LANDSCAPE

Roger Harris
Section Editor and Moderator

Twenty-eight students competed In the Bryson L. James Student Research Competition and twenty-nine research projects were presented in poster form, which were displayed for review during the SNA Research Conference and Trade Show, this year. Their research is presented in the topical sections which follow and are designated as Student or Poster papers.

The Revitalization of Landscape Gardening

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Nature of Work: The garden is the timeless manifestation of landscape design, as they can be found in the most ancient of civilizations. America's earliest gardens were unconscious design expressions developed as an outgrowth of practical food production needs. As the country developed, and capitalism created a wealthy segment of society, formal aesthetic gardens were built. This was a symbol of mastering a yet untamed world. Much has been written about the history of landscaping, but the most valuable of the early works on the practice of landscape gardening was ' Theory and Practice of Landscape Gardening " in 1793 by Humphrey Repton. Many of those observations can be applied to our 20th century spaces. As one of the earliest amateur gardeners, Thomas Jefferson in 1805 wrote that gardening should be considered one of the fine arts: "not horticulture but the art of embellishing grounds by fancy."

Several landscape architects with horticultural and agricultural backgrounds expanded the early foundation of the profession, including Andrew Jackson Downing , Robert Morris Copeland, and O.C. Simonds. Simonds design philosophy was best expressed in his book "Landscape Gardening", (1925) where he emphasized the need for studying nature as an inspiration for design. His designs featured carefully shaped land forms with paths and roads to reveal a site's natural character. The use of native flora was the backbone of his planting designs. He preferred the title 'landscape gardener' over the title
'landscape architect. '

Results and Discussion: The demand for professional landscape services has never been better. The economy is booming all across the nation and expendable income is at an all time high. Because of this economic situation and period of tremendous growth, a current niche market in the landscape industry has evolved...again. It is that of a professional landscape gardener. The modern day landscape gardener is a hybrid of several trade occupations:, designer, horticulturist, floriculturist, agronomist, carpenter, plumber, mason and electrician. An astute knack for business is also a fundamental ingredient for success.

The following 5 points are a brief description of a modern day, fine-gardening business.

1. It is not a landscape 'by the numbers' design firm where one offers a CAD oriented blueprint the same day of the initial site visit. The estimate is not a computer generated spreadsheet where everything is itemized and every minute of labor is accounted for. The landscape gardener creates a space specifically with the client in mind. The design evolves after several site visits and sketches on yellow trash. The estimate is negotiated in person. It is not a bid submitted along with numerous other landscapers. The garden evolves over many years.

2. This is not just another lawn care service business or landscape maintenance business where a crewcab pickup full of migrant laborers can do an entire residence every 22 minutes...mow, blow and go! he cleint and gardener have a personal relationship

3. The gardener is a 'hands-on' person. He/she doesn't control operations entirely from a clubcab pickup and a Nortel phone system. A minimum number of skilled employees are required for this type business. They have to take pride in their work and have a good eye for a 'finished' look.

4. There are a limited number of accounts. Don't over commit and under deliver on fine gardening. Fine gardening takes time and your clients want the best. They are willing to pay premium fees, so don't take shortcuts just to add on more customers. If you do, your company will become just another landscape design/ build/ maintenance business. Fine gardening at a private estate /residence includes all outdoor areas and activities; pools and water gardens, mixed borders, container gardens, roses, herbs, and vegetables, butterfly and wildlife gardens. A landscape gardening business often requires a greenhouse for growing , overwintering and plantcycling.

5. Adopt the philosophy that "bigger is not necessarily better", that quality is the top priority and that your reputation is the future. Develop a business reputation where clients specifically ask for your assistance and where gardening referrals are the best source of clients. If you have any employees, make sure they know the need for quality and they represent the company well. As they grow with the company, empower them to make decisions.

Significance to Industry: There is a demand for professional, fine gardening services. One will find that the capital outlay and investment is somewhat significant to start a gardening business but much less than the typical maintenance business. With good ‘people’ skills, good business ethics and proper technical skills, the professional landscape gardener can be quite successful in today’s economy.

Literature Cited:

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2. ‘Observations on the Theory and Practice of Landscape Gardening’ 1793 Humphrey Repton

3. ‘Treatise on the Theory and Practice of Landscape Gardening’ 1841 A.J. Downing

4. ‘Beautifying Country Homes’ 1870 J. Weidenmann

5. ‘Landscape Gardening’ 1912 F.A. Waugh Taunton’s Fine Gardening Magazine 1998 The Taunton Press

Obtaining and Sharing New Plant Germplasm

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Nature of Work: Botanical gardens have long been gathering plant materials for both scientific study and for the simple enjoyment of their visitors. Just before the turn of the century, a horticultural revolution began which prompted numerous botanical institutions to initiate collecting expeditions to far corners of the world. Today, these botanical gardens and arboreta serve as an invaluable source of germplasm for research efforts as well as for the green industry. More recent plant collecting expeditions continue to add greater diversity and value to the collections at many of these institutions.

Results and Discussion: As horticulturists and plant scientists, we are very fortunate to live in this day in age, as there are many wonderful plants that are readily available to us. With the technological advances in research and development and the ease of communication and travel, our abilities to obtain and share new and unusual plants are greatly facilitated. Despite an industry already rich with plant diversity, there are still many untapped sources of plant material that hold great potential.

For at least a century, both botanical gardens and nurserymen have been sponsoring plant collecting expeditions with the hopes of obtaining new germplasm. Towards the end of the 19th century, botanical institutions developed a very proactive approach towards sponsoring expeditions particularly to the newly “opened” country of China. It was in this time period that plant exploration became a profession in its own right and with that profession new species were arriving in the West with the return of almost every expedition. Many new introductions soon made their way into European and American gardens and were placed under evaluation to monitor their potential as ornamentals. The plant collecting of this time period had an enormous impact on American and European horticulture. Many of these shipments of seeds and plants were distributed to nurserymen and botanical institutions throughout Europe and North American. Consequently, several gardens, particularly in England and the northeastern US, maintain very diverse collections with much emphasis on the Asian flora.

Since the primary role of botanical institutions at this time was research, newly introduced plants were well maintained and documentation of their origin was recorded. As a result, several botanical institutions hold a wealth of information both in written records and living specimens that could serve as an invaluable source for plant related research. In addition to making materials available to nurserymen, most institutions have been and still are very eager to supply plant material for research at other institutions. In fact, the mission statements of numerous botanical gardens and arboreta state that as being one of their primary roles. Many old specimens that originated from these early expeditions still stand today and are awaiting their role as subjects in scientific studies.

Botanical gardens and arboreta have played a major role in plant introduction and horticultural research in the past. Today, however, conservation and cooperation between institutions have become two main areas of focus in the botanical garden community. Duplication of effort has been recognized as a major problem that is ultimately caused by a lack of communication. Botanical institutions are now making attempts to work closely with other organizations such as the USDA and the American Association of Botanical Gardens and Arboreta (AABGA, Kennett Square, PA) to resolve these issues. Current objectives are to minimize duplication, pool areas of expertise and involve all gardens, both large and small, in a cooperative effort to preserve genetic diversity.

