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Integrated Management of *Fusarium* in Florists' Crops

Sensitivity of *Fusarium oxysporum* from Ornamentals to Selected Fungicides

M. L. Gilbert[1], C. R. Semer IV[1], R. J. McGovern[1], W. H. Elmer[2], and D. M.Geiser[3]
[1]University of Florida-IFAS, Plant Medicine Program, Gainesville, FL, 32611; [2]The Connecticut Agricultural Experiment Station, Dept. of Plant Pathology and Ecology, New Haven, CT 06504,
[3]Pennsylvania State University, Dept. of Plant Pathology State College, PA

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BACKGROUND

Fusarium oxysporum can not only cause rot of roots, crown, and underground storage organs but also wilt, in most container- and field-grown ornamentals. Severe outbreaks of diseases caused by the fungus consistently result in extensive production losses. Due to the high value and esthetic nature of ornamentals, a rigorous integrated disease management program including the preventive use of fungicides is essential.

A number of fungicides are labeled for the control of *Fusarium* species in ornamentals. Some of the most commonly used fungicides in ornamentals for control of the fungus include the following groups: benzimidazoles (thiophanate methyl = 3336 WP, Systec 1998, etc.), triazoles (triflumizole = Terraguard), dicarboximides (iprodione = Chipco 26019, Sextant, etc.), strobilurins (azoxystrobin = Heritage), phenylpyrroles (fludioxonil = Medallion).

Each of these fungicide groups has a different but narrow mode of action that has the potential to impose selection pressures on a fungal population for the development of resistance. Some fungal propagules (hyphae, spores, and other survival structures) may persist and reproduce following fungicide usage. Assuming that fungicide resistance does not affect the overall fitness (ability to survive) of the fungus, resistance to the specific chemical will build up in the population. Resistance to fungicides among plant pathogens is an increasingly important problem in control of crop diseases. The purpose of this research was to evaluate the sensitivity of *Fusarium oxysporum* isolates recovered from different ornamentals and geographic areas to selected commercial fungicides.

MATERIALS AND METHODS

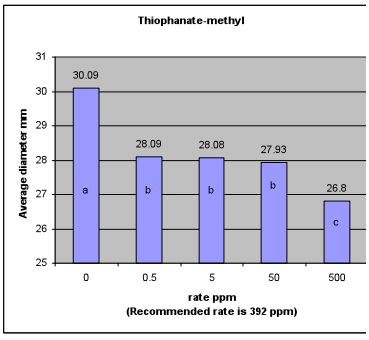
Sixty-two isolates of *Fusarium oxysporum* were tested. These isolates were collected between 1996 and 2001 from seven species of naturally infected, commercially produced ornamentals (caladium, calla lily, Christmas cactus, chrysanthemum, gladiolus, lisianthus, and pentas) grown in California, Pennsylvania, New York and Ecuador.

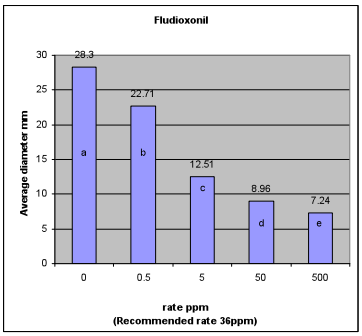
The fungicides evaluated, (azoxystrobin, fludioxonil, iprodione, thiophanate methyl and triflumizole), were prepared by dissolving in either water or acetone+ water. The final fungicide concentration was adjusted to achieve 0.5, 5, 50 or 500 ppm. The label rates of these fungicides for *Fusarium* control are: azoxystrobin, 7-33 ppm; fludioxonil, 36 ppm; iprodione, 592 ppm; thiophanate-methyl, 392 ppm; Triflumizole, 147-295 ppm.
Cellulose discs were placed into the test solution for 2

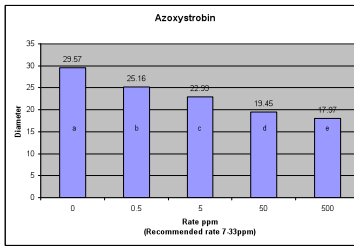
minutes and then placed in a laminar flow hood for 60 minutes to evaporate free moisture from the disc surface. After the one hour drying time the moist discs were placed onto acidified potato dextrose agar so that each plate (three per isolate per concentration) contained two treated discs and one untreated check disc. Each disc was inoculated with a mycelial plug of the selected *F. oxysporum* isolate. The inoculated plates were incubated for 72 hours at 25°C with 12 hours of light. The radial growth of the test fungus was measured and recorded. The experiment was conducted two times.

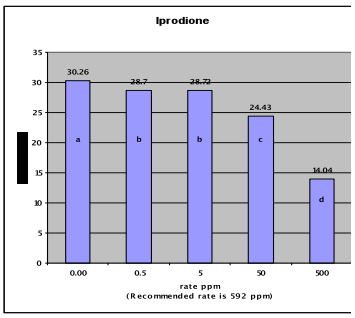
RESULTS

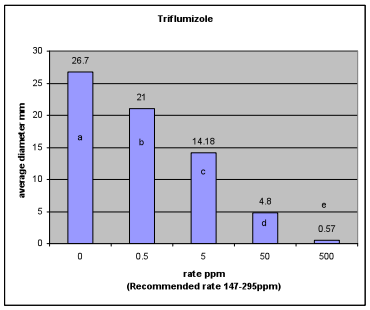
At label rates, four of the five fungicides showed limited or no inhibition of the radial growth of the isolates tested. At the highest rate tested, 500 ppm, *F. oxysporum* inhibition was as follows: thiophante-methyl, 11%; iprodione, 20%; azoxystrobin, 40%; fludioxonil, 75%; and triflumizole, 98% (five Figures below). Different letters indicate that the means are significantly different.











CONCLUSIONS

Selection of the proper fungicide for disease control is based on the product information and the recommendations of extension faculty and other professionals. All of the fungicides evaluated in this "in vitro" study are labeled for control of diseases caused by *Fusarium oxysporum* in various ornamental crops. However, only one fungicide, triflumizole, showed effective inhibition of the 62 isolates of *F. oxysporum* tested at the label rate. Of the remaining fungicides evaluated, only fludioxonil and iprodione showed a greater than 50% growth reduction at the label rate. Our research suggests that some level of insensitivity in *F. oxysporum* to a number of the fungicides tested is widespread and not limited to one geographic location. These findings indicate the need to use more than one material for disease control and the practice of resistance management is critical to prevent further reduction of the effectiveness of these materials.

IMPACT TO THE INDUSTRY

The isolates of *F. oxysporum* from ornamentals examined have some level of insensitivity to the fungicides tested. This data reinforces the importance of resistance management practices including the rotation or combination of different groups of fungicides. The industry has limited numbers of control materials available and the complete loss of one or more of these materials for control of *Fusarium* could have a significant impact upon future management practices.

For additional information, contact Dr. R. J. McGovern