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Influence of Nitrogen and Phosphorus on Growth and Tissue N and P Concentration in *Salvia greggii*[1]

Billy W. Hipp, Benny J. Simpson and Paul S. Graff[2]
Texas Agricultural Experiment Station
Texas A&M University Research and Extension Center
17360 Coit Road, Dallas, TX 75252

Abstract

Studies were conducted at the Texas Agricultural Experiment Station, Dallas to determine nitrogen and phosphorus requirements of *Salvia greggii* Gray. (autumn sage), a resource-efficient landscape plant for the Southwest. Maximum growth of potted rooted cuttings used in the studies was obtained with application of 200 mg/liter (ppm) N and 50 mg/liter (ppm) P, although fertilization with 150 mg/liter (ppm) N and 30 mg/liter (ppm) P would produce near maximum growth. Tissue levels should be > 2.2% N and > 0.20% P for these elements not to limit growth.

Index words: fertilizer, landscape plants, native plants, plant analysis, autumn sage

Introduction

Resource efficient native landscape plants are gaining in popularity, particularly in the Southwest, where water is frequently limited or rationed. Most native plants with landscape potential are taken from locations such as the Chihuahuan Desert where annual rainfall is 25–30 cm/yr (10–12 in/yr) (7) and soil fertility is low. Little information is available regarding nutritional requirements for these plants under growth conditions required in containerized nursery production. Nursery production is an essential step in providing native plant material for landscape use. Nitrogen fertilizer requirements for nursery production of *Leucophyllum candidum* (3), *Arbutus xalapensis* (4), and N effects on rooting by *Leucophyllum* (6) have been determined.

Salvia greggii (autumn sage) is an attractive, hardy native perennial shrub that blooms much of the summer and is an excellent landscape plant for the Southwest. Since there is no information relative to containerized production of this plant, studies were conducted at the Texas Agricultural Experiment Station at Dallas to determine nitrogen (N) and phosphorus (P) fertilizer requirements and critical tissue N and P levels.

Materials and Methods

Rooted tip cuttings of *S. greggii*, approximately 6 cm (2.4 in) in length, were placed in 15 cm (1 gal) plastic pots containing 2 parts perlite:1 part vermiculite (by vol). Nitrogen treatments were applied by irrigating weekly with water containing variable levels of N and biweekly with water containing three different levels of P. Nitrogen levels were 12.5, 25, 50, 100 and 200 mg/liter (ppm) and P application rates were 0, 25, and 50 mg/liter (ppm). Water extracts (saturated paste) of medium from the zero P treatments contained 0.3 mg P/liter; thus the zero P treatment was actually 0.3 mg P/liter and each treatment level was elevated by that amount. The source of N was NH_4NO_3 and the P source was H_3PO_4. All pots were irrigated every 2 weeks with nutrient solution lacking N and P as described by Hoagland and Arnon (5) except chelated iron was substituted for iron tartrate. Media pH was approximately 6.3. Sufficient fertilizer solution was applied to provide about

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[2]Professor of Soil Chemistry, Research Scientist and Research Associate, resp.

300 ml drainage per pot. Irrigation water between treatments did not contain fertilizer. Treatments were replicated four times in a factorial arrangement. This study was conducted from April 21 to June 30, 1986. At termination of the study, plants were cut at media level, dried at 65°C (149°F), weighed, then ground in a Wiley mill. Nitrogen in whole plant material was determined by digestion as described by Gallaher et al. (2), and automated steam distillation and titration. Phosphorus in whole plants was determined by the molybdenum blue method described by Chapman and Pratt (1).

Results and Discussion

Plant dry weight increased with increasing N up to 100 mg/liter if no additional P was applied (Fig. 1); however, growth at 100 mg N/liter with no added P was only 63% of that obtained when 25 or 50 mg P/liter was applied at the same N level. Phosphorus rate was not important at 12.5 or 25 mg/liter N because growth was also limited by N. The relationship between N applied (X) and plant dry weight (Y) with no P applied could be described by the parabolic regression equation $\hat{Y} = 1.73 + 0.049X - 0.000132X^2$ ($R^2 = 0.88$). When 25 or 50 mg P/liter was applied, the increase in growth was almost linear to the 100 mg/liter N rate. A linear response to 100/mg N/liter was also observed on *Leucophyllum candidum* (3). The N response at 25 mg P/liter was curvilinear ($\hat{Y} = 1.01 + 0.10X - 0.000255X^2$, $R^2 = 0.96$). This indicates that 96% of the variation in plant dry weight could be accounted for by N rate. Increasing P fertilization rate to 50 mg/liter resulted in slightly more growth than at 25 mg P/liter when the N rate was increased to 200 mg/liter. Dry weight was only increased 13% by increasing P to 50 mg/liter (over 25 mg/liter P) at the 200 mg/liter N level. Dry weight could be predicted at the 50 mg/liter P rate by the equation $\hat{Y} = 1.23 + 0.092X - 0.000185X^2$ ($R^2 = 0.96$).

