Proc. Fla. State Hort. Soc. 106:173-175. 1993.

EFFECT OF TRANSPLANT TRAY TYPE AND TOMATO CULTIVAR ON THE INCIDENCE OF FUSARIUM CROWN AND ROOT ROT IN TOMATO TRANSPLANTS

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Additional index words. Fusarium oxysporum f.sp. *radicis-lycopersici, Lycopersicon esculentum,* styrofoam, steam disinfestation.

Abstract. **The effect of transplant tray type and tomato (*Lycopersicon esculentum* Miller) cultivar on the incidence of Fusarium crown and root rot caused by the fungus *Fusarium oxysporum* f.sp. *radicis-lycopersici* (FORL) was examined in a commercial transplant house. Four common south Florida tomato cultivars, Agriset-761, PAP-34283, Sunbeam, and Sunny, were seeded in a peat-based medium in five different types of transplant trays, two polystyrene and three styrofoam trays with respective cell volumes of 19 and 28 cm^3, and 6, 20, and 32 cm^3. Six weeks after seeding, the roots and crown of eight randomly selected transplants from each tray type were surface disinfested and plated on Komada's selective medium for *Fusarium oxysporum*. Following removal of all transplants, and surface disinfestation, cotton tipped applicators dipped in sterile water were used to swab ten cells of each tray and to streak plates of Komada's. Isolation of FORL was assessed 5 days following incubation of plates at 28 C/82 F. No significant differences in varietal susceptibility to FORL were detected. Crown rot incidence was significantly highest in transplants from styrofoam trays with the largest cell sizes (20 and 32 cm^3), and FORL was most frequently recovered from styrofoam trays. Steam disinfestation of styrofoam trays at 71 C/160 F for 45 min eliminated FORL.**

Introduction

Fusarium crown and root rot of tomato, caused by the fungus *Fusarium oxysporum* f.sp. *radicis-lycopersici* (FORL), was first detected in Florida in 1974 (Sonoda, 1976). The disease has been reported from all major production areas of the state but is particularly severe in the acidic, sandy soils of southwest Florida. Fusarium crown and root rot has also occurred in Canada, Mexico, Israel, Japan, many countries in Europe, and other states in the United States (Jarvis, 1988). The disease has been a serious problem for transplant and greenhouse fruit production, and consistently decreases yields of field-grown, staked tomatoes in Florida. Incidences of crown rot in excess of 90% were commonly observed in tomato production areas of southwest Florida during the fall, 1992 and spring, 1993 seasons. Major outbreaks of FORL also occurred in tomato transplant production houses during the same period.

The pathogen is favored by cool temperatures and forms rugged resting spores (chlamydospores) which enable it to survive in the soil and plant debris for many years. FORL also produces microconidia and macroconidia, the former of which has been implicated in the recolonization of sterilized soil in greenhouses through aerial dispersal (Rowe, 1977). The fungus can survive on wooden tomato stakes for at least one year (McGovern et al., 1992; McGovern, unpublished data). Early symptoms caused by FORL in tomato seedlings include stunting, yellowing, and premature abscission of cotyledons and lower leaves. A pronounced brown lesion that girdles the hypocotyl, root rot, wilting, and seedling death are advanced symptoms.

An experiment was conducted to determine the effect of tomato cultivar and transplant tray type on the incidence of FORL in commercially produced tomato transplants. The effectiveness of different methods of tray disinfestation was also compared in a separate experiment.

Materials and Methods

Detection of FORL in Tomato Transplants. The research was conducted in a commercial vegetable transplant house in the southwest Florida using conventional cultural practices. Seeds of four commonly used tomato cultivars, Agriset-761, PAP-34283, (Petoseed Co., Inc., Saticoy, CA), Sunny (Asgrow Seed Co., Inc., Kalamazoo, MI), and Sunbeam (Rogers NK, Minneapolis, MN) were surface disinfested in 1% NaOCl for 30 min., rinsed with sterile deionized water, and seeded in a peat-based medium on 12 Dec. 1992. Two different types of polystyrene (Plantaway Ltd, Essex, U.K.) and three styrofoam transplant trays (Modern Polymer, Cherryville, N.J.), with respective individual cell volumes of 19 and 28 cm^3, and 6, 20, and 32 cm^3 were used. All trays had been previously used for commercial tomato transplant production and were washed with well water and surface-disinfested with an aqueous solution of a quaternary ammonium salt solution [Bear-Cat Disinfectant, H. Wilson Mfg. Co., Jefferson, GA (0.7 oz./gal. water)], using a custom-built transplant tray washer. Five replicates of each cultivar by tray combination were arranged on benches in a randomized complete block design. Six weeks after seeding, the roots and crowns of eight randomly selected transplants from each tray were surface disinfested for 1 min in 10% NaOCl, rinsed with sterile deionized water, and plated on Komada's selective medium for *F. oxysporum* (Komada, 1975). Isolation of FORL was assessed 5 days following incubation of plates at 28 C/82 F. Separation of mean FORL incidences utilized a least significant

Florida Agricultural Experiment Station Journal No. N-00866.
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difference procedure [LSD (p=0.05)] following square root transformation.

