# *Nonmercury* FUNGICIDES *for control of* SEEDLING DISEASE OF COTTON

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DAMPING-OFF of cotton seedlings (caused by the fungus *Rhizoctonia solani* Kuehn) can be a serious seedling disease in the interior valleys of southern California. *Pythium* spp. may cause some seed rot and seedling decline. Mercury fungicides were recently banned from use as cotton seed treatments and trials were initiated in the spring of 1970 to find effective replacements.

## Spring trial–1970

All 1970 spring trial seed treatments were applied to 100 lbs of acid-delinted Delta Pine 16 variety cotton seed (table 1). All treatments received an inoculation of Rhizoctonia by metering infected oat seed through a Noble granular applicator into the planting furrow as the soil covered the seed. This placed seed and inoculum in close proximity—resulting in uniform Rhizoctonia infection of cotton seedlings, and permitting an accurate assessment of fungicides.

Two hundred cotton seeds were planted per plot on May 28 and replicated five times. Healthy-appearing plants were counted on June 18 and July 8.

Captan plus either Terra-Coat L-105, Vitavax, Demosan or PCNB; and Terra-Coat L-105 used alone were significantly better on June 18 than all other materials tested for control of Rhizoctonia seedling disease of cotton. Terra-Coat L-105 was less effective in control by the July 8 disease evaluation. Bay 78175 or Dithane M-45 were not significantly different from the check or no treatment at either evaluation date.

## Spring trial–1971

Trials in 1971 compared the effectiveness of single and combination seed treatments for control of cotton seedling damping-off. Materials and rates were per 100 lb of acid-delinted Delta Pine 16 cotton seed (table 2). The plot was planted on May 24 with six replications and 300 seeds per replicate. Rhizoctonia inoculum was metered into the row furrow at planting as in previous experiments.

Arasan or Captan plus Demosan were significantly better than all other materials tested for control of Rhizoctonia seedling disease. Captan plus PCNB, while providing only intermediate control, was significantly better than Busan, Captan, Arasan used alone, the combination material Terra-Coat L-21 and Captan plus Hoechst 2989.

## Fall trial–1971

A new material, RH 893, was added to the fall trials in 1971 and compared alone and in combination. Other treatments consisted of various combinations of materials previously tested. Treatments and rates were per 100 lb acid-delinted Delta Pine 16 cotton seed (table 3). Three hundred cotton seeds were planted per replicate on September 29, and each treatment was replicated six times. Rhizoctonia inoculum was metered through a Noble granular applicator and applied in the planting furrow as the soil covered the seed. Healthy appearing plants were counted on October 25.

Arasan plus either Terra-Coat L-21 or RH 893 and Demosan provided excellent control of Rhizoctonia seedling disease of cotton and were significantly better than all other materials tested. Single seed treatment of Arasan, RH 893, and the combination treatment of Captan plus Hoechst were not significantly different from the check treatment with results

TABLE 1. SPRING TRIAL—1970 COTTON SEED TREATMENTS

| Treatment | No. healthy plants/rep June 18 | July 8 |
|---|---|---|
| Captan 75W, 2 oz + Terra-Coat L-105, 24 oz | 119 a* | 108 a |
| Captan 75W, 2 oz + Vitavax 75W, 8 oz | 112 a | 94 ab |
| Captan 75W, 2 oz + Demosan 65W, 10 oz | 109 a | 80 abc |
| Captan 75W, 2 oz + PCNB 75W, 4 oz | 82 ab | 73 abcd |
| Terra-Coat L-105, 24 oz | 83 ab | 66 cd |
| Bay 78175 40W, 2 oz | 57 bc | 45 cde |
| Dithane M-45 80W, 3 oz | 49 bc | 39 de |
| Check or no treatment | 27 c | 24 e |

* Significant 1% level

TABLE 2. SPRING TRIAL—1971 COTTON SEED TREATMENTS

| Seed Seed treatment | No. healthy plants/rep June 16 |
|---|---|
| Arasan 75W, 3 oz + Demosan 65W, 10 oz | 148 a* |
| Captan 75W, 2 oz + Demosan 65W, 10 oz | 136 a |
| Captan 75W, 2 oz + PCNB 75W, 12 oz | 67 b |
| Captan 75W, 2 oz + Hoechst 2989, 50W, 8 oz | 49 c |
| Busan 72 60%, 3.5 oz | 49 c |
| Arasan 75W, 3 oz | 37 c |
| Terra-Coat L-21, 12 oz | 42 c |
| Captan 75W, 2 oz | 29 c |
| Check or no treatment | 12 c |

* Significant 1% level

TABLE 3. FALL TRIAL—1971 COTTON SEED TREATMENTS

| Seed treatment | No. healthy plants/rep Oct. 25 |
|---|---|
| Arasan 75W, 3 oz + Terra-Coat L-21, 12 oz | 172 a* |
| Arasan 75W, 3 oz + RH 893 90%, 3 oz | 143 ab |
| Arasan 75W. 3 oz + Demosan 65W. 8 oz | 124 ab |
| Arasan 75W. 3 oz + Busan 72 60%. 3 oz | 101 bc |
| Captan 75W 2 oz + PCNB 75W, 12 oz | 114 bc |
| RH 893 90%, 3 oz | 94 bcd |
| Captan 75W, 2 oz + Hoechst 2989 50W, 8 oz | 88 bcd |
| Arasan 75W, 3 oz | 60 cd |
| Check or no treatment | 39 d |

* Significant 1% level

TABLE 4. SPRING TRIAL—1972 COTTON SEED TREATMENTS

| Seed treatment | No. healthy plants/rep May 24 |
|---|---|
| PCNB 10%-Terrazole 2.5% granular, 1 lb active per acre | 210 a* |
| Arasan 75W, 3 oz + Demosan 65W, 10 oz | 205 a |
| Dexon 70W, 3 oz + Demosan 65W, 10 oz | 193 ab |
| Captan 4F, 3 oz + Demosan 65W, 10 oz | 198 ab |
| Terra-Coat L-21, 12 oz | 153 b |
| Arasan 75W, 3 oz | 77 c |
| Check or no treatment | 21 d |

* Significant 1% level

TABLE 5. SUMMER TRIAL—1972 COTTON SEED TREATMENTS

| Seed treatment | No. healthy plants/rep June 29 |
|---|---|
| Arasan 75W 3 oz + Demosan 65W 10 oz | 201 a* |
| Difolatan 4F 3 oz + Vitavax F 16 oz | 149 b |
| Captan 4F 3 oz + Vitavax F 8 oz | 137 b |
| Captan 4F 3 oz + Vitavax F 16 oz | 137 b |
| Difolatan 4F 3 oz + Vitavax F 8 oz | 110 b |
| Difolatan 4F 3 oz | 57 c |

* Significant 1% level

similar to those obtained in the spring trial.

### Spring trial–1972

This trial compared a standard commercial granular row furrow treatment used without seed treatment, three seed treatment fungicides effective for Pythium and systemic Demosan fungicide. Acid-delinted Acala SJ-1 cotton seed was used in the 1972 trials and seed treatment rates were per 100 lbs of cotton seed (table 4). Three hundred cotton seeds were planted per replicate on April 25 and the plot was replicated six times. Rhizoctonia inoculum was applied in furrow at planting time as in previous experiments. Healthy appearing plants were counted on May 24.

PCNB-Terrazole granular used alone without seed treatment and Demosan plus either Dexon, Captan, or Arasan provided excellent control of Rhizoctonia seedling disease of cotton. Terra-Coat L-21 provided intermediate control of the disease as a combination material and was significantly better than Arasan used alone.

### Summer trial–1972

Captan and Difolatan flowable were used with two rates of Vitavax F seed treatment and compared with the effective combination Arasan plus Demosan seed treatment. Acid-delinted Acala SJ-1 cotton seed was used in this trial and seed treatment rates were per 100 lb of cotton seed. Inoculations were made by Rhizoctonia in-furrow application at planting time. Three hundred cotton seeds were planted per replicate on June 7 and replicated five times. Healthy-appearing plants were counted on June 29 (table 5).

Arasan plus Demosan seed treatment was significantly better than all other treatments for the control of Rhizoctonia seedling disease of cotton. Intermediate in control was Captan and Difolatan used in combination with Vitavax. Doubling the amount of Vitavax used in the combination did not significantly increase control. Difolatan used alone provided the poorest control of Rhizoctonia seedling disease.

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# USING ORGANIC

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EVEN THOUGH ORGANIC WASTES have been used as sources of nutrient elements for many centuries, a rational basis for their use has never been developed. Recommended rates have been based on experience and research planned without the ability to match application rates to the needs of crop plants, and with little information on the rate of biological decay of the organic materials.

Research on organic materials, particularly animal wastes, was popular previous to the availability of inexpensive inorganic N fertilizers following World War II. With a shift to the inexpensive inorganic N sources with their many advantages, the research on organics decreased. Interest and activity with organics has increased in the past 5 years largely as a result of the need for land disposal of large volumes of animal wastes. At present, the concern for animals wastes remains high, and in addition, interest in land disposal of municipal sludges has increased.

Field research presently underway with animal wastes and municipal sludges as sources of available N for plants is still based largely on experience. The usual approach is to add various amounts of wastes and to measure the amounts of N used by plants and the amounts of N in the soil in available and organic form. No theoretical basis for matching rates to crop needs has been proposed or tested for continued use over a period of years.

Agricultural land will be needed for disposal of wastes in the future. A scarcity of inorganic fertilizers may result from fuel shortages. In the future, organic sources of N will be needed to maintain optimum production of food and fiber as the supply of inorganics decreases; and it will be necessary to avoid excesses of nitrates because of the way this ion moves into surface and groundwaters. These are some of the reasons for a rational approach to determining application rates of organics. This study proposes an approach which is consistent with these needs and with the long-term use of organics as N sources.

### Mineralization rates

Organically combined N must be mineralized before it can become available to plants. Thus, the rate of mineralization is the key to the rate of application of any given material. The yearly rates of mineralization are expressed as a series of fractional mineralizations of any given application, or the residual of that application. These are referred to hereafter as a *decay series*. For example, the decay series, 0.30, 0.10, .05, means that for any given application, 30% is mineralized the first year, 10% of the residual (that which was not previously mineralized) is mineralized the second year, and 5% of the residual is mineralized the third and all subsequent years. The same series is applied individually to each yearly application of organic N.

With this decay series, if 100 lbs N were added per acre per year, the mineralized N the first year would be 30 lbs per acre, the second year it would be 30 lbs from the second application and 7 lbs from the first application (10% of the residual, which is 70 pounds) for a total of 37 pounds per acre. During the third year the total N mineralized would be 30 ($.30 \times 100$) plus 7 ($0.10 \times 70$) plus 3.2 ($0.05 \times 63$) for a total of 40.2 lbs per acre. The total mineralization each year over a long period of time can be calculated in a similar fashion. Because these calculations become rather tedious, computer programs were developed to handle a number of decay series in combination with various rates and times.