Table 2. Retention of spring yellows virus by individual *Myzus persicae*.[z]

Aphid	Transmission record (Days)[y]						
	1	2	3	4	5	6	7
1	−	−	+	+	D		
2	−	−	−	+	−	−	D
3	−	−	−	+	D		
4	−	−	−	+	−	−	+
5	+	−	−	−	−	−	−
6	−	−	+	−	−	−	D
7	−	−	−	−	−	−	−
8	−	+	+	−	−	−	−
9	−	+	+	+	−	−	−
10	−	D					
11	−	−	−	−	−	−	−
12	−	−	+	−	−	−	D
13	−	−	−	−	−	−	−
14	−	−	−	−	−	−	−

[z]Aphids were allowed a 24 hr acquisition access to detached spring yellows virus infected leaves with petri dishes. Individual aphids were transferred daily to single *Capsella bursa-pastoris*.
[y]Symbols: plus (+) indicates infection and minus (−) no infection; D is death of aphid.

fields in south Florida, suggest that perhaps the best way to control spring yellows may be to search for sources of resistance to SYV in lettuce and escarole.

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BOTRYTIS LEAF BLIGHT OF BULB ONION IN SOUTHEAST FLORIDA[1]

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Additional index words: *Botrytis squamosa* W., *Allium cepa* L, fungicides.

Abstract. **The occurrence, impact and control of Botrytis leaf blight (onion blast) incited by** Botrytis squamosa **Walker was discussed. The disease is endemic in onions in southeast Florida. Yield reduction of Texas Early Grano 502 and Granex 33 was measured in a planting severely affected by Botrytis leaf blight in the spring of 1978 at the Agricultural Research Center, Fort Pierce, Fla. Results from fungicide trials indicated the disease can be managed under southeast Florida conditions with mancozeb which is used successfully in other areas of the U. S. where Botrytis leaf blight is a problem. Work with other fungicides is also discussed.**

Bulb onions (*Allium cepa* L.) have been grown sporadically over the years in southeast Florida (5). There has been an upsurge of interest in growing onions in the last 4-5 years. Several leaf diseases of onion have been reported in Florida (12), however, Botrytis leaf blight, or onion blast, incited by Botrytis squamosa Walker has been the primary foliage disease problem observed on the few onion farms in southeast Florida. Several species of *Botrytis*, including *B. squamosa* have been reported as incitants of Botrytis leaf blight (4). Other leaf diseases observed on onions in southeast Florida by the authors over the past several years include those incited by *Alternaria porri* and *Stemphyllium* spp.

A leaf spot incited by *Botrytis cinerea* Pers. was reported as a disease of onion in the 1923 Annual Report of the Florida Agricultural Experiment Station (2). The disease was found in a half acre of onions near Gainesville, Fla. It reportedly killed the foliage in a short period of time. However, it was not until 1954 (6), that onion leaf blight or leaf spot, was re-identified as a *Botrytis* spp. incited problem outside of Florida. Until that time the cause of onion leaf blighting or onion blast, an endemic problem in the northeast U.S., was reported to be unknown and was listed as a non-parasitic disease by Walker (10). In Florida, the only subsequent reference found to onion blast was by E. A. Wolf reporting in the 1956 Annual Report of the Florida Agricultural Experiment Station where he stated (11): "purple blotch and a disease resembling blast . . . caused heavy reductions in yield from the November plantings."

B. squamosa is listed as an incitant of neck rot of onions in the Index of Plant Diseases in Florida (12), however, no reference to a source of this information was listed. The various species of Botrytis that cause leaf blight can incite

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neck rot or bulb rot (4). Bulb rot incited by *Botrytis* spp. has not been observed on Botrytis leaf blight infected, untreated (no fungicides), onions in experiments conducted in 1976-77, 1977-78, and 1980-81 by the authors at the University of Florida Agricultural Research Center, Fort Pierce, Florida (ARC-FP).