It is hoped that a National Collections system can be established through a network of American gardens. A similar system already exists in the United Kingdom and has proven to be a successful way of eliminating duplication. The National Council for the Conservation of Plants and Gardens (NCCPG, Woking, England) is an organization, the first of its kind, which coordinates the efforts of gardens, both private and public, throughout Great Britain and Ireland. This system allows participating gardens to focus on one particular group (genus) of plants. The collections are as diverse as possible and well curated so to serve as permanent resources for education, research, and conservation. These plants, including older varieties that have been abandoned by growers, contain valuable genetic resources that could prove vital in future breeding projects as well as in other horticultural research.

In addition to gardens, there are other sources that should be consulted when looking to acquire new germplasm. To mention one, the National Plant Germplasm System (NPGS, supported by the National Germplasm Resource Laboratory, Beltsville, MD) is a cooperative effort of public and private organizations that work to preserve the genetic diversity of plants. This network is comprised of over 30 different repositories that maintain and freely distribute plant material from their collections to facilitate research. Although the focus is mainly on crop plants, it is still a valuable source of genetic material for breeding and research on ornamental plants.

In combining the collections of repositories with that of botanical gardens, there is a vast amount of germplasm readily available to both researchers and nurserymen. Despite the large collections that are currently be maintained, collecting expeditions are still continuing. The introduction of new species to cultivation is not as common as times past but obtaining and sharing new, valuable germplasm is still in much need. At least two expeditions were undertaken last Fall to different parts of China bringing back new germplasm of plants already known in cultivation as well as a few that have not previously been cultivated in the West. These collections will ultimately make their way into gardens to serve as future resources for research and potentially may become new garden ornamentals.

Significance to the Industry: The role that botanical gardens and arboreta have played in plant related research has been very profound in the past but is still very much needed today. Gardens that are not directly affiliated with universities often collaborate with such educational institutions on research efforts. With the financial hardships that many gardens face today, it is imperative that universities and other research institutions utilize these sources of material for conducting research. Several institutions advertise their collections as a source of material for research by making available copies of their inventories and supplying requested material free of charge. A well curated and documented collection is of enormous value but only when they are utilized in research efforts. The rich collections at private, public, and state institutions combined hold a wealth of germplasm that should not be allowed to go unexploited in our efforts to make improvements in the green industry.

Effect of Mowing Height and N and K Rate on 'Palmetto' St. Augustinegrass

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Nature of Work: St. Augustinegrass [*Stenotaphrum secundatum* (Walt.) Kuntze] is a widely utilized lawn turfgrass that is found from the Carolinas to Florida and along the Gulf Coast into Texas (1). It is best adapted to areas with mild winter temperatures and is tolerant of high summer temperatures (1, 3). St. Augustinegrass is a coarse textured turfgrass with stolons and has good to excellent shade tolerance. It is utilized primarily for lawns providing adequate turf at moderate maintenance levels but it will result in a more dense and greener stand of turf when maintained at a higher level of maintenance (3).

The most common cultivar of St. Augustinegrass utilized in Louisiana is 'Raleigh' which has excellent cold tolerance but is susceptible to chinch bugs and brown patch disease. Recently, a new cultivar of St. Augustinegrass, 'Palmetto', has been released that is gaining popularity as a lawn and commercial turfgrass. In the last two to three years, many sod producers from the Carolinas to California have started growing 'Palmetto'. It is a semi-dwarf type with an attractive dark green color and a medium leaf texture (2). It performs well in the shade and has very good cold and frost tolerance. There has been a limited amount of research done on 'Palmetto'. The objective of this study was to evaluate the effects of combinations of mowing height, nitrogen rate, and potassium rate on 'Palmetto' St. Augustinegrass in southern Louisiana.

A study was initiated on newly established turfgrass plots of 'Palmetto' St. Augustinegrass in May of 1997 at the Burden Research Plantation in Baton Rouge, LA. The treatments started in May and continued through November. The treatment combinations consisted of high (H) and low (L) mowing heights, high (H) and low (L) rates of nitrogen (N), and high (H) and low (L) rates of potassium (K) at the following levels: mowing heights of 5 cm (2 inches) and 7.5 cm (3 inches); N rates of 454 and 227 g N/92.9 m^2/month (1.0 and 0.5 lb N/1000 ft^2/month); and K rates of 454 and 227 g K/92.9 m^2/month (1.0 and 0.5 lb K/1000 ft2/month). The treatment combinations were (mowing, N, and K): HHH, HHL, HLH, HLL, LHH, LHL, LLH, and LLL. Half of each of three replications were cut twice weekly at the two mowing heights in order to maintain the proper mowing heights. Fertility treatments were applied in 2 split applications each month in order to provide half of the total N and K monthly amounts for each treatment at any one application. Nitrogen applications were made in one direction and K applications made in the perpendicular direction. All plots received two applications of a micronutrient fertilizer (late June and August) and were irrigated as needed. The study was a randomized complete block design with 3 replications. Data analyses utilized the GLM procedure of SAS (4).

Color, density, texture, uniformity, and quality were determined visually on a monthly basis from May through October (only data for May - July is presented). Each of these parameters were determined on a 1 to 9 scale as follows: a) color: 1=brown, 9=dark green; b) density: 1=lowest shoot density, 9=highest shoot density; c) texture: 1=widest leaf blades (most coarse leaf blades), 9=finest (least coarse); d) uniformity: 1= least uniform (presence of weeds, bare areas), 9=most uniform (absence of weeds, bare areas); and e) quality: 1=lowest, 9=highest. Quality takes into account the color, density, and uniformity of the turfgrass stand thus providing an indication of the overall appeal of the stand of turf (5).

Results and Discussion: There were significant differences for color, uniformity, and quality for ‘Palmetto’ St. Augustinegrass from May through July, with the only exception being no differences for uniformity during May (Table 1). There were no differences for either texture or density for any month (data not shown).

The high mowing height and N rate treatments (HHH and HHL) had the highest color ratings for May (Table 1). For both June and July, these two treatments along with the low mowing height and high N rate treatments (LHH and LHL) had the highest color ratings. Therefore, mowing height did not affect color during June and July since both heights under the high N rate resulted in similar color. The four treatments with low N (HLH, HLL, LLH, and LLL) had color ratings of 4.0 during July; this would be considered unacceptable color as far as being aesthetically pleasing.

The high N rate in combination with both mowing heights (HHH, HHL, LHH, and LHL) had the highest uniformity in June and July (Table 1). The LLH and LLL treatments were similar to these for July while the two high mowing height and low N rate treatments (HLH and HLL) had the lowest uniformity. The lower mowing height in combination with the low N rate (LLH and LLL) had greater uniformity than the high height and low N rate (HLH and HLL). A lower height of cut enhances horizontal spread of the stolons and may have a positive effect on uniformity especially when the N rate is low.

Turfgrass quality was the best under the high mowing and high N rate (HHH and HHL) during May (Table 1). Quality was similar under these two treatments and the low mowing and high N rate treatments (LHH and

LHL) for both June and July. This was similar to what resulted for color ratings for these months and these treatments. The low mowing height and low N rate treatments (LLH and LLL) and the high mowing height and low N rate treatments (HLH and HLL) had the lowest quality for May and July, respectively.

