Significance to the Nursery Industry

Salvia greggii is a desirable native plant for landscapes in the Southwestern United States. However, before it can be made available in the landscape and nursery trade it must be commercially grown. These research findings furnish nitrogen and phosphorous fertilizer guidelines for container production of this resource-efficient, native landscape plant.

Literature Cited

1. Chapman, H.D., and P.F. Pratt. 1961. Methods of analysis for soils, plants and waters. Univ. Calif., Div. Agric. Sci., Riverside, CA.

2. Gallaher, R.N., C.O. Weldon, and F.C. Boswell. 1976. A semi-automatic procedure for total nitrogen in plant and soil samples. Soil Sci. Soc. Amer. J. 40:887–889.

3. Hipp, B.W., and B.J. Simpson. 1981. Influence of N on growth and tissue N concentration in *Leucophyllum candidum*. Commun. Soil Sci. Plant Anal. 12:205–209.

4. Hipp, B.W., and B.J. Simpson. 1983. Nitrogen requirements of container grown Texas madrone (*Arbutus xalapensis*). Proc. Texas State Hort. Soc. 1:3–5.

5. Hoagland, D.R., and D.I. Arnon. 1950. The water-culture method for growing plants without soil. Calif. Agric. Expt. Stn. Cir. 347.

6. Simpson, B.J., and B.W. Hipp. 1982. Influence of nitrogen on rooting by *Leucophyllum candidum*. Plant Propagator 27(4):10–11.

7. Texas Almanac. 1978. Mean annual temperatures and precipitation by climatic division, p. 130. *In* F. Pass (Ed.). Texas Almanac and State Industrial Guide. A.H. Belo, Dallas.

Effects of Temperature and Preinoculation Light Level on Severity of Syngonium Blight Caused by *Xanthomonas campestris*[1]

A.R. Chase[2]

University of Florida - IFAS
Central Florida Research and Education Center
2807 Binion Rd., Apopka, FL 32703

Abstract

The effect of temperature on growth of *Xanthomonas campestris* pv. *syngonii* isolated from *Syngonium podophyllum* 'White Butterfly' and *X. campestris* pv. *dieffenbachiae* isolated from *Anthurium andraeanum* was tested *n vitro*. Growth of *X. campestris* pv. *syngonii* occurred between 18 (65) and 32°C (90°F) (optimum 26°C [79°C]); growth of *X. c.* pv. *dieffenbachiae* occurred from 18 (65) to 34°C (93°F) (optimum 22°C [72°F]). Severity of syngonium blight was greatest for plants maintained at 30°C (86°F); no symptoms developed at temperatures below 26°C (79°F). Preinoculation light levels from 1600 to 5000 ft-c did not affect subsequent disease development on plants inoculated with *X. campestris* pv. *syngonii*.

Index words: *Syngonium podophyllum* 'White Butterfly', bacterial disease

Introduction

Plants in the Araceae family are among those most widely grown as foliage plants, and include many cultivars and species of *Aglaonema, Dieffenbachia, Philodendron*, and *Syngonium*. Bacterial diseases of foliage plants have caused serious losses over the past 20 years. Many of the 500 varieties grown in Florida are susceptible to at least one bacterial pathogen from the genera *Erwinia, Pseudomonas* or *Xanthomonas*. *Xanthomonas campestris* pv. *dieffenbachiae* (Pammel) Dowson has caused diseases of these plants for many years, with the original description made in 1939 by McCulloch and Pirone on *Dieffenbachia maculata* (Lodd.) G. Don (=*D. picta*) (3). In 1982, a serious blight disease was first noted on *Syngonium podophyllum* Schott 'White Butterfly', a relatively new cultivar (2, 3). This disease has continued to cause losses of up to 50% in the majority of Florida nurseries producing the plant.

[1]Received for publication January 4, 1988; in revised form February 26, 1988.

Published as Florida Agricultural Experiment Stations Journal Series No. 8618.

[2]Associate Professor of Plant Pathology.

Materials and Methods

Inoculum production and preparation. Inocula were produced on nutrient agar amended with 0.5% sucrose (NAS). Inoculated plates were incubated at 28°C (82°F) for 3 days and bacteria were recovered by flooding media surfaces with 0.01 M $MgSO_4$ (MgS) and gently rubbing with a sterilized cotton swab. Suspensions were collected and adjusted to 1×10^8 colony forming units (cfu)/ml using a spectrophotometric method. Inocula were used within 30 min of preparation.

Plant production. All 'White Butterfly' plants were obtained directly from tissue culture producers to limit potential for exposure to plant pathogens. Explants were established in steam-treated (1.5 hr at 90°C [194°F]) Canadian peat and pine bark (1:1 by vol) amended with 3.6 kg/m^3 (10 lb/yd^3)

Osmocote 19N-2.6P-10K (19:6:12) 2.7kg/m^3 (7.5 lb/yd^3) dolomitic lime, and 0.5kg/m^3 (1.5 lb/yd^3) Micromax after steaming. Explants were rooted under intermittent mist (5 sec/30 min, 12 hr/day) for approximately 3 wk and then removed and irrigated once or twice weekly depending upon season.

