | 43 | 23 | 76 | 61 | 68 | 60 | 18 | 74 | 47 | 60 | 83 | 15 | 13 | 42 | 67 | 50 |
| RTU Baytan Thiram + Allegiance FL + L1080 + L1072 | 3.0 + 0.75 + 0.5 + 9.1 | 40 | 39 | 74 | 63 | 38 | 57 | 30 | 66 | 52 | 61 | 78 | 24 | 13 | 40 | 70 | 50 |
| Protégé 70 WP + Ascend 30 + Allegiance LS | 0.07 + 1.5 + 1.2 | 34 | 48 | 72 | 47 | 58 | 64 | 13 | 79 | 43 | 59 | 81 | 22 | 6 | 43 | 71 | 49 |
| Apron XL-LS + Maxim 4FS + CGA301940 | 0.32 + 0.08 + 3.1 | 40 | 34 | 68 | 52 | 64 | 59 | 17 | 83 | 43 | 54 | 74 | 23 | 10 | 38 | 63 | 48 |
| HM 9906 | 12.0 | 44 | 34 | 72 | 48 | 71 | 63 | 16 | 70 | 50 | 57 | 74 | 15 | 9 | 40 | 64 | 48 |
| Apron XL-LS + Maxim 4FS + Dividend XL | 0.32 + 0.08 + 1.0 | 30 | 34 | 68 | 48 | 60 | 53 | 8 | 81 | 43 | 60 | 76 | 24 | 7 | 45 | 68 | 47 |
| Apron XL-LS + Maxim 4FS + CGA301940 | 0.32 + 0.08 + 1.5 | 37 | 29 | 71 | 43 | 56 | 65 | 16 | 75 | 48 | 64 | 73 | 21 | 7 | 38 | 63 | 47 |
| HM 9703 | 12.0 | 35 | 35 | 65 | 50 | 69 | 54 | 11 | 81 | 44 | 61 | 70 | 18 | 14 | 35 | 61 | 47 |
| WECO 0118 + WECO 01B50 | 2.0 + 0.5 | 38 | 30 | 68 | 36 | 60 | 33 | 20 | 69 | 34 | 58 | 72 | 21 | 9 | 38 | 58 | 43 |
| HM 2049 + 011501-A | 12.0 + 12.0 | 35 | 40 | 60 | 42 | 56 | 25 | 16 | 83 | 28 | 60 | 69 | 19 | 8 | 41 | 56 | 43 |
| HM 2049 | 12.0 | 36 | 33 | 62 | 35 | 54 | 17 | 4 | 72 | 42 | 61 | 72 | 20 | 4 | 42 | 56 | 41 |
| | | | | | | | | | | | | | | | | | |
| Vitavax-PCNB + Allegiance FL | 6.0 + 0.75 | 40 | 30 | 70 | 50 | 64 | 65 | 11 | 77 | 56 | 61 | 78 | 16 | 12 | 37 | 68 | 49 |
| Allegiance FL | 1.5 | 39 | 31 | 60 | 46 | 43 | 40 | 8 | 74 | 48 | 50 | 66 | 19 | 3 | 35 | 65 | 42 |
| RTU-PCNB | 14.5 | 41 | 28 | 61 | 38 | 61 | 12 | 6 | 68 | 30 | 58 | 72 | 20 | 11 | 46 | 45 | 40 |
| Nontreated | --- | 34 | 42 | 55 | 27 | 43 | 12 | 2 | 71 | 34 | 44 | 66 | 20 | 3 | 25 | 47 | 35 |
| | | | | | | | | | | | | | | | | | |
| Location average | | | 38 | 35 | 69 | 51 | 59 | 49 | 15 | 77 | 44 | 58 | 75 | 19 | 9 | 40 | 63 |
| Coefficient of Variation (%) | | 19 | 34 | 10 | 18 | 19 | 21 | 62 | 14 | 21 | 16 | 11 | 57 | 76 | 22 | 10 | |
| LSD (*P*=0.05) | 00 | NS | NS | 8.3 | 9.2 | 15.9 | 13.3 | 12.7 | NS | 11.6 | NS | 7.3 | NS | NS | NS | 8.7 | |