Nitrogen at the high rate in combination with either mowing height provided the best color, uniformity, and quality overall for 'Palmetto' St. Augustinegrass. There did not seem to be any trend regarding the potassium rates. Potassium is important to the turfgrass plant in relation to the stress tolerance and water relations of the plant. Although the rates of K did not seem to show any visual differences as did the N rates, proper amounts of K are important to the overall health and quality of the turfgrass stand.

Significance to Industry: 'Palmetto' St. Augustinegrass is starting to be utilized in Louisiana as a lawn turfgrass. Presently, 'Raleigh' is the predominant cultivar being used, so 'Palmetto' has the potential to be utilized even more as an alternative to 'Raleigh'. This study indicated that 'Palmetto' provided a very good to excellent stand of turf with very good color during the months of May, June, and July in southern Louisiana. Over the course of the study, the high rate of N (1.0 lb N/1000 ft^2/month) provided the best color, uniformity, and quality. The low N rate resulted in unacceptable color for July and average or above average color for May and June. Therefore, proper N fertility along with the appropriate mowing height will result in good quality 'Palmetto' turf that has acceptable color. Further research needs to be done to compare 'Palmetto' with 'Raleigh' and to investigate the cold, frost, and shade tolerance of 'Palmetto'.

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Table 1. Visual color, uniformity, and quality for 'Palmetto' St. Augustinegrass under different mowing height, N rate, and K rate treatment combinations for May, June, and July 1997.

			May			June			July		
Mowing	N	K	Color	Uniformity	Quality	Color	Uniformity	Quality	Color	Uniformity	Quality
H	H	H	7.7 a[1]	7.7	7.3 a	7.3 a	8.3 a	7.3 a	6.0 a	8.0 a	8.0 a
H	H	L	7.7 a	7.7	7.3 a	7.3 a	8.0 a	7.3 a	6.0 a	7.7 a	7.7 a
H	L	H	6.0 b	7.3	6.3 b	5.3 b	7.0 b	5.3 b	4.0 b	6.3 b	6.0 c
H	L	L	6.0 b	7.3	6.3 b	5.0 b	7.0 b	5.3 b	4.0 b	6.3 b	6.0 c
L	H	H	6.0 b	7.7	6.3 b	7.7 a	8.0 a	7.7 a	6.0 a	8.0 a	8.0 a
L	H	L	6.0 b	7.7	6.3 b	7.7 a	8.0 a	7.7 a	6.0 a	8.0 a	8.0 a
L	L	H	5.0 c	6.3	5.0 c	5.0 b	7.0 b	5.3 b	4.0 b	7.3 a	7.0 b
L	L	L	5.0 c	6.3	5.0 c	5.0 b	7.0 b	5.3 b	4.0 b	7.3 a	7.0 b
		LSD	0.5	NS	0.8	1.3	0.7	1.3	1.0	0.8	0.4

[1] Means within columns followed by the same letter are not significantly different according to LSD mean separation test, alpha = 0.05.

Effect of Nitrogen and Potassium on 'El Toro' Zoysiagrass

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Nature of Work: Zoysiagrass is a warm season turfgrass native to China, Japan, and Southeast Asia that is adapted to the very warm humid, warm humid, warm semiarid, and transitional zones of the United States (1). It is utilized as a lawn turfgrass and may be used on golf course tees and fairways, athletic fields, and parks. Zoysiagrass has stolons and rhizomes which form a very dense stand of turf resulting in few weed problems in established turf. In addition, it has a deep root system and excellent heat and drought hardiness. Despite many positive attributes, zoysiagrass has not been utilized in Louisiana and the Gulf States very much. This may be attributed to a slow rate of establishment and a tendency to form thatch. When maintained under proper cultural and climatic conditions, it forms a uniform, dense, and high quality turfgrass.

'El Toro' is a cultivar of Korean lawngrass (*Zoysia japonica* Steud.) that was released in the 1980's by the University of California, Riverside. It is characterized by having a coarse leaf texture similar to 'Meyer' and a faster establishment rate than most other zoysiagrasses (3). Compared to 'Meyer', it has better cool season color and an earlier spring green-up. It has a lower thatch production compared to other zoysiagrasses and has very high resiliency once established. The stiffness of the stems and leaves allows it to provide a high quality turf and to be resistant to wear. There is the potential for zoysiagrasses to be utilized more in the Gulf Coast states as a lawn grass and on golf courses and athletic fields (2). Minimal work has been done on the fertility response of zoysiagrass, specifically 'El Toro' zoysiagrass, and the effect on turf color and quality. The objective of this study was to evaluate the effects of nitrogen and potassium fertility on 'El Toro' zoysiagrass.

Studies were initiated on established turfgrass plots of 'El Toro' in July of 1996 at the Burden Research Plantation in Baton Rouge, LA. Treatments began in July and continued through November. The treatment combinations consisted of high (H) and low (L) rates of nitrogen (N) and potassium (K) at the following levels: N levels of 454 and 227 g N/92.9 m^2/month (1.0 and 0.5 lb N/1000 ft^2/month) and K levels of 454 and 227 g K/92.9 m^2/month. The treatment combinations were (N and K): HH, HL, LH, and LL. All fertility treatments were applied in 2 split applications each month in order to provide half of the total N and K amount for each treatment at any one application. The study was a randomized complete block design with 3 replications. Individual plots were divided into four sub-plots with N applications applied in one direction and K applications applied in a perpendicular direction. Plots received two applications of a micronutrient fertilizer (late June and August), were irrigated as needed, and maintained at a height of 3.8 cm (1.5 inch).

Turfgrass color, density, texture, uniformity, and quality were determined visually for each month. Each of these were determined on a 1 to 9 scale as follows: a) color: 1=brown, 9=dark green; b) density: 1=lowest shoot density, 9=highest shoot density; c) texture: 1=widest leaf blades (most coarse leaf blades), 9=finest (least coarse); d) uniformity: 1= least uniform (presence of weeds, bare areas), 9=most uniform (absence of weeds, bare areas); and e) quality: 1=lowest, 9=highest. Quality takes into account the color, density, and uniformity of the turfgrass stand thus providing an indication of the overall appeal of the stand (5). Plant tissue samples from each plot were collected in August and analyzed for macronutrient content (nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur).

Results and Discussion: There were significant differences for color for the months of July and September as shown in Table 1. Both high nitrogen treatments provided the highest color rating in July (5.0) and in September (6.8). Color ratings for the low nitrogen treatments in July were 3.3 which would be considered a low value. There were similar color ratings for all treatments in October (5.8). In December, the color ratings for the high N treatments were 3.5 and 3.3 for the low N treatments (data not shown). There were no differences among treatments for density, uniformity, and quality for any month (Table 1). Texture was similar for all treatments for each month varying from 3.8 to 4.7 (data not shown). The nitrogen and potassium treatments used in this study resulted in few differences for color, density, uniformity, and quality in ‘El Toro’ zoysiagrass. High and low levels of both N and K provided similar responses.