Inoculation method. Plants were sprayed to runoff with the bacterial suspension and enclosed in polyethylene bags for 3 days. Symptom development was monitored for 3 weeks. Foliar symptoms were subjectively rated as the percentage of the total leaf area with symptoms of blight.

Effect of temperature on growth of X. campestris from 'White Butterfly' and X. c. pv. dieffenbachiae in vitro. Effects of temperature on growth of two strains of *X. campestris* pv. *syngonii* from 'White Butterfly' and one isolate of *X. campestris* pv. *dieffenbachiae*, were tested in Wilbrink's medium prepared without agar. The medium was dispensed into Spectronic 20 tubes which were autoclaved, then inoculated with 1 droplet each of a suspension containing 1×10^8 cfu/ml of a test bacterium. Transmittance was measured at 600 nm immediately following inoculation and tubes (5 per isolate) were placed in growth chambers. Light levels were approximately 50 ft-c from 0800 to 2000 hr daily. Tubes were agitated daily and a final transmittance reading was recorded after 1 wk. The following continuous temperatures were used: 18, 20, 22, 24, 26, 28, 30, 32, and 34°C (65, 68, 72, 75, 79, 82, 86, 90 and 93°F). This test was performed twice.

Effect of temperature on disease development. The effect of temperature on disease development was tested with two isolates of *X. campestris* pv. *syngonii* from 'White Butterfly'. Plants were transferred to the growth chambers described above, 2 days prior to inoculation. Eight plants, at each temperature, were inoculated by spraying plants with 1×10^8 cfu/ml MgS and then enclosing them in polyethylene bags for 5 days. The following continuous temperatures were tested: 15, 20, 25, 30, and 35°C (60, 68, 77, 86 and 95°F) (two tests); 22, 24, 26, 28, and 30°C (72, 75, 79, 82 and 86°F) (one test); and 26, 28, 30, 32, and 34°C (79, 82, 86, 90 and 93°F) (two tests). Light levels of approximately 50 ft-c were maintained between 0800 and 2000 hr daily. The percentage of total leaf area with disease symptoms was estimated for each plant after 14–28 days.

Effect of preinoculation light level on susceptibility. Plants were produced as described earlier and established in 15 cm (6 in) pots. Leaf number and plant height were recorded before treatment and again at monthly intervals. The following light levels (from sunlight) were maintained with shadecloth: 5000 (47% shade), 3500 (63% shade), 2700 (73% shade), and 1600 (80% shade) ft-c. Ten plants per light level were grown under these conditions for approximately 2 months. A visual rating of plant quality (salability) was recorded at 2 months, and all plants were moved to a greenhouse with the conditions described for other tests. Plants were inoculated using methods previously described and the percentage of leaf area with blight symptoms was estimated 10 to 14 days later. This test was performed three times between July 1986 and August 1987.

Results and Discussion

Effect of temperature on growth of X. campestris from 'White Butterfly' and X. c. pv. dieffenbachiae in vitro. The effect of temperature on growth of the two organisms differed (Table 1). Growth was optimal for *X. campestris* pv. *syngonii* at 26°C (79°F) and for *X. c.* pv. *dieffenbachiae* at 22°C (72°F). In addition, *X. c.* pv *dieffenbachiae* grew at 34°C (93°F), while strains of *X. campestris* pv. *syngonii* did not survive 1 week at this temperature.

Effect of temperature on disease development. Temperatures between 18 and 34°C (93°F) had a marked effect on symptom expression (Table 2). No disease occurred at or below 24°C (75°F) with slight disease at 26 and 28°C (79 and 82°F) and optimal development at 30°C (86°F). Very slight disease development occurred at 32 or 34°C (90 and 93°F).

Effect of preinoculation light level on susceptibility. Preinoculation light levels between 1600 and 5000 ft-c did not consistently or significantly influence susceptibility of

Table 1. Effect of temperature on growth of *Xanthomonas campestris* pv. *syngonii* from *Syngonium podophyllum* 'White Butterfly' and *X. campestris* pv. *dieffenbachiae* from *Anthurium andraeanum* in liquid Wilbrink's medium.

Temperature °C (°F)	Mean percent transmittance after 1 week[z]	
	X. c. syngonii 'White Butterfly'	*X. c. dieffenbachiae* Anthurium
18 (65)	73.0[y]	22.7
20 (68)	66.5	19.9
22 (72)	61.5	16.7
24 (75)	60.0	26.2
26 (79)	55.8	51.7
28 (82)	63.6	66.3
30 (86)	63.5	73.2
32 (90)	76.1	77.7
34 (93)	95.9[x]	83.7

[z]Higher values of transmittance denote lesser bacterial growth. Means are given for five tubes per temperature.

[y]Significant effects of temperature on bacterial growth occurred for both pathogens by analysis of variance.