Table 5. Disease ratings and isolation frequency of seedling pathogen groups for the 2001 National Cottonseed Treatment Program locations.

| | | | | Isolation frequency (%) | | | |
|---|---|---|---|---|---|---|---|
| | | Disease | Index | Rhizoctonia | Pythium | Thielaviopsis | Fusarium |
| Location | Nodes[2] | Hyp.[3] | Root[4] | *solan* | spp. | *Basicola* | spp |
| AL | -[5] | 2.2 | 3.6 | 28 | 10 | 54 | 82 |
| AR2 | - | 2.7 | 3.6 | 0 | 4 | 0 | 92 |
| AR3 | 3.4 | 2.5 | 2.4 | 43 | 2 (57)[6] | 71 | 80 |
| CA | 3.2 | - | - | 8 | 2 (61) | 18[7] | 94 |
| GA | 2.2 | 2.3 | 2.9 | 2 | 13 (83) | 0 | 77 |
| LA1 | 3.8 | 2.6 | 2.9 | 29 | 29 (100) | 16 | 84 |
| LA2 | 3.4 | 2.3 | 2.2 | 34 | 2 | 0 | 80 |
| MS1 | 2.4 | 2.4 | 2.4 | 0 | 12 (78) | 60 | 42 |
| MS2 | 3.4 | 2.8 | 3.8 | 26 | 14 (33) | 0 | 82 |
| OK1 | - | 3.3 | 3.3 | 0 | 4 (26) | 69 | 90 |
| TN | 4.6 | 2.1 | 2.1 | 22 | 10 | 2 | 84 |
| TX1 | 5.8 | 2.2 | 2.0 | 2 | 34 (90) | 0 | 84 |
| TX2 | 1.8 | 2.9 | 3.7 | 6 | 10 | 82 | 80 |
| TX3 | - | 2.6 | 3.0 | 2 | 12 | 0 | 92 |
| VA | - | 2.2 | 2.0 | 4 | 2 | 0 | 96 |

[1] Isolation frequency is based on approximately 50 seedlings per location.
[2] Nodes based on five seedlings per location.
[3] Hypocotyl index; 1=no symptoms, 2=few pinpoint lesions or diffuse discolored areas, 3=distinct necrotic lesion, 4=girdling lesion, and 5=seedling dead.
[4] Root index; 1=no symptoms, 2=1-10% of the root system discolored, 3=11-25% of the root system discolored, 4=26-50% of the root system discolored, and 5>50% of the root system discolored.
[5] Information not available.
[6] Isolation frequenc y from water agar.

Table 6. Soil populations of selected soilborne fungi from sites in the 2001 National Cottonseed Treatment Program.

| Location | *Rhizoctonia solan* CFU[1]/100g | *Pythium* spp. CFU/g | *Thielaviopsis basicola* CFU/g |
|---|---|---|---|
| AL | ND[2] | 37 | 2 |
| AR2 | ND | 15 | 0 |
| AR3 | 18 | 108 | 60 |
| CA | ND | 293 | 493 |
| GA | ND | 166 | 0 |
| LA1 | ND | 298 | 0 |
| LA2 | ND | 350 | 0 |
| MS1 | ND | 18 | 8 |
| MS2 | ND | 92 | 0 |
| OK1 | ND | -[3] | 0 |
| TN | ND | 88 | 4 |
| TX1 | 6 | 483 | 0 |
| TX2 | ND | ND | 64 |
| TX3 | ND | 247 | 0 |
| VA | ND | 50 | 0 |

[1] Colony forming units.
[2] Populations not detected in soil sample; less than approximately 3 CFU/100 g of soil for *Rhizoctonia solani,* and 8 CFU/g of soil for *Pythium* spp.
[3] Information not available.