Macronutrient content was determined for all treatments in August and resulted in no significant differences for any nutrient under any treatment (Table 2). Nitrogen (sufficiency range of 20.0 - 50.0 g kg^{-1}), phosphorus (2.0 - 6.0 g kg^{-1}), and sulfur (2.0 - 5.0 g kg^{-1}) contents were within the sufficiency ranges for each of these nutrients for turfgrasses (4). Potassium content was below the sufficiency range (20.0 - 50.0 g kg^{-1}) for all treatments. Calcium content was below the sufficiency range (5.0 - 15.0 g kg^{-1}) as was magnesium (2.0 - 5.0 g kg^{-1}) for all treatments. Although turfgrass color was acceptable, the levels of magnesium in the plant affect color since magnesium is a component of the chlorophyll molecule.

Slightly higher Mg content might then help improve the color of the ‘El Toro’ zoysiagrass. Adequate levels of all nutrients would be more beneficial to the overall quality of the turf.

Significance to Industry: ‘El Toro’ zoysiagrass has potential to be utilized as a turfgrass in the Gulf Coast states including Louisiana. It establishes faster than most other zoysiagrass cultivars and, once established, it forms a dense turf which is usually weed-free maintaining its color well into the fall. Since it is very heat and drought tolerant, it can survive periods of limited or no rainfall. ‘El Toro’ zoysiagrass has the potential to be utilized on home lawns, golf tees and fairways, and parks. In this study, it provided good quality turfgrass of acceptable color even at low nitrogen and potassium rates. This cultivar of zoysiagrass needs to be considered as a turfgrass in certain situations in Louisiana and the Gulf states.

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Table 1. Visual color, density, uniformity, and quality ratings for 'El Toro' zoysiagrass.

Treatment N	Treatment K	Color	Density	Uniformity	Quality
		July			
H	H	5.0 a[1]	5.5	5.3	5.3
H	L	5.0 a	5.5	5.5	5.5
L	H	3.3 b	5.5	5.5	5.2
L	L	3.3 b	5.5	5.5	5.2
	LSD	1.3	NS	NS	NS
		August			
H	H	4.5	6.75	7.25	5.3
H	L	4.5	6.75	7.25	5.3
L	H	4.5	6.75	7.25	5.3
L	L	4.5	6.75	7.25	5.3
	LSD	NS	NS	NS	NS
		September			
H	H	6.8 a	7.5	8.0	7.0
H	L	6.8 a	7.5	8.0	7.0
L	H	5.6 b	7.5	7.7	6.3
L	L	5.6 b	7.5	7.7	6.3
	LSD	0.8	NS	NS	NS
		October			
H	H	5.8	8.25	8.0	6.0
H	L	5.8	8.25	8.0	6.0
L	H	5.8	8.25	8.0	6.0
L	L	5.8	8.25	8.0	6.0
	LSD	NS	NS	NS	NS
		November			
H	H	5.8	7.0	7.0	6.0
H	L	5.8	7.0	7.0	6.0
L	H	5.8	7.0	7.0	6.0
L	L	5.8	7.0	7.0	6.0
	LSD	NS	NS	NS	NS

[1] Means within columns followed by the same letter are not significantly different according to LSD mean separation test, alpha = 0.05.

Table 2. Macronutrient concentrations for 'El Toro' zoysiagrass under high and low nitrogen and potassium rates.

	Nitrogen and Potassium Treatments			
Nutrient	HH	HL	LH	LL
	$g\ kg^{-1}$			
Nitrogen	33.3[1]	36.1	32.6	32.9
Phosphorus	3.3	3.7	3.9	3.9
Potassium	18.8	19.3	19.0	18.4
Calcium	2.5	2.8	2.4	2.7
Magnesium	1.4	1.5	1.4	1.4
Sulfur	3.5	3.7	3.6	3.6

[1] There were no significant differences based on LSD mean separation test, alpha = 0.05.

Ornamental Crabapples Cultivar Recommendations for Plant Hardiness Zones 6 and 7

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Nature of Work: Crabapple (*Malus* sp.) is a major small to medium size tree representing over 300 species and cultivars. Most crabapple cultivars are susceptible to one or more serious diseases in the landscape among which are fireblight, apple scab, cedar-apple rust and powdery mildew. Observational and research evaluations of crabapple cultivars were reported through the decades of the seventies and eighties in the several northeastern and midwestern states. (see L.P. Nichols et al And T.L. Green2). Previous papers reported at SNA by K.Tilt et al3 and W. Witte et al4 reported that disease pressure from apple scab was less significant at either trial sites in Greeneville, TN (plant zone 6b) or in Brewton, AL (8a). Sutton et al5 states that apple scab "is generally not as important in apple orchards in the southeastern United States."

Results and Discussion: A summary of the results from the TN and AL studies and additional information from other sources is contained in table 1. The term "ornamental crabapple" refers to those cultivars which (1) show high resistance to the four major diseases reported for Malus sp. and (2) produce fruit equal to or less than 5/8 inches in diameter. The double attractions of colorful fruit and bird feeding during the fall and winter seasons have spurred greater production, sales and marketing for planting the better ornamental crabapples in residential and commercial landscapes. The listing also singles out those cultivars susceptible to frog-eye disease. This leaf spot fungus does not result in significant premature leaf drop through the spring and summer seasons.

Significance to Industry: This information represents the latest information on the selection of crabapple cultivars based on their ornamental and aesthetic values in the landscape. This listing should prove valuable to nursery producers wishing to improve their catalog inventory and to landscapers and garden center operators desiring disease resistant crabapple cultivars for residential and commercial properties and for attracting fruit-feeding birds. Most ornamental crabapples are small trees and offer an alternative to the over-planted and taller callery pears within plant zones 6 and 7.

Acknowledgment: The authors wish to thank J. Frank Schmidt and Son, Inc., Boring, Oregon for generously donating 60 cultivars of crabapples in TN and AL trial sites.

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Table 1: RECOMMENDED ORNAMENTAL CRABAPPLES FOR PLANT ZONES 6 AND 7

CULTIVAR *(Malus* x)	**MATURE FORM**	**FLOWER**	**FRUIT**
	Height x Spread (ft.)		$\preceq$ 5/8" diameter
Adams	20 x 20	magenta	red
Adirondack	18 x 10	white	orange-red
Beverly	20 x 20	white	red
Bob White	20 x 20	white	yellow
Candied Apple (weeping)	15 x 15	magenta	red
Centurion	20 x 15	pink	red
David[a]	12 x 12	white	red
Donald Wyman	20 x 20	white	red
Doubloons	18 x 16	double white	yellow
Indian Summer	20 x 18	magenta	red
baccata Jacki	20 x 20	white	red
Liset[a]	15 x 15	red	red
Louisa[b] (weeping)	15 x 15	pink	yellow
Ormiston Roy	20 x 25	white	yellow-orange
Prairifire	20 x 20	red-purple	dark red
Professor Sprenger[a]	20 x 20	white	orange-red
Red Jewel[a]	16 x 12	white	cherry-red
Robinson	25 x 25	deep pink	red
sargentii	8 x 14	white	red
Silver Moon[a]	20 x 12	white	red
Sinai Fire (weeping)	15 x 15	white	red
Sugar Tyme[a]	18 x 15	white	red
Tina	5 x 6 (dwarf)	white	red
White Cascade	15 x 15	white	lime-yellow
zumi 'Calocarpa'	20 x 20	white	red

