

# RESULTS FROM A THIRTEEN YEAR STUDY TO STUDY EFFECTIVE SPRAY TIMING WITH GREASY SPOT (*MYCOSPHAERELLA CITRI*) SPORE POPULATIONS ON EAST COAST AND RIDGE AREA GROVES

L. W. RUSSO AND F. W. BISTLINE  
Coca-Cola Foods, P.O. Box 247  
Auburndale, FL 33823

**Abstract.** The greasy spot spore monitoring program began in 1976 following consistently heavy disease incidence in several company groves. Poor spray coverage, insufficient fungicides and ineffective spray nozzling were often targeted as causes. However, our observations showed that in some years infection occurred before spray application. Spore populations and germ tube growth were monitored by battery operated spore traps set up in conjunction with hygrothermographs and rain gauges. The data gathering locations were under trees in east coast and ridge area groves. During several years, when weather conditions were such that the spring and fall flushes were not severely infected, a June/July spray was sufficient. In other years we observed high populations of germinating spores as early as March and as late as mid-September, indicating a deviation in standard spray practices was in order when a significant flush was present. Field evaluations were made by visual inspections and by tagging individual spring flushes to determine the effectiveness of sprays applied during high populations of germinating spores.

## Introduction

Citrus greasy spot (*Mycosphaerella citri* Whiteside) infection in Florida generally occurs June through August when environmental conditions allow spore germination and subsequent infection of summer leaves (Whiteside, 1971, 1982).

After consistently heavy disease incidence in several Company groves located in both the ridge and the east coast citrus areas, the greasy spot spore monitoring program began in 1976. Unsatisfactory ground speed, insufficient fungicides and ineffective spray nozzling were often targeted as causes. However, our observations showed that in some years and in various locations infection occurred long before spray application. The objective of the program was to ascertain times of the year when the spore population, temperature, humidity and precipitation were optimum for infection and to correlate this information against spray application.

## Materials and Methods

Battery powered spore traps (modified after Schenck's trap) held two Vaseline coated glass slides which trapped spores and debris over a 48-hour span (Schenck, 1964). Each slide collected 24 sections representing 24 hours of trapping. Every two days the slides were collected and sent to our lab for spore counts. Each trap was located beneath the tree canopy in conjunction with a hygrothermograph and three rain gauges. Diverse locations with heavy infection were our main criteria used for selecting each trapping station. Field evaluations were made by visual inspection;

and in some years, assessing percent defoliation by tagging individual spring flush twigs. Leaves were counted in April and again in March of the following year to determine the effectiveness of sprays applied during periods of high spore release. In 1982, the spore counts were modified to indicate spore germination. Germ tube growth on the slide was evidence that all necessary conditions, (rain-fall, high temperature and humidity) were present and any new growth flush was subject to greasy spot infection if not protected with a fungicide (Whiteside, 1970). We found that at times there could be a spore release but conditions were not favorable for germination and thus no infection took place at that time.

## Observations and Discussion

After several years of monitoring spore release throughout our groves, we found that the time of peak release varied by year and by grove (Tables 1, 2, & 3). When our trapping stations were operated from March

Table 1. Average spore population - east coast groves.

	March	April	May	June	July	August	September
1976	—	—	—	—	—	—	—
1977	188	833	429	1281	473	299	—
1978	44	52	1521	1545	438	227	90
1979	—	133	4159	492	166	1185	157
1980	—	—	43	221	129	67	45
1981	—	204	1041*	3220*	2009	691	95
1982	—	881*	375*	177*	61	77	53
1983	88	134	411*	2197*	462*	75*	—
1984	85*	436*	529*	1939*	268	—	—
1985	—	1264*	2116*	859*	313*	46	—
1986	—	—	1840*	9776*	294*	505*	—
1987	—	195	687*	3821*	2586*	568*	—
1988	—	—	2286*	953*	782*	512*	—
1989	—	—	—	395*	204*	815*	—

\*Indicates spore germination.

Table 2. Average spore populations - south & central ridge area groves.

	March	April	May	June	July	August	September
1976	250	1646	3507	595	18	24	0
1977	96	1362	2713	2183	421	215	—
1978	—	9	1150	1782	372	119	78
1979	—	38	871	252	200	373	—
1980	—	—	186	626	2280	663	—
1981	—	—	331	—	—	—	—
1982	594*	2935*	1649*	84	68	217*	—
1983	326	582*	671*	5070*	719	71	—
1984	—	495	261*	—	—	—	—
1985	—	30	—	902*	—	—	—
1986	—	—	182*	670*	47*	—	—
1987	—	565	1006*	4578*	2025*	65*	—
1988	—	65	114	898*	640*	698*	—
1989	—	—	200*	46	623*	172*	506*

\*Indicates spore germination.

Table 3. Average spore population - north ridge grove.

