Effects of Fertilizer Rates on Severity of Xanthomonas Leaf Spot of Schefflera and Dwarf Schefflera

A. R. CHASE, Associate Professor of Plant Pathology, and R. T. POOLE, Professor of Ornamental Horticulture, University of Florida, IFAS, Agricultural Research and Education Center, 2807 Binion Road, Apopka 32703

ABSTRACT

Chase, A. R., and Poole, R. T. 1987. Effects of fertilizer rates on severity of Xanthomonas leaf spot of schefflera and dwarf schefflera. Plant Disease 71: 527-529.

Severity of Xanthomonas leaf spot of *Brassaia actinophylla* (schefflera) and *Schefflera arboricola* (dwarf schefflera) caused by *X. campestris* pv. *hederae* was negatively correlated with fertilizer rates up to five times those recommended for schefflera and dwarf schefflera. Plant growth was not affected over this fertilizer range, although elemental content of schefflera and dwarf schefflera were affected. As fertilizer rate increased, levels of nitrogen, phosphorus, and potassium increased; levels of sulfur, iron, manganese, boron, copper, and zinc were unaffected; and levels of magnesium, sodium, and calcium decreased.

One of the oldest known bacterial diseases of a foliage plant is caused by *Xanthomonas campestris* pv. *hederae* (Pammel) Dowson (1). This disease causes serious losses in worldwide production of *Hedera helix* L. (English ivy) (1,8,11). Recently, the disease was identified on several other members of the Araliaceae family including *Fatsia japonica* (Thunb.) Decne. & Planch. (Japanese fatsia), *Brassaia actinophylla* Endl. (schefflera), and *Schefflera arboricola* H. Ayata (dwarf schefflera) (4). Attempts to control this disease have included elimination of overhead irrigation and applications of bactericides. Although bactericides are commonly used for disease control on some hosts, they usually are not effective and sometimes damage foliage plants.

Florida Experiment Stations Journal Series No. 7525.

This research was supported in part by a grant from A & L Southern Agricultural Laboratories.

Accepted for publication 20 January 1987 (submitted for electronic processing).

The publication costs of this article were defrayed in part by page charge payment. This article must therefore be hereby marked "*advertisement*" in accordance with 18 U.S.C. § 1734 solely to indicate this fact.

Host nutrition is known to affect severity of a wide variety of diseases of plants (9) including Pseudomonas leaf spot of dwarf schefflera (5) and Alternaria leaf spot of schefflera and dwarf schefflera (6). In addition, high fertilizer rates appeared to reduce Xanthomonas leaf spot of schefflera (3) in some preliminary tests. Research was conducted to evaluate potential effects of host nutrition on severity of Xanthomonas leaf spot of schefflera and dwarf schefflera.

MATERIALS AND METHODS

Dwarf schefflera and schefflera plants were obtained from commercial growers as small seedlings (shorter than 6 cm) and potted in steam-treated (1.5 hr at 90 C) potting medium composed of Canadian peat and pine bark (50:50, v/v). The medium was amended with 4.2 kg of dolomite and 0.9 kg of Micromax (micronutrient source; Sierra Chemical Co., Inc., Milpitas, CA) per cubic meter. Ten plants of each species were fertilized with Osmocote (19:6:12, slow-release fertilizer; Sierra) as a topdressing at 2, 4,

6, 8, 10, or 12 g per 10-cm-square pot. The recommended rate for schefflera and dwarf schefflera is about 2.5 g of Osmocote 19:6:12 per 10-cm-square pot every 3 mo (7). Some tests were performed with larger (15-cm) pots and proportionally (based on surface area) the same amounts of fertilizer were used. Plants were grown in a glasshouse for 2 mo before inoculation, with diurnal temperatures fluctuating between 18 and 33 C and a maximum light level of 200 μE m^{-2} s^{-1}. Plant height and available soluble salts were recorded at test initiation and at 4 and 8 wk. Soluble salts were leached from pots with about 50–100 ml of deionized water, which was added to the potting medium surface in place of normal irrigation. The leachates, collected in beakers beneath the plants, were analyzed for soluble salts with a Hach conductivity meter no. 2511 (Hach Chemical Company, Ames, IA). Plants were inoculated after final growth measurements and soluble salts evaluations were made.

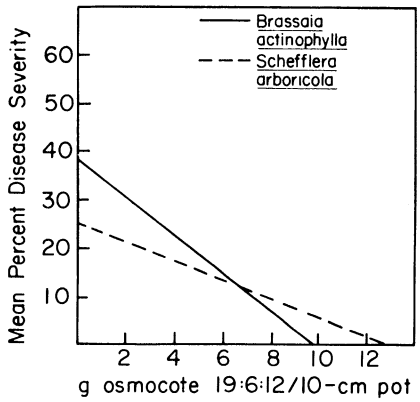

Fig. 1. Effects of fertilizer level on severity of Xanthomonas leaf spot of *Brassaia actinophylla* and Schefflera arboricola. Equations for the lines are (——) $y = 38.7 - 4.0x$, $R^2 = 0.56$ ($P = 0.05$) and (---) $y = 25.2 - 2.0x$, $R^2 = 0.72$ ($P = 0.05$).