Detection of FORL in Transplant Trays. Following removal of all experimental transplants, trays were washed with well water and surface disinfested as above. Cotton-tipped applicators dipped in sterile, deionized water were used first to swab ten cells of each tray, and then to streak plates of Komada's medium. Colonies of FORL were counted 5 days following incubation of plates. Separation of mean FORL colonies utilized LSD.

Disinfestation of Styrofoam Transplant Trays. Styrofoam transplant trays with a cell size of 32 cm^3, previously used for commercial tomato transplant production, were randomly selected for experimentation. Five disinfestation techniques were employed including a well water wash, a disinfectant (Bear-Cat) wash, a combined water wash and steam treatment (71 C/160 F for 45 min), a combined disinfectant wash and steam treatment, and an untreated control. Ten trays (replicates) were used for each treatment. Isolation techniques for FORL and mean separation procedures were as previously stated.

Results and Discussion

No significant differences in the incidence of FORL were detected among the four tomato cultivars examined (Table 1). These results concur with field and laboratory experiments which also failed to detect significant differences in the incidence of the fungus among 'Agriset-761', 'PAP-34283', and 'Sunny' and other commonly used tomato cultivars (McGovern et al., 1993). Furthermore, no significant interactions were observed between tomato cultivar and either transplant tray type or cell size on incidence of the fungus (data not presented).

Crown rot incidence in transplants and recovery of FORL from trays was significantly highest from the largest styrofoam cells (20 and 32 cm^3 (Table 2). The greater recovery of the fungus from styrofoam vs. plastic trays may be related to the presence of larger pores in the former which become more numerous as the styrofoam ages, making styrofoam trays more difficult to disinfest. Although the recovery of FORL was actually higher in the small-celled (6 cm^3) styrofoam trays than from either of the two plastic types, no differences were observed in the incidence of the fungus in tomato transplants. This result may be related to the lower evaporation potential from plastic trays leading to a wetter growing medium which appears to favor the disease (McGovern and Datnoff, 1992).

Table 1. The effect of cultivar on the incidence of *Fusarium oxysporum* f.sp. *radicis-lycopersici* (FORL) in tomato transplants.

Tomato cultivar	FORL incidence (%)[z]
PAP-34283	6.3a[y]
Agriset-761	4.6a
Sunny	3.9a
Sunbeam	2.9a

[z]Incidence based on plating the roots and crown of eight randomly selected transplants from 25 trays on Komada's selective medium for *Fusarium oxysporum*.
[y]Means followed by different letters are significantly different by LSD (P=0.05) following square root transformation. Nontransformed means are presented.

Table 2. The effect of transplant tray type on the incidence of *Fusarium oxysporum* f.sp. *radicis-lycopersici* (FORL) in tomato transplants and recovery of FORL from trays.

Transplant cell size (cm^3)	Tray composition	Mean FORL incidence in tomato transplants (%)[z]	Mean recovery of FORL from trays (colonies/cell)[x]
32	Styrofoam	11.9a[y]	26.5a[w]
20	Styrofoam	10.00a	17.2b
6	Styrofoam	0.6b	9.2c
28	Plastic	1.2b	3.0d
19	Plastic	2.0b	1.3d

[z]FORL incidence was determined by plating the roots and crown of eight randomly selected transplants from 25 trays of each type on Komada's selective medium for *Fusarium oxysporum*.
[y]Means followed by different letters are significantly different by LSD (P=0.05) following square root transformation. Untransformed means are presented.
[x]Ten cells from 25 trays of each type were tested for FORL using Komada's medium.
[w]Means followed by different letters are significantly different by LSD (P=0.05).

Table 3. Effect of disinfestation method on the recovery of *Fusarium oxysporum* f.sp. *radicis-lycopersici* (FORL) from styrofoam tomato transplant trays.[z]

Disinfestation method	Mean recovery of FORL from trays (colonies/cell)[x]
Water Wash	54.7a[w]
Untreated Control	24.7b
Disinfestant Wash[y]	23.1b
Steam (160 F/45 min) + Water Wash	0.0c
Steam (160 F/45 min) + Disinfestant Wash	0.0c

[z]Transplant trays had an individual cell size of 32 cm^3.
[y]Bear-Cat Disinfectant, H. Wilson Mfg. Co., Jefferson, GA (0.7 oz./gal water).
[x]Ten cells from ten trays of each treatment were tested for FORL using Komada's medium.
[w]Means followed by different letters are significantly different by LSD (P=0.05).

More propagules of the fungus were recovered from styrofoam trays washed with water alone than from the other disinfestation treatments (Table 3). Only steam disinfestation completely eliminated the fungus from the trays. Since separate studies indicated that irrigation water did not contain propagules of FORL, washing trays with water may have activated chlamydospores leading to an increase in FORL colony numbers. Steam disinfestation of transplant trays should be a routine sanitary operation in tomato transplant production to reduce crown rot occurrence. However, care must be taken when steam-treating trays so as not to exceed the temperature recommendations of the manufacturer or damage to the trays may result.