[a]resistance to fire blight good
[b]susceptible to frog eye

Evaluation of Deciduous Azaleas (*Rhododendron* spp.) for Cold Hardiness Potential

(Student)

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Nature of Work: The popularity of deciduous azaleas in the southeastern United States has increased due to their showy floral displays and adaptability to adverse environmental conditions (Bowers, 1960). However, breeders and growers have concerns regarding the adaptability of deciduous azaleas to freezing stress. The flower buds are the most vulnerable organ to cold injury and are particularly susceptible to hardening and dehardening induced by temperature fluctuations (Alexander & Havis, 1980). Temperature fluctuations are common in southern geographic regions even during midwinter. Many *Rhododendrons* have extended north-south ranges and provenance can dictate the maximum low temperature survival (Dirr, Lindstrom, Lewandowski, & Vehr, 1993). Field observations in a few locations have provided cold hardiness ratings for many species and cultivars. For species with a wide geographic range these ratings may not be applicable. Dirr and Lindstrom (1990) have indicated a strong correlation between cold hardiness observed in the field and laboratory tests for accessions evaluated at the same location. Therefore, laboratory cold hardiness evaluations were done as previously described by Lindstrom and Dirr (1989) to determine the maximum midwinter hardiness of flower buds of *Rhododendron* spp. in the southeastern United States. The taxa evaluated were *R. arborescens, R. atlanticum*, *R. calendulaceum, R. viscosum* (species), *R. viscosum* (Serrulatum series), 'Buttercup', 'My Mary', 'Nacoochee' and TNLV1 (a hybrid with R. *molle* subsp. *japonicum* parentage). Samples were collected from outdoor plantings in Griffin, GA.

Results and Discussion: *Rhododendron* taxa showed wide variability in flower bud hardiness on both sampling dates. Cold hardiness in December 1997 and February 1998 for the *Rhododendron* taxa evaluated in this study is given in Table 1. *Rhododendron atlanticum*, TNLV1, and *R. viscosum* (species) exhibited the greatest cold hardiness on both dates. All three taxa survived to -21°C (-6°F) in December 1997 and *R. atlanticum, R. molle* subsp. *japonicum* hybrid, and *R. viscosum* (species) survived to -21°C (-6°F), -21°C (-6°F), and -24°C (-10°F) in February 1998, respectively. The least hardy taxa was 'Buttercup' which survived to only -9°C (16°F) in February 1998. Two of the nine taxa, *R. arborescens* and 'Buttercup', were less hardy in February than December in comparison to the other seven taxa which were hardier in February than December. Temperatures just prior to testing can cause rapid hardening and dehardening of flower buds (Pellett, Rowen, & Aleong, 1991). Graham and Mullin (1976) reported that taxa which harden more readily during decreasing temperature regimes also deharden more readily during increasing temperature regimes. Interactions between genotype and environment (e.g. temperature fluctuations) may explain why *R. arborescens* and 'Buttercup' were less hardy in February than in December.

In a previous study, Pellett et al. (1991) examined the cold hardiness of various provenances of *R. calendulaceum* and *R. viscosum.* The cold hardiness of the flower buds of *R. calendulaceum* and *R. viscosum* ranged from -20°C(-4°F) to -25°C(-13°F) and -30°C(-22°F) to -35°C(-33°F), respectively. Plants of *R. calendulaceum* and *R. viscosum* were grown in Minnesota from seeds collected in Kerens, WV and Packardville, MA, respectively. Seeds of both species were also collected along the Blue Ridge Parkway in North Carolina and grown in Minnesota. In the present study, the lowest survival temperatures for the flower buds of *R. calendulaceum* and *R. viscosum* ranged from -12°C(10°F) to -18°C(0°F) and -21°C(-6°F) to - 24°C(11°F). The accessions examined in this study were grown from an unknown seed source by a commercial nursery in Georgia. While differences were found in the lowest survival temperatures of flower buds, the species ranked in the same order of cold hardiness with *R. viscosum* being hardier than *R. calendulaceum.* Differences in the lowest survival temperatures of flower buds are attributed to either provenance or cold hardiness changes associated with temperature fluctuations.

Further evaluations of these taxa will be made in the fall and spring to determine the effects hardening and dehardening induced by temperature fluctuations on the cold hardiness of flower buds.

Significance to the Industry: Many woody plants, including deciduous azaleas, are limited in their range of adaptability due more so to cold than any other environmental factor. The distribution of azaleas is primarily limited by the susceptibility of their flower buds to cold injury. Hardiness ratings are available for many taxa, however, these ratings are based on field observations in a few locations and may not be applicable to different geographic regions. This study provides laboratory information on the cold hardiness of flower buds of deciduous azalea (*Rhododendron* spp.) in Georgia.

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Table 1. Lowest survival temperatures (LST) in %C(%F) for flower buds of Rhododendron taxa.

Taxa	Dec. 97 Buds ºC(ºF)	Feb. 98 Buds ºC(ºF)
R. arborescens	-18(0)	-15(5)
R. atlanticum	-21(-6)	-21(-6)
R. calendulaceum	-12(10)	-18(0)
R. viscosum (Serrulatum series)	-15(5)	-21(-6)
R. viscosum	-21(-6)	-24(-11)
‘Buttercup’	-12(10)	-9(16)
‘My Mary’	-18(0)	-21(-6)
‘Nacoochee’	-18(0)	-21(-6)
TNLV1[z]	-21(-6)	-21(-6)

[z]A hybrid with R. molle subsp. japonicum parentage.

Heat Tolerance in Perennial Salvias

(Student)

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Nature of Work: The genus *Salvia* L. comprises approximately 900 species of shrubs and perennial, biennial, and annual plants of cosmopolitan distribution. In recent years, many of these species, and cultivars derived from hybridization and selection, have been introduced into cultivation in American gardens (2). However, limited information is available on heat tolerance of salvias now cultivated. Only *S. splendens* Sell. ex Roem. & Schult. has been studied extensively, due to its importance as a bedding plant.

Of the species of *Salvia* that are grown currently in the southeastern U.S., two groups can be designated: (A) European species and derived cultivars [*Salvia* x s*ylvestris* L. 'Mainacht' (usually translated as "May Night") and *S. nemorosa* L. 'Ostfriesland' (translated as "East Friesland")] and (B) Latin American species and derived cultivars [*S. leucantha* Cav. ("Mexican bush sage"), *S. greggii* A. Gray ("Texas sage" or "autumn sage" or "cherry sage"), *S. guaranitica* St.-Hil. ex Benth. ("blue anise sage"), and *S. chamaedryoides* Cav. ("blue oak sage" or "germander sage")]. On average, European *Salvia* are believed to prefer cooler, moister conditions than the Latin American (especially the Mexican) Salvia, many of which are adapted to hot, sunny sites. Therefore, the objective of this study was to quantify the range of heat tolerance existing among a diverse group of perennial salvias.