[x]Cultures were not viable after 1 week incubation at 34°C (93°F).

Table 2. Effect of temperature on development of Xanthomonas blight of *Syngonium podophyllum* 'White Butterfly' in growth chambers.

Temperature °C (°F)	Mean percentage of leaf area with symptoms[z]				
	Test 1 June 9	Test 2 June 26	Test 3 July 21	Test 4 August 19	Mean
18 (65)	nt[y]	nt	nt	0	0
22 (72)	0[x]	nt	nt	0	0
24 (75)	0	nt	nt	nt	0
26 (79)	2.2	9.0	16.0	7.5	8.7
28 (82)	5.4	9.4	10.0	nt	8.3
30 (86)	34.0	34.8	34.0	16.2	29.8
32 (90)	nt[y]	4.0	0	nt	2.0
34 (93)	nt	8.0	0	0	2.7

[z]Means are given for eight plants for each temperature included per test.

[y]nt = not tested.

[x]Significant differences (by analysis of variance) between temperatures occurred in each test.

'White Butterfly' to *X. campestris* pv. *syngonii* (Table 3). Although plant appearance differed among treatments (data not shown) sensitivity to the pathogen was not affected. Growth of these two organisms at different temperatures indicates that the two sets of isolates were different. This is also supported by two recently published reports of Syngonium blight from New York (2) and Florida (1).

Table 3. Effect of preinoculation light level on development of Xanthomonas blight of *Syngonium podophyllum* 'White Butterfly' in the greenhouse.

Light level ft-c.	Mean percentage of leaf area with symptoms[z]		
	Test 1 September 22	Test 2 June 4	Test 3 August 12
5000	14.5	80.0[y]	23.0
3500	17.0	72.0	19.4
2700	12.5	69.0	23.0
1600	24.0	70.0	16.5

[z]Means are given for ten plants per light level.

[y]Significant differences among treatments occurred in Test 2 only (analysis of variance P = 0.05).

Significance to the Nursery Industry

Because low temperature reduces syngonium blight disease severity, growers will be able to better control this disease by maintaining temperatures at less than 24°C (75°F) or higher than 30°C (86°F). Alternatively, bactericides can be applied during periods when the temperature is between 24 and 30°C (75 and 86°F). Since preinoculation light levels do not affect susceptibility, growers can produce plants at light levels optimum for plant production without increasing susceptibility to this bacterial pathogen.

Literature Cited

1. Chase, A.R., P.S. Randhawa and R.H. Lawson. 1988. A new disease of *Syngonium podophyllum* 'White Butterfly' caused by a pathovar of *Xanthomonas campestris*. Plant Disease 72:74–78.

2. Dickey, R.S. and C.H. Zumoff. 1987. Bacterial leaf blight of *Syngonium* caused by a pathovar of *Xanthomonas campestris*. Phytopathology 77:1257–1262.

3. McCulloch, L. and P.P. Pirone. 1939. Bacterial leaf spot of *Dieffenbachia*. Phytopathology 29:956–962.

A Dibble Fertilizer Applicator for Containers in Nursery Beds[1]

R.L. Parish[2], P.P. Chaney[3], W.A. Meadows[4], and D.L. Fuller[5]

Department of Agricultural Engineering
Louisiana Agricultural Experiment Station
Louisiana State University Agricultural Center
Baton Rouge, LA 70803

Abstract

A machine to punch dibble holes in multiple filled containers and simultaneously to meter fertilizer has been designed, built and tested. The machine handles up to 12 containers at a time in beds 6 containers wide. Transported and powered by a tractor, this machine straddles the containers in a nursery bed. Alignment of the mechanism over the containers and the dibble operation itself are accomplished hydraulically. Force and speed of the dibbles are adjustable. Uniformity of metering is good, with coefficients of variation in the range of 2 to 3%.

Index words: dibble, fertilizer application, metering

Introduction

Research on placement of fertilizers in containers has given somewhat variable results. In one test, dibble application of Osmocote resulted in better plant growth than did incorporation for 4 cultivars of azaleas, and 2 hollies, and equal results with 3 other species (2). In another test comparing dibble application with surface application, surface application resulted in better growth for 3 cultivars of azaleas, but dibble application gave better results for 3 other species (3). In several cases, dibble application has given better growth than larger amounts of incorporated fertilizer (3, 4); however, in 2 tests with sulfur-coated urea, surface application gave better growth than dibbling or incorporation (1, 3).

Although dibble application does not consistently lead to improved growth, it can offer some operational advantages to the grower. Containers can be filled and placed weeks

[1]Received for publication November 19, 1987; in revised form March 9, 1988. Approved for publication by the Director of the Louisiana Agricultural Experiment Station as Manuscript No. 87-07-1582.

[2]Associate Professor

[3]Research Associate

[4]Professor and Resident Director, Burden Research Plantation, Baton Rouge, LA 70809.

[5]Instructor, Burden Research Plantation