Inocula were prepared from a strain of *X. campestris* pv. *hederae* originally isolated from schefflera (4). Culture plates 48 hr old were flooded with sterilized 0.01 M $MgSO_4$, and the surface of each was gently rubbed with a sterilized rubber policeman. The concentration of bacteria in the suspension was estimated with a spectrophotometer (600 nm) and diluted as needed to 1×10^8 colony-forming units. All plants were inoculated with a pump-action hand sprayer 24 hr after mist treatment was initiated (5 sec/30 min from 0800 to 2000 hours each day). Plants were enclosed in a polyethylene bag for 48–72 hr after inoculation, then arranged in a randomized complete block design with mist treatment until test completion. The mean percentage of the leaf area showing symptoms was estimated visually 7–28 days after inoculation. Tests were run on each host plant three times consecutively between 2 May 1984 and 28 April 1986.

In a separate test, leaf tissues were analyzed. Procedures and treatments were those described earlier. Mature leaves were collected and dried at 60 C for 3 days. Tissue was finely ground and analyzed for elements. Five replicate pots were used for each treatment for each plant species.

Data for percentage of leaf area with symptoms were converted to the square root of the arc sine value, then subjected to an F test (ANOVA) and, finally, regression analysis.

RESULTS

Severity of Xanthomonas leaf spot decreased linearly as fertilizer level increased on scheffleras and dwarf

Table 1. Effects of Osmocote rates on tissue analysis of *Brassaia actinophylla*

Osmocote (19N:2.6P:10K) per 10-cm pot[a] (g)	Percentage dry weight							Parts per million				
	N	P	K	S	Mg	Na	Ca	Fe	Mn	B	Cu	Zn
2	2.7	0.30	2.4	0.17	0.41	0.18	1.3	49	432	23	11	188
4	3.1	0.39	3.1	0.18	0.43	0.16	1.4	56	692	24	12	228
6	3.9	0.43	3.2	0.20	0.33	0.18	1.2	66	652	25	14	167
8	4.2	0.48	3.6	0.21	0.32	0.14	1.1	72	720	23	15	160
10	4.1	0.46	3.4	0.17	0.33	0.14	1.1	80	650	27	13	167
12	4.1	0.45	2.9	0.15	0.27	0.12	0.9	63	626	19	14	158
F test[b]												
Linear	78.07**	26.56**	5.16*	1.23	23.74**	7.08*	23.73**	9.08**	13.18**	0.25	4.46*	7.24*
Quadratic	20.08**	13.42**	17.10**	9.17**	0.05	0.13	2.31	6.08*	34.38**	1.94	2.24	0.05
Residual	1.63	0.29	0.75	1.37	1.85	0.71	1.14	1.05	3.45	1.05	1.07	2.77

[a] Fertilizer was applied once, about 8 wk before tissue harvest.
[b] Significant effects were partitioned into linear, quadratic, or residual character with the corresponding F value and significance levels at * = $P = 0.05$ or ** = $P = 0.01$.

Table 2. Effects of Osmocote rates on tissue analysis of *Schefflera arboricola*

Osmocote (19N:2.6P:10K) per 10-cm pot[a] (g)	Percentage dry weight							Parts per million				
	N	P	K	S	Mg	Na	Ca	Fe	Mn	B	Cu	Zn
2	2.9	0.27	2.8	0.14	0.90	0.08	2.0	427	838	38	25	242
4	3.4	0.32	3.1	0.14	0.65	0.05	1.7	558	960	38	20	269
6	3.2	0.34	2.6	0.13	0.54	0.04	1.6	495	1,000	35	16	259
8	3.9	0.33	3.3	0.14	0.47	0.04	1.8	521	1,080	31	27	269
10	3.7	0.31	3.4	0.13	0.60	0.04	1.5	516	902	35	21	199
12	3.6	0.35	2.9	0.15	0.50	0.03	1.6	357	848	32	20	250
F test[b]												
Linear	2.51	7.25*	1.07	0.16	21.50**	27.50**	6.22*	0.23	0.00	3.12	0.06	0.63
Quadratic	0.75	1.82	0.89	0.49	10.58	8.61**	0.77	1.70	6.51*	0.02	0.02	0.03
Residual	0.44	1.87	0.00	0.34	1.72	1.56	1.09	0.08	0.00	0.67	1.17	1.80

[a] Fertilizer was applied once, about 8 wk before tissue harvest.
[b] Significant effects were partitioned into linear, quadratic, or residual character with the corresponding F value and significance levels at * = $P = 0.05$ or ** = $P = 0.01$.

scheffleras in each test (Fig. 1). The decrease was linear, with very little disease occurring at the 10-g rate for schefflera and at the 12-g rate for dwarf schefflera.