Rooted stem cuttings of *S.* x*sylvestris* 'Mainacht', *S. nemorosa* 'Ostfriesland', *S. leucantha, S. greggii* 'Furman's Red', *S. guaranitica,* and *S. chamaedryoides*, and seedlings of S. splendens were grown in pots [10.2 cm x10.2 cm x 36 cm (4 in x 4 in x 14 in)] containing a medium of 1 sand:8 pine bark (by vol.) at varying temperatures. Instead of using a factorial arrangement of treatments, which would limit the number of taxa that could be tested, increasing day temperatures were combined with both a "cool" or a "warm" night temperature over a 15-hour photoperiod. Temperature treatments were 15-hour day temperatures of 20, 25, 30, 35, and 40 °C (68, 77, 86, 95, and 104 °F), in combination with 9-hour night temperatures of 15 ("cool") or 25 %C ("hot"), yielding 10 different temperature combinations. Plants were fertilized with a modified Hoagland's solution every other day and were watered on alternating days with distilled water. The experimental design was a randomized complete block with eight replications of each temperature treatment, for a total of 80 plants per taxon.

Temperature treatments were initiated October 6, 1997, and the experiment concluded November 10, 1997, for a duration of 35 days. At the conclusion of the experiment, dry weights of leaves, stems, and roots were determined, except for plants of *Salvia greggii* 'Furman's Red' for which only shoot and root dry weights were recorded. Data were subjected to analysis of variance procedures.

Results and Discussion: Plants of all seven taxa grown at 25 and 30 °C appeared normal and exhibited no visual stress symptoms, regardless of night temperature. However, stunting of growth was observed in selected *Salvia* at 20 °C. Symptoms of heat stress were apparent in many taxa at 35 °C, and were observed in all taxa at 40 °C; although the severity of symptoms varied by taxa. Symptoms appeared as general stunting, followed by foliar chlorosis, distortion, and necrosis, which progressed from leaf margins toward the central area of the blade. By the end of the experiment, most plants of *Salvia splendens, S. guaranitica*, and *S. chamaedryoides* were dead in the 40°C chamber.

Among all taxa, shoot dry weights were significantly affected by day temperatures (Fig. 1A). The day temperature x night temperature interaction was nonsignificant for all measured variables in all taxa. Quadratic trends across increasing day temperatures were observed for *S. leucantha*, *S. splendens, S. guaranitica, S. chamaedryoides, S.* x *sylvestris* 'Mainacht', and *S. nemorosa* 'Ostfriesland'. *Salvia greggii* 'Furman's Red' exhibited a weaker quadratic response and showed decreased shoot growth with increasing temperature. Response of root dry weight to day temperature was similar to shoot dry weight, except that data were nonsignificant for *S. nemorosa* 'Ostfriesland' and S. x*sylvestris* 'Mainacht' (Fig. 1B). Root dry weight of *S. chamaedryoides, S. greggii* 'Furman's Red', and *S. guaranitica* decreased linearly with day temperature, whereas *S. leucantha* and *S. splendens* showed quadratic responses.

To our surprise, *Salvia* x *sylvestris* 'Mainacht' and *S. nemorosa* 'Ostfriesland' displayed the greatest heat tolerance. Of the caulescent species, *S. greggii* 'Furman's Red' appeared to be the most heat tolerant, followed by S. leucantha, although the plants appeared weak and spindly at 35 and 40 °C. The most heat intolerant caulescent species were *S. chamaedryoides, S. guaranitica,* and *S. splendens.* Observations of severe damage due to high temperature stress were observed in *Salvia splendens* at 30 and 35 °C. All plants of *Salvia splendens* were dead in the 40 °C chamber by the conclusion of the experiment. The lack of observed heat tolerance in the Mexican caulescent *Salvia* taxa was unexpected.

Significance to Industry: Unlike the extensive work which exists on cold hardiness, the role of heat tolerance in limiting the geographic distribution and adaptability of ornamental landscape plants remains poorly understood. However, recent efforts, such as the American Horticultural Society Plant Heat-Zone Map (1), are adding much-needed climatic data upon which a better understanding of heat tolerance will ultimately be based. The critical information which is thus-far lacking centers around plant responses to high-temperature-induced stress (as well as any interactions with other concomitant stresses). The results presented herein with salvias clearly show wide variations in responses to high temperatures that can occur within a single genus. The most heat tolerant taxon was *Salvia* x*sylvestris* 'Mainacht', and the least heat tolerant taxon was *S. splendens*. Future work will focus on these differences to elucidate specific parameters that allow one *Salvia* to be better adapted to high-temperature stress than another.

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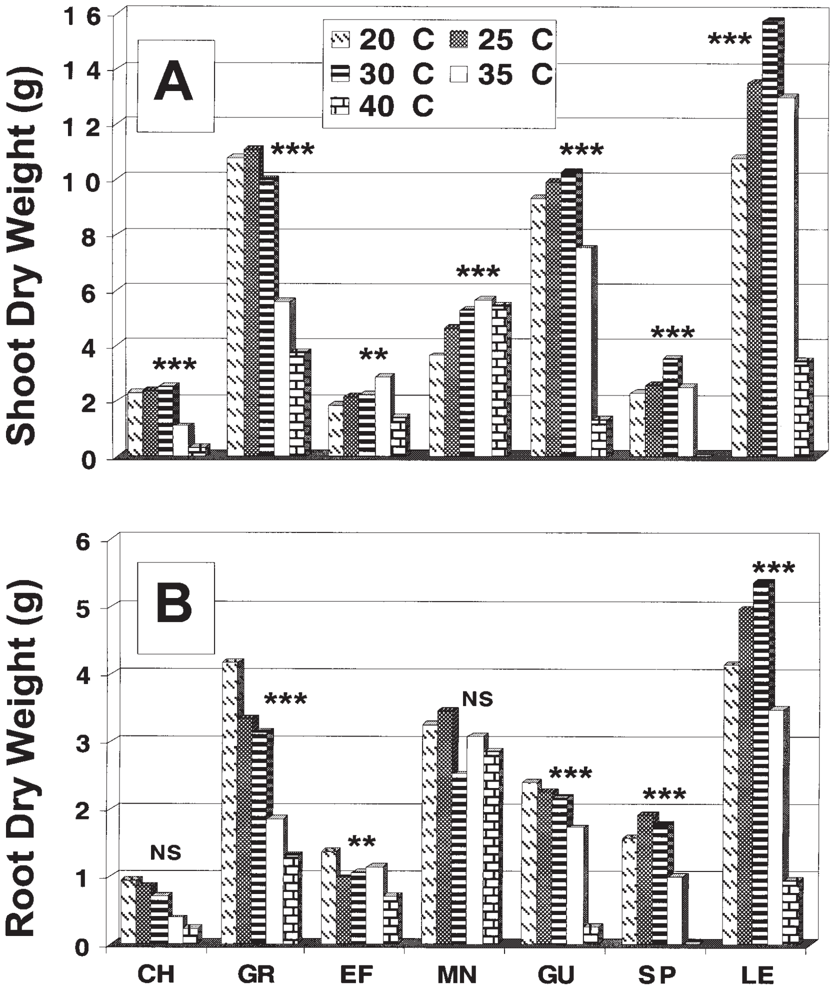

Fig. 1. Effect of day temperature (°C) on shoot (A) and root (B) dry weights of selected taxa of *Salvia*. Legend A applies to both figures.