The relationship between percent N in whole plants and plant dry weight was curvilinear and indicated that 96% of the variation in dry weight could be accounted for by tissue N concentration (Fig. 2). Maximum growth could be attained with about 2.4% N in whole plants but about 80% of maximum growth was obtained with 2% N in whole plants. The 2% N level corresponds to the 100 mg/liter N rate. The data in Fig. 2 include only those plants from the 50 mg/liter P treatment. These tissue N levels are higher than the levels required by *Leucophyllum candidum* (3) and *Arbutus xalapensis* (4).

Data in Fig. 3 indicate that near maximum growth of the *S. greggii* used in this study was obtained with tissue P concentrations between 0.20 and 0.25%. Growth was reduced by about 30% if P levels in tissue were 0.12% compared to 0.25%. All data in Fig. 3 are from plants receiving 200 mg/liter N.

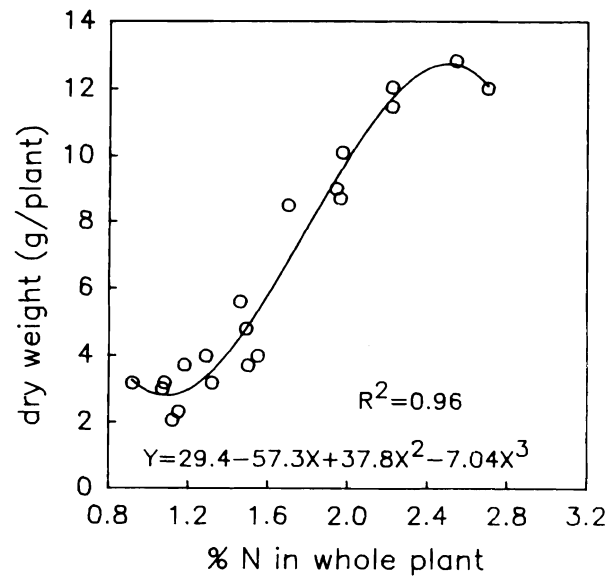

Fig. 2. Relationship between % N in *Salvia greggii* and plant dry weight.

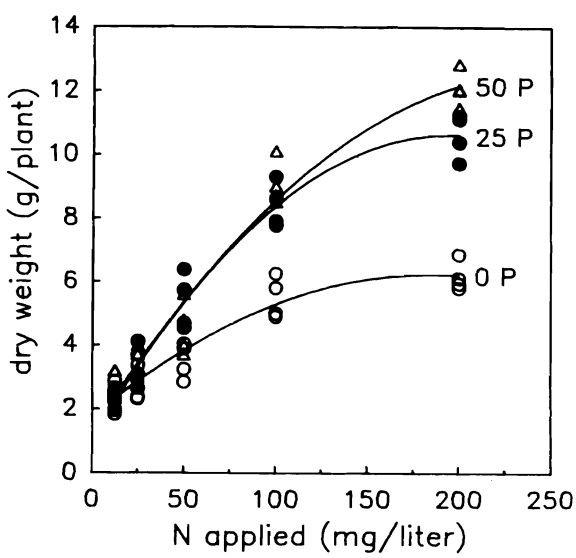

Fig. 1. Influence of applied N on dry weight of *Salvia greggii* at 3 rates of P fertilizer.

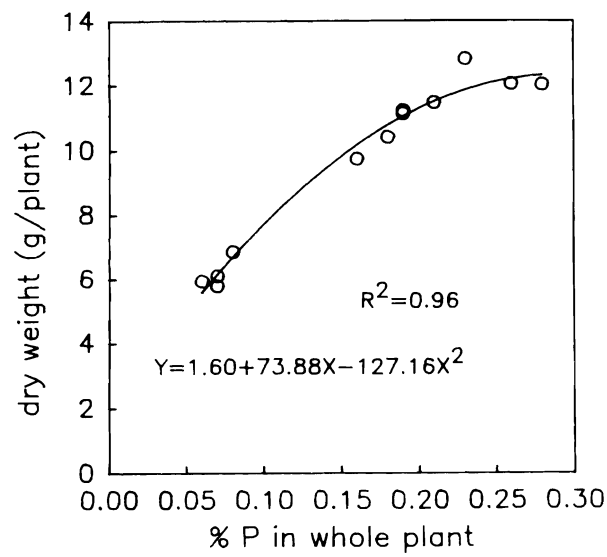

Fig. 3. Relationship between % P in *Salvia greggii* and plant dry weight.

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.

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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.

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[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)