There was no apparent effect of fertilizer rate on plant growth in any of the tests. Plant height, foliage quality grades, and foliage color were similar for all treatments of both hosts.

Increasing amounts of Osmocote led to a quadratic increase in tissue content for nitrogen, potassium, and phosphorus and a linear decrease in content for calcium, magnesium, and sodium (Tables 1 and 2). Tissue contents of other elements were unaffected by fertilizer treatment. These analyses were within those suggested for high-quality schefflera, with the notable exception of nitrogen and phosphorus. The levels of these elements in most of the treatments were in excess of the upper limit previously suggested (10).

Soluble salts readings ranged from 2,000 to 8,000 μmhos/cm at test initiation and from 500 to 6,000 μmhos/cm 8 wk after application. Some slow-release fertilizers such as Osmocote are known to release at different rates for different temperatures. In general, the higher the soil temperature the more rapid the nutrient release (2). Because soluble salts were monitored throughout each test and the tests were performed under a variety of temperature regimes, this fluctuation apparently did not influence the host response to the pathogen.

DISCUSSION

Because these plants were all high quality, the range for nitrogen and phosphorus should be extended to 2.5–4.2% for nitrogen and to 0.20–0.48% for phosphorus. Previously suggested levels for iron, manganese, and zinc were also low compared with those obtained in these studies, again indicating a need to revise suggested levels. The fact that such a wide range of tissue content for these elements results in a similar quality plant indicates the potential for fertilizer modification as a disease management tool.

Disease severity decreased on both schefflera and dwarf schefflera when higher-than-recommended amounts of fertilizer were applied to plants 2 mo before inoculation. Because these plants did not react adversely to this treatment, use of higher-than-recommended rates of fertilizer may be a means of reducing susceptibility of these hosts to *X. campestris* pv. *hederae*. In previous reports, the susceptibility of dwarf schefflera to Pseudomonas and Alternaria leaf spot was reduced when plants were heavily fertilized (5,6). In addition, Alternaria leaf spot on schefflera was reduced with fertilization (6). Thus, fertilization rates currently recommended could be increased to reduce disease susceptibility while continuing to maintain optimal plant growth.

ACKNOWLEDGMENTS

We thank Bill McLees and Jeanne Yuen for excellent technical assistance and Central Florida foliage producers for their generous donations of plant materials used throughout these tests.

LITERATURE CITED

1. Arnaud, G. 1920. Une maladie bacterie-une du lierra (*Hedera helix* L.) C.R. Hebd. Seances Acad. Sci. 171:121-122.
2. Brown, M. J., Luebsand, R. E., and Pratt, P. F. 1966. Effect of temperature and coating thickness on the release of urea from resin-coated granules. Agron. J. 58:175-178.
3. Chase, A. R. 1984. Effects of light level and fertilizer level on Xanthomonas leaf spot of scheffleras. Foliage Dig. 8(3):1-2.
4. Chase, A. R. 1984. *Xanthomonas campestris* pv. *hederae* causes a leaf spot of five species of Araliaceae. Plant Pathol. 33:439-440.
5. Chase, A. R., and Jones, J. B. 1986. Effects of host nutrition, leaf age, and preinoculation light levels on severity of leaf spot of dwarf schefflera caused by *Pseudomonas cichorii*. Plant Dis. 70:561-563.
6. Chase, A. R., and Poole, R. T. 1986. Effects of fertilizer rate on severity of Alternaria leaf spot of three plants in the Araliaceae. Plant Dis. 70:1144-1145.
7. Conover, C. A., and Poole, R. T. 1984. Light and fertilization recommendations for production of acclimatized potted foliage plants. Foliage Dig. 7(8):1-6.
8. Dye, D. W. 1967. Bacterial spot of ivy caused by *Xanthomonas hederae* (Arnaud, 1920) Dowson, 1939, in New Zealand. N.Z. J. Sci. 10:481-485.
9. Huber, D. M., and Watson, R. D. 1974. Nitrogen form and plant disease. Annu. Rev. Phytopathol. 12:139-165.
10. Poole, R. T., Conover, C. A., and Joiner, J. N. 1976. Chemical composition of good quality tropical foliage plants. Proc. Fla. State Hortic. Soc. 89:307-308.
11. White, R. P., and McCulloch, L. 1934. A bacterial disease of *Hedera helix*. J. Agric. Res. 48:807-815.