NS, **, *** Nonsignificant or significant at 0.01 or 0.001 probability levels, respectively.

CH = *Salvia chamaedryoides*
GR = *S. greggii* 'Furman's Red'
EF = *S. nemorosa* 'Ostfriesland' (East Friesland)
MN = *S.* ×*sylvestris* 'Mainacht' (May Night)
GU = *S. guaranitica*
SP = *S. splendens*
LE = *S. leucantha*

Drought Stress Affects Leaf Gas Exchange and Spring Growth of Herbaceous Perennials

(Student)

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Nature of Work: During water stress, many physiological functions are affected before the leaves show signs of wilting (2). Drought stress decreases leaf gas exchange (transpiration, stomatal conductance, and photosynthesis). This can been attributed to a decrease in CO_2 concentration in leaves as a result of reduced stomatal conductance (4, 5) and/or non-stomatal effects (1, 3). Leaf gas exchange measurements were taken as early indicators of the effects of drought stress on growth. Photosynthesis produces carbohydrates, the building blocks of plant growth. The ability of three species of herbaceous perennials to withstand and recover from drought stress periods of 2, 4, and 6 days was evaluated in this study. *Eupatorium rugosum* (Houtt.) was chosen because of its reported drought intolerance, while *Boltonia asteroides* (L'Herit.) 'Snowbank' and *Rudbeckia triloba* (L.) were chosen based on their reported drought tolerance. Plugs of the perennials were obtained from a commercial nursery, potted into 3-qt gallon containers with a 4 pine bark fines:1 river sand (v/v) medium amended with pelletized dolomitic limestone at a rate of 10 lb yd^{-3} (6 kg m^{-3}). All plants were grown outdoors under natural daylight in Clemson, S.C. Plants were spaced in a completely randomized design on Sept. 12, 1997. There were eight replicates for each of the six treatments: 2, 4, and 6 day stresses and 2, 4, and 6 day controls for each of the species for a total of 144 plants.

Stress was imposed on Sept. 18, 1997 by withholding water from the containers. Control plants were watered twice daily at 0800 and 1500 HR. Following each stress period plants were planted in the field and well watered to allow recovery. Leaf gas exchange was measured with an infrared gas analysis system (CIRAS-1, PP Systems, Haverhill, MA) daily between 1000 and 1350 HR. Height and width were measured every other day during stress, and then weekly following transplanting, until a killing frost on Nov. 3, 1997. Growth measurements were resumed on April 30, 1998 and taken monthly throughout the growing season.

Results and Discussion: All differences reported in this study are between control and stressed plants within species, not between species. Transpiration was lower *Eupatorium* after two days of stress and after three days of stress for *Rudbeckia* (Fig. 1). There was no difference in transpiration of *Boltonia* during stress. Stomatal conductance of *Rudbeckia* and *Boltonia* decreased after three and five days of stress, respectively. Photosynthesis of *Eupatorium* decreased after three days of stress, but there were no differences for *Rudbeckia* or *Boltonia* during stress. After rewatering, leaf gas exchange of Rudbeckia returned to non-stressed levels immediately for all stress durations (data not shown). Leaf gas exchange of 2-day stressed *Boltonia* and *Eupatorium* returned to non-stressed levels immediately following rewatering (Fig. 2). Transpiration of 4 and 6-day stressed (data not shown) and photosynthesis (Fig. 2-C) of 6-day stressed *Boltonia* returned to non-stressed levels immediately after rewatering. Photosynthesis of 4-day stressed *Boltonia* returned to non-stressed levels after 11 days, but fell on day 42. Stomatal conductance (data not shown) and transpiration (Fig. 2-A) of 4-day and 6-day stressed *Eupatorium* returned to non-stressed levels after 16 and 19, respectively. Photosynthesis of 4-day and 6-day stressed *Eupatorium* returned to control levels after 8 and 11 days, respectively (Fig. 2-B). Photosynthesis of 6-day stressed *Eupatorium* fell to a negative percent of control (net respiration) on day 42. There were no differences in leaf gas exchange for any of the species on June 8, 1998. There were no differences in growth before frost between any of the stressed and non-stressed plants (data not shown). There were no differences in spring 1998 growth of *Boltonia* (data not shown). For *Rudbeckia*, 2-day stressed plants were the tallest and 4-day stressed were the shortest on April 30, 1998. By May 18, there were no differences in growth of *Rudbeckia.* There were no differences in the growth index ((height + width)/2) of any of the treatments of *Eupatorium* up to June 15. On June 15, 6-day stressed plants were the shortest of all treatments of *Eupatorium.* This could be due to the 6-day stressed *Eupatorium* having fewer reserves to carry them through the rapid growth period that occurred between May 18 and June 15.

Significance to Industry: The objective of this experiment was to determine the ability of three herbaceous perennials to tolerate and recover from drought stress. There were adverse effects on growth of *Rudbeckia* as a result of drought stress, but the plants recovered in time for the rapid growth period during the spring. *Boltonia* tolerated drought stress periods of 2, 4, and 6 days during the fall without detrimental effects on spring growth. Photosynthesis for was reduced for only two days during the fall, which was not likely to affect growth. Photosynthesis of 6-day stressed *Eupatorium* was reduced for 9 of the days measured during the fall, which could have lead to the reduction in growth the following spring.

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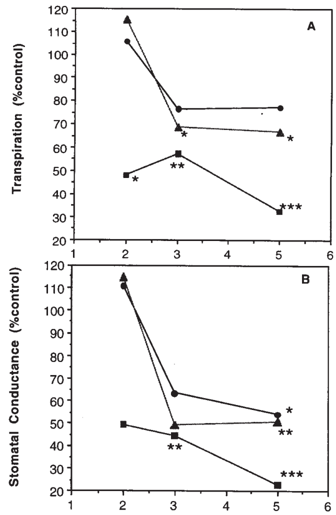


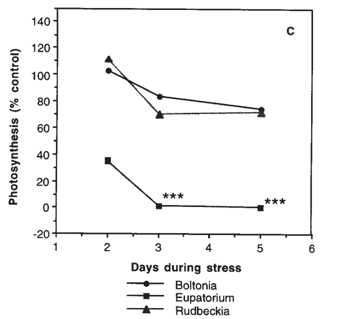
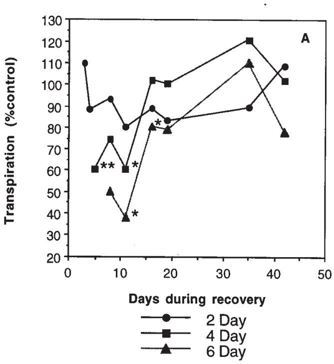


Figure 1. Transpiration (A), stomatal conductance (B), and photosynthesis (C) during stress of *Boltonia*, *Eupatorium*, and *Rudbeckia*. Values are percent of control. *, **, *** significantly different at p=0.05, 0.01, or 0.001, respectively. Comparisons are between the control (100%) and stress within species.