Literature Cited

Jarvis, W. R. 1988. Fusarium crown and root rot of tomatoes. Phytoprotection 69:49-64.

Komada, H. 1975. Development of a selective medium for quantitative isolation of *Fusarium oxysporum* from natural soil. Rev. Plant Prot. Res. 8:114-125.

McGovern, R. J. and L. E. Datnoff. 1992. Fusarium crown and root rot: Reevaluation of management strategies. Pages 75-86 *In* C. S. Vavrina (Ed.) Proc. Florida Tomato Institute. Vegetable Crops Special Series SS-HOS-1, Vegetable Crops Department, University of Florida-IFAS, Gainesville, FL 32611.

McGovern, R. J., L. E. Datnoff, I. Secker, C. S. Vavrina, J. C. Capece, and J. W. Noling. 1993. New developments in the management of Fusarium crown and root rot of tomato in Southwest Florida. Pages 45-64. *In* C. S. Vavrina (Ed.) Proc. Florida Tomato Institute. Vegetable Crops Special Series SS-HOS-1, Vegetable Crops Department, University of Florida-IFAS, Gainesville, FL 32611.

Rowe, R. C., J. D. Farley, and D. L. Coplin. 1977. Airborne spore dispersal and recolonization of steamed soil by *Fusarium oxysporum* in tomato greenhouses. Phytopathology 67:1513-1517.

Sonoda, R. M. 1976. The occurrence of Fusarium root rot of tomatoes in South Florida. Plant Dis. Rep. 60:271-274.

Proc. Fla. State Hort. Soc. 106:175-176. 1993.

NON-CULTURAL FACTORS AFFECTING DADE COUNTY VEGETABLE PRODUCTION AFTER HURRICANE ANDREW

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Additional index words. storm debris, equipment, irrigation systems, packing houses, farmworker housing, emergency preparedness.

Abstract. **Hurricane Andrew, which struck the agricultural area surrounding Homestead, Florida, on the morning of 24 Aug. 1992, did extensive damage to the commercial fruit and nursery industries. Fall planting for vegetables was to have begun the last week in August, but was delayed by the storm. Several other factors prevented vegetable growers from planting their usual acreage allotments. These included: debris on previously disced fields; the appropriation of vegetable land for tent cities and debris disposal sites by the federal government or its agents; lack of housing for migrant and other labor; damage to equipment, including irrigation systems; and damage to packing facilities. While some of these factors where unavoidable consequences of the storm, others might have been prevented had the needs of agriculture been included in emergency preparations at the county, state, and federal levels.**

Introduction

As experts from the National Weather Service and the National Hurricane Center (Paul Hebert, 1993, personal communication) remind Floridians, every hurricane is different. Some bring heavy rains, while others are characterized by violent winds. Still others combine heavy rains with strong winds. State, county, and local governments in Florida have departments or divisions which handle emergency preparedness operations for natural disasters such as hurricanes, but most do not take agricultural activities into account. The effects of a storm may cause severe crop loss, but other non-cultural factors can affect agricultural production for many months after a major storm. Examples of the types of non-cultural factors which caused disruptions to vegetable production in Dade County are discussed below.

Immediate Problems

Since the main planting season for winter vegetables had not begun when Hurricane Andrew struck Dade County the morning of 24 Aug. 1992, crop damage was limited to tropical and specialty vegetables and a few early plantings of traditional vegetables. The first problems facing Dade County vegetable growers included: (a) debris which accumulated on previously disced fields as a result of the storm itself and from clean up activities which followed, (b) damage to equipment, (c) damage to packing houses, and (d) lack of farmworker housing.

A. *Storm debris.* Storm debris usually came from adjacent or nearby properties and included: (a) agricultural debris - trees or tree limbs from groves, shade houses and plant materials from container nurseries, and agricultural structures, both metal and wood; and (b) residential debris - roofs, shingles, windows, sections of mobile homes, etc. Clean up debris was also illegally dumped on vegetable lands by both neighbors and people passing through the farming area. Some of this debris was the result of grove clean up, while other debris was residential.

Debris caused the following problems: (a) plantings were delayed until debris could be removed, (b) remnants interfered with equipment, and (c) debris clean up sometimes created low spots because it removed top soil.

B. *Damage to equipment.* The strong winds accompanying Hurricane Andrew caused damage to most agricultural equipment, including tractors and trucks which were blown several or more feet during the peak of the storm and to all types of irrigation systems. Many pole barns blew down on top of equipment, adding to clean up problems. Private insurance covered replacement of some irrigation systems, especially lateral move rigs. Other equipment was eligible for USDA Emergency Conservation Program funds through the Agricultural Stabilization & Conservation Service (ASCS) and the Soil Conservation Service. Both private and government funds required meetings with and site visits by insurance adjustors or USDA field inspectors.

C. *Damage to packing houses.* All vegetable packing houses in Dade County were affected by the winds accompanying Hurricane Andrew. Damage ranged from complete destruction of several older wooden structures, to loss of trusses and metal siding in the newest buildings and to window, door and cooling systems in the concrete block stucco houses. Wooden packing houses have been de-