Occurrence and Impact

The first symptoms of Botrytis leaf spot are usually seen in late winter in plantings made in October and November of the preceding year in southeast Florida. In plantings made at the ARC-FP over the past few years, the first lesions were observed on: Feb. 24, 1977 in a planting seeded on Oct. 22, 1976; in early March, 1978 in a planting seeded on Nov. 7, 1977; and Feb. 27, 1981 in a planting seeded on Nov. 19, 1980. All of the infections in the plots at the ARC-FP were natural infections. Heavy infection occurred following periods of rain. The initial symptoms consisted of small white lesions scattered over the leaf surfaces. Attempts to isolate the pathogen from the small white spots were unsuccessful. Chupp and Sherf (4) report that the leaf blight pathogen cannot infect healthy, growing tissue. They reported that the first wave of spores that land and germinate on onion leaves produce a toxic substance that kills a few onion cells on the surface. These Botrytis spores die. Succeeding waves of spores landing on these white spots can infect the plant through dead tissue if environmental conditions permit. White spots continue to increase with germination and death of succeeding waves of spores that land on healthy tissue. Large tan to brown colored elliptical lesions are produced on areas of the leaves that are infected with the pathogen. The leaves eventually die. In cases of heavy inoculum pressure and favorable environmental conditions for disease development, the whole top of the onion may be 'blasted' resulting in a light tan appearance of whole fields.

Examination of lesions on severely affected onion leaves over the past few years in southeast Florida has revealed the presence of nonsexual fruiting structures (condiophores and conidia) of *B. squamosa*. The disease has been endemic in commercial onion fields in southeast Florida over the past several years. Severe leaf blight occurred on several farms in southeast Florida in the spring of 1980.

Botrytis leaf blight incidence was heavy in experimental plots of Texas Early Grano 502 (TEG 502) and Granex 33 (G 33) onions at the ARC-FP in the spring of 1977 and again in 1978. TEG 502 plots treated with mancozeb in the spring of 1977 and 1978 outyielded TEG 502 plots with no fungicide treatment (Table 1). G 33 plots treated with mancozeb outyielded no-fungicide treatment plots in 1977-78 but not in 1976-77 (Table 1). Losses in yield on bulb onions to *B. squamosa* have been reported in New York (7) and Texas (1).

Storage life of bulbs of Botrytis leaf blight affected plants has been unaffected in tests at the ARC-FP.

Table 1. Yield of Texas Early Grano 502 and Granex 33 onion in *Botrytis squamosa* affected plots with and without fungicides.

Crop period	Cultivar[1]	Treatment: No-fungicide	Treatment: Fungicide
1976-77	TEG 502	18.7	23.2*
	G 33	23.0	25.4
1977-78	TEG 502	19.7	28.3*
	G 33	19.2	28.2*

[1]TEG 502 = Texas Early Grano 502. G 33 = Granex 33.
*Means significantly different at 5% level between fungicide (mancozeb) and no-fungicide treatments.

Table 2. Yield of Granex 33 onions sprayed with various fungicides in the spring of 1978.

Treatment and rate per 100 gals.	Yield T/A
Unsprayed check	19.2 a[1]
Benlate 50W 1#	31.7 d
Dithane M-45 80W 2#	28.2 cd
Difolatan 4F 2 pts	26.3 bc
Bravo 6F 2 pts	25.6 bc
Kocide 101 1#	22.7 ab
Wettable sulfur 2#	22.1 ab

[1]Mean separation by Duncan's multiple range test, 5% level.

Experiments with Fungicides

Carbamates have been used effectively to control Botrytis leaf blight of onions in other areas of the U. S. (7). The data on Table 1 shows that plots treated with mancozeb, a dithiocarbamate, had significantly higher yields of onions than plots receiving no fungicide treatment. However, even with the use of mancozeb, some commercial growers of onions in southeast Florida reported that they were unable to control epiphytotics of the disease. Tests were conducted at the ARC-FP using fungicides registered for use on onions or fungicides registered for use on other food crops (8, 9). TEG 502 and G 33 were direct seeded in raised beds on Oldsmar fine sand in November 1976 and October 1977. Spraying with various fungicides was initiated in January of each year before onset of symptoms. Fungicides used in the experiments were mancozeb (Dithane M-45, a coordination product of zinc ion and manganese ethylene bisdithiocarbamate); captafol Difolatan 4F, cis-N-(1,1,2,2-Tetrachloroethyl)thio)4-cyclohexene-1,2-dicarboximide); chlorothalonil (Bravo 6F, tetrachloroisophthalonitrile); anilazine, (Dyrene 65W, 4,6-dichloro-N-(2-chlorophenyl)-1,3,5,-triazin-2-amine); cupric hydroxide, (Kocide 101); and wettable sulfur. A surfactant, Naco Spred-all, was added to all sprays. Fungicide suspensions were applied with a hand-held boom-type sprayed delivering spray at 30 lb psi. Treatments were replicated in a randomized block design. The results of tests in 1976-77 and 1977-78 (8, 9) were similar in that several fungicides provided protection against losses to the disease.

Results from a typical test (7) conducted on Granex onions in 1977-78 show that mancozeb, applied at 2 lb/100 gal at weekly intervals produced significantly more marketable yield than the untreated plot. Benomyl treated plants had the fewest leaf spots (7). Benomyl is not registered for use on onions. In tests over the two year-period, plots treated with chlorothalonil had fewer spots than the mancozeb treated plots (8, 9), however, there were indications that yields (8, 9) and bulb size (9) were reduced in some cases where chlorothalonil was used. More recent work by Stoffella *et al.* (1980-81 ARC-FP, unpublished) shows that there was a significant reduction in yield and bulb size with the use of chlorothalonil on TEG 502 and G 33 onions. A similar decrease in yield for sweet spanish type onions sprayed with chlorothalonil was reported in New York by Cetas (3).

Our results indicate that Botrytis leaf blight can be managed with sprays of mancozeb. Since the disease spreads rapidly, protective sprays have to be applied during periods of wet weather. Further studies on timing of applications for effective control are needed.

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MIXTURES OF COPPER AND MANEB OR MANCOZEB FOR CONTROL OF BACTERIAL SPOT OF TOMATO AND THEIR COMPATIBILITY FOR CONTROL OF FUNGUS DISEASES[1]

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Abstract. **Combinations of basic copper sulfate (BCS) and maneb or mancozeb were significantly more effective for control of bacterial spot** (Xanthomonas campestris **pv.** vesicatoria **(Doidge) Young** et al.**) of tomato than BCS by itself. Combinations of BCS with anilazene or captafol were no more effective than BCS alone. Copper-zinc chromate was less efficacious than BCS when combined with maneb or mancozeb. BCS combined with maneb or mancozeb was less effective than maneb or mancozeb alone for control of late blight** (Phytophthora infestans **(Mont.) dBy.) and gray leaf spot** (Stemphylium solani **Weber) of tomato but was more effective than BCS alone.**

Bacterial spot (*Xanthomonas campestris* pv. *vesicatoria* (Doidge) Young *et al.*) has been a very serious disease of the tomato in Florida for more than 40 years. It is probably the most difficult to control of all the fungal and bacterial diseases that affect the crop. Even after three decades of research a wholly satisfactory control for bacterial spot has not been developed. The disease flourishes during warm, windy, rainy periods. These conditions not only favor rapid spread and development of bacterial spot but they also interfere with applications of control measures at the time when they are most needed.

Until about the mid 1950's copper fungicides were the only materials available for control of bacterial spot. Copper fungicides are only of limited value for short periods. If bacterial spot was prevalent and weather conditions favored its rapid spread, copper fungicides often had no measurable effect on disease progress. In the late 1950's streptomycin and combinations of copper and streptomyin, showed much promise of providing good control of bacterial spot (1, 2). Within a short time, however, streptomycin-resistant strains of *X. vesicatoria* appeared (3, 4). From then on usefulness of streptomycin was limited to short periods or special circumstances.

In the mid 1960's combinations of copper and maneb or mancozeb were found to be considerably more effective than copper alone. Since then these combinations have been widely used in Florida for the control of bacterial spot. The combination of copper and maneb or mancozeb has been recommended by the Florida Cooperative Extension Service for many years. The experimental data supporting this recommendation and usage have never been published. To fill in this gap in the literature, we are presenting results of experiments with tomatoes performed in the 1950's and 1960's relating to the superiority of copper-ethylene bisdithiocarbamate (CEB) combinations for bacterial spot control. Also presented are data regarding their compatibility for control of late blight (*Phytophthora infestans* (Mont.) dBy.) and gray leaf spot (*Stemphylium solani* Weber).

Materials and Methods

All experiments were conducted at Agricultural Research and Education Center or at the Rohm & Haas Experimental Farm, Homestead during fall and winter months. Experiments on control of bacterial spot and gray leaf spot were performed in 1962-1964 and on late blight in 1956-57. Some experiments were performed on tomato plant beds, others were on plants grown to maturity. Insect pests were controlled by separate applications of insecticides. Sprinkler irrigation was used as needed to maintain optimum conditions for disease development.

A randomized complete block design was used in all experiments. Sprays were applied in most instances with a tractor-drawn power sprayer but, in some tests, applications were made by hand with a compressed air sprayer. Care was taken to insure complete coverage as possible on all leaf surfaces. In plantbed experiments sprays were applied at 3 to 4 day intervals until plants were 12″ to 15″ tall. In experiments where plants were grown to maturity applications were made at 3 to 7 day intervals until the end of the harvest. In most tests plants were inoculated with a culture of *X. vesicatoria* or with conidia of *S. solani.* Secondary spread of diseases was by natural means.

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