	March	April	May	June	July	August	September
1976	—	2291	7315	490	116	26	50
1977	14	132	147	404	70	14	—
1978	—	6	89	2192	145	52	—
1979	—	—	—	—	—	—	—
1980	—	—	—	—	—	—	—
1981	—	61	219	803	313	81	—
1982	663*	1644*	1940*	2115*	203*	19	—
1983	53	39	460*	2743*	48*	18	—
1984	—	104	107	103	126*	—	—
1985	—	—	—	—	—	—	—
1986	—	—	—	—	—	—	—
1987	—	—	—	—	—	—	—
1988	—	—	—	—	—	—	—
1989	—	—	—	—	—	—	—

\*Indicates spore germination.

through September, large populations of germinating spores occurred as early as March and as late as Mid-September in some years. In most years June and July were the months of peak release, which is when weather conditions are normally conducive to infection (Whiteside, 1989). During the years when conditions were such that the spring and fall flushes were not severely infected, a June/July spray was sufficient. Spore releases, (indicating decomposing leaf litter), optimum temperatures of 77-86F, approximately 100% relative humidity in excess of 6 hours and a growth flush are necessary for infection (Whiteside, 1974). These requirements were present and coincided with fungicidal applications in April of 1982 in our south and central ridge area groves and in 1984, on the east coast groves. Both resulted in adequate greasy spot control (Figure 1). Table 2 shows a high population of spores during April/May of 1977, in the south and central ridge groves. Also during a two week period in April of that year, data gathered from hygrothermographs at those locations showed relative humidity above 90% and temperatures in excess of 73F for periods of 6-8 hours, in addition, 2.25 inches of rainfall was recorded at those stations. Again in April 1982, trapping stations from that same area showed a high spore release with germ tubes present and 2.12 inches of rain were recorded. Field observations and percent leaf loss showed that we had the best control when spray applications began within 20 days of a spore release with germ tubes present. Figure 1 shows the correlation between percent leaf loss, germ tube growth and spray timing over a three year period on the east coast.

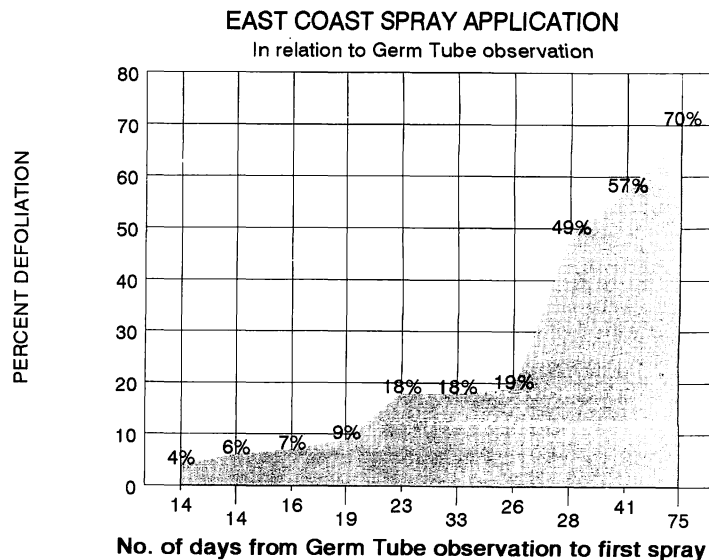


Figure 1. No. of days from Germ Tube observation to first spray.

The combination of a spore release, favorable climate for spore germination plus the presence of new growth definitely indicates the need for a spray application (Whiteside, 1977). Our observations show that in some years, a single spray applied in June/July will not be sufficient for commercial greasy spot control and that additional sprays as early as April and as late as August/September may be necessary.

#### Literature Cited

- Schenck, N. C. 1964. A portable, inexpensive, and continuously sampling spore trap. *Phytopathology* 54:613-615.
- Whiteside, J. O. 1970. Etiology and epidemiology of citrus greasy spot. *Phytopathology* 60:1409-1414.
- Whiteside, J. O. 1971. Effectiveness of spray materials against citrus greasy spot in relation to time of application and infection periods. *Proc. Fla. State Hort. Soc.* 84:56-63.
- Whiteside, J. O. 1974. Environmental factors affecting infection of citrus leaves by *Mycosphaerella citri*. *Phytopathology* 64:115-120.
- Whiteside, J. O. 1977. Behavior and control of greasy spot in Florida citrus groves. *Proc. Int. Soc. Citriculture* 3:981-986.
- Whiteside, J. O. 1982. Effect of temperature on the development of citrus greasy spot. *Proc. Fla. State Hort. Soc.* 95:66-68.
- Whiteside, J. O. 1989. Questions and misconceptions about the behavior and control of citrus fungal diseases. *Citrus & Vegetable Magazine*. January:10-11, 53, 66-68.