

# Special Research Report # 123: Disease Management

## Integrated Management of *Fusarium* in Florists' Crops

### Evaluation of Fungicide Combinations for Reduction of *Fusarium solani* Infection of Caladium Tubers

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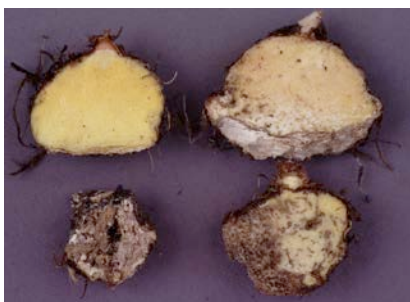
## BACKGROUND

In recent years, production of caladiums tubers in Florida has steadily declined across all cultivars. One of the primary reasons for this decline is *Fusarium* tuber rot caused by *Fusarium solani*. *Fusarium* tuber rot has led to the abandonment of a number of important commercial cultivars by caladium producers.

*Fusarium solani* invades the base of the caladium tuber and the infection progresses upward. The fungus initially causes a light brown tuber discoloration that darkens over time. Individual brown flecks (infected tuber fibers) are a characteristic and intermediate symptom of the disease. When infection by *F. solani* is complete, all that

remains is a totally desiccated tuber with a chalky

consistency. Warm to hot temperatures (84-93 F/29-34 C) favor the pathogen and enhance disease.



## Syptoms of *Fusarium* tuber rot in caladium

At present, only the fungicide thiophanate methyl (3336 F, Systec 1998, etc.) is labeled for use against *Fusarium* as a preplant caladium tuber soak. Unfortunately, we detected insensitivity to the fungicide in isolates of *F. solani* from caladium. Sensitive, moderately insensitive, and highly insensitive isolates had EC<sub>50</sub> values (effective concentrations required to reduce hyphal growth by 50%) of ≤5mg, >5 but ≤50, and >1000 mg thiophanate methyl per liter of agar. Of 70 isolates tested, 9 were moderately insensitive and 2

were highly insensitive to thiophanate methyl.

In laboratory and field experiments, we found that the combination of thiophanate methyl and chlorothalonil was more effective in reducing *F. solani* infection in tubers than the former fungicide alone.

The purpose of this research was to evaluate additional fungicide combinations for reduction of *F. solani* infection of caladium.

## MATERIALS AND METHODS

Fungicides were applied to tubers of caladium 'Florida Cardinal' as a hot water soak (122 F (50 C)/30 min). Fungicides tested included: chlorothalonil (Daconil Ultrex 82.5 WDG), fludioxonil (Medallion 50 WP), azoxystrobin (Heritage 50 G), triflumizole (Terraguard 50 W), combinations of chlorothalonil with either fludioxonil, azoxystrobin, or triflumizole, and a combination of chlorothalonil, fludioxonil, and azoxystrobin. Treatments

and a non-treated control were replicated three times using 20 or 10 tubers in experiments one and two, respectively. After the treatment, a core was removed from each tuber and cultured on Komada's medium. After 9 days at 76 F/24 C, infection severity (0-4) and incidence (%) of *Fusarium* spp. were determined. The experiment was conducted twice.

## RESULTS

All fungicide treatments significantly reduced *F. solani* infection severity and incidence compared to the control and hot water control in both experiments (see Tables 1 & 2). In Experiment 1, Terraguard + Daconil and Medallion + Heritage + Daconil were significantly more effective in reducing disease severity and incidence than either Daconil or Medallion alone. In Experiment 2, Medallion, Heritage, and Terraguard were more effective in reducing disease severity when combined with Daconil. Combining Medallion and Terraguard with Daconil also enhanced

their ability to reduce disease incidence in Experiment 2.

| Treatment       | Disease Incidence (%) |              |
|-----------------|-----------------------|--------------|
|                 | Experiment 1          | Experiment 2 |
| Non-treated     | 100 a                 | 100 a        |
| Hot water       | 87.3 b                | 86.6 b       |
| Daconil         | 70.6 c                | 60.0 cd      |
| Medallion       | 70.0 c                | 73.3 c       |
| Heritage        | 53.3 cd               | 60.0 cd      |
| Terraguard      | 50.0 cd               | 73.3 c       |
| Med. + Daconil  | 51.6 cd               | 50.0 d       |
| Her. + Daconil  | 50.0 cd               | 50.0 d       |
| Terr. + Daconil | 48.3 d                | 46.6 d       |
| Med+Her+Dacon   | 36.6 d                | 56.6 cd      |

Table 2 – Experiment 2 Treatments

## SPECIFIC CONCLUSIONS

Combinations enhanced the effectiveness of individual fungicides in reducing *F. solani* infection of caladium tubers. Medallion was generally more effective in reducing both the severity and incidence of *Fusarium* tuber rot in caladium when combined with Daconil. Enhanced disease reduction was also sometimes observed when Heritage and Terraguard were combined with Daconil.

## IMPACT TO THE INDUSTRY

Promising fungicide combinations were identified for reduction of *Fusarium* tuber rot in caladium. Since three of the fungicides tested, Heritage (azoxystrobin), Medallion (fludioxonil) and Terraguard

(triflumizole) have narrow modes of action there is a constant challenge to

maintain their usefulness through avoidance of resistance development in target fungal populations. Rotating or mixing fungicides with narrow modes of action with those having multisite

modes of action such as chlorothalonil may provide an effective resistance management strategy. Additional research and the cooperation of agrichemical companies in expanding fungicide labels will be needed to implement this management approach for *Fusarium*.

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For additional information,  
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| Treatment       | Disease Severity (0-4) |              |
|-----------------|------------------------|--------------|
|                 | Experiment 1           | Experiment 2 |
| Non-treated     | 2.95 a                 | 3.03 a       |
| Hot water       | 2.56 a                 | 2.33 b       |
| Daconil         | 1.50 bc                | 1.06 cde     |
| Medallion       | 1.53 b                 | 1.30 c       |
| Heritage        | 1.16 bcd               | 1.23 c       |
| Terraguard      | 0.95 d                 | 1.13 cd      |
| Med. + Daconil  | 1.03 cd                | 0.63 f       |
| Her. + Daconil  | 0.88 d                 | 0.70 ef      |
| Terr. + Daconil | 0.92 d                 | 0.63 f       |
| Med+Her+Dacon   | 0.72 d                 | 0.80 def     |

Table 1 – Experiment 1 Treatments