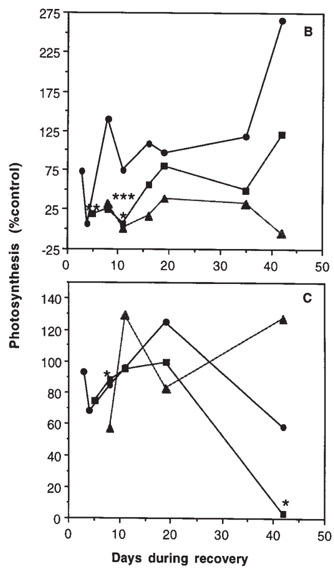


Figure 2. Transpiration for *Eupatorium* (A), photosynthesis for *Eupatorium* (B) and *Boltonia* (C) during recovery from stress. Values are percent of control. *, **, *** significantly different at p=0.05, 0.01, or 0.001, respectively. Comparisons are between the control (100%) and stress within the species.

Extension Workshops Improve Floridians' Adoption of Environmental Landscape Management Practices

(Poster)

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Nature of Work: The Public recognizes the importance of environmental issues but homeowners often fail to realize the environmental impacts of their landscape practices. Our water and ecosystem resources can be damaged by the cumulative impacts of homeowners' plant selection, fertilization, irrigation, pest management and other landscaping practices.

The Florida Cooperative Extension Service is teaching residents about proper landscaping practices that minimize detrimental impacts to the environment while creating and maintaining beautiful landscapes. This Extension program is called Environmental Landscape Management (ELM) and its guidelines integrate and promote landscape practices that foster water conservation, pest control through IPM (Integrated Pest Management), recycling of yard wastes, wildlife enhancement, energy conservation and abatement of non-point source pollutants (Park Brown and Knox, 1991). "Florida Yards and Neighborhoods" (FYN) is a grant-funded Extension program, derived from ELM, that emphasizes messages related to stormwater runoff. Both programs reach residents via publications as well as workshops and short courses utilizing ELM or FYN publications, displays, slide sets, and videos.

In 1997, FCES conducted over 500 ELM and FYN programs in 46 of Florida's 67 counties, resulting in over 820,000 customer contacts. To assess the effectiveness and impact of the program, we used questionnaires to evaluate participants' use of ELM practices, comparing their usage with that of a nonparticipant "control" group. Before participating in an ELM program, audience members are asked to complete the questionnaire. Six months after the ELM program, a follow-up questionnaire is mailed to each audience member.

Results and Discussion: In 1993, surveys collected baseline information on landscape design and maintenance practices from a nonparticipant "control" group (n = 186) sampled from licensed drivers in 23 counties. In 1997, similar data was collected from participants (n = 526) in Extension ELM and FYN programs in eight out of the forty-six counties participating in the program.

Table 1 presents adoption rates of ELM practices for program participants as compared to the nonparticipant "control" group. Pre-test results show that program participants had greater adoption rates of ELM practices than the nonparticipant "control" group in 27 of 39 practices, implying greater initial knowledge about recommended landscape practices.

Extension workshops proved to be effective in teaching residents to adopt environmental landscape practices. Participants significantly increased adoption of 34 out of 39 practices from the pre-test to the six month post-test; nonparticipants showed essentially no change (McNemar's Test, 5% level; data not shown). Residents who adopt these recommended irrigation, fertilization, pest management and other practices clearly reduce the potential for runoff and leaching of excess nutrients and pesticide residues.

Significance to Industry: The nursery and landscape industries benefit from effective Extension programs that create better-educated consumers of plant materials and landscape services. Informed consumers will make more appropriate choices for their landscapes which, in turn, should lead to healthier landscapes and more satisfied customers. The extension programs, Environmental Landscape Management and Florida Yards and Neighborhoods, increase consumers' use of environmentally-sound landscape practices.

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Table 1. Adoption rates of ELM landscape practices from pre- and post-tests for the ELM-trained group as compared to a nonparticipant "control" group.

Recommended Landscape Practice	ELM Program Group		"Control" Group	
	Pre-test Adoption (%)	Post-test Adoption (%)	Pre-test Adoption (%)	Post-test Adoption\ (%)
Group by water needs	38.2	54.4	22.0	15.0
Group by maintenance needs	31.9	47.5	16.7	12.4
Select adapted plants	74.9	85.7	73.7	62.9
Design for low maintenance	60.1	67.7	43.0	34.4
Identify sun/shade	70.9	81.9	35.5	41.9
Test soil pH	17.5	20.5	6.4	5.9
Group into beds	67.7	71.7	54.3	42.5
Select moderate growth rates	35.7	51.3	24.7	30.1
Test soil drainage	9.1	17.9	9.1	3.2
Plant in holes 2x as wide	63.3	67.5	38.7	38.7
Plant at proper depth	72.0	73.2	52.7	44.6
Shade walls	43.0	48.1	29.6	20.4
Water when blades fold	33.1	47.9	20.4	28.5
Apply _ to 3/4 inch of water	49.8	65.2	33.9	35.5
Water lawn separately	58.9	67.5	51.1	51.6
Irrigate by season	46.4	58.0	41.4	47.3
Water early a.m.	77.6	84.4	80.6	70.4
Apply 1 lb. N/1000 ft2	20.7	41.1	10.2	10.8
Fertilize sparingly	35.4	53.8	15.6	22.6
Use slow-release fertilizer	60.3	74.7	41.4	41.4
Use iron sulfate	12.4	18.4	7.5	14.5
Scout for pests	57.2	74.5	48.4	49.5
Choose least-toxic pesticide	56.5	66.7	46.8	37.1
Tolerate plant damage	64.1	77.4	36.0	39.8
Change cultural practices	37.6	47.1	16.1	14.5
Identify problem	55.5	65.8	44.6	39.2
Spot-treat	34.6	43.4	28.9	28.5
Follow pesticide label	68.8	77.6	68.3	66.1
Prune at branch collar	47.5	63.7	30.7	32.8
Mow 1/3 of grass blade	49.6	58.8	28.0	33.3
Mow at proper height	56.3	67.5	63.4	62.4
Use sharp mower blade	50.8	61.4	54.3	60.2
Pull mulch from trunk	43.1	60.1	14.5	14.0
Increase mulch area under trees	38.2	48.7	24.2	23.1
Use a compost pile	36.1	43.5	12.9	14.0
Leave grass clippings	64.8	73.2	54.3	53.2
Maintain 3 inches of mulch	57.6	68.1	35.5	34.4
Apply mulch in beds	73.9	76.6	55.9	52.7

Research and Education Garden: Pollution Prevention for the Landscape

(Student)

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Nature of Work: The Georgia Station Research & Education Garden is a 65-acre tract that contains research plots and a demonstration area which lies adjacent to the University of Georgia - Griffin Campus. It serves as a vehicle to transfer research results to the general public through hands-on programs. Research has focused primarily on improving the economic viability of the ornamental industry while reducing the environmental effects of fertilizers and pesticides in the landscape. Programs offer an opportunity to connect scientists with industry, homeowners and students and reduce the time required for research results to reach the general public.

Water pollution resulting from urban run-off containing fertilizers and pesticides is a considerable problem in metro Atlanta. Environmental and public concerns have led to public demands for critical reassessment of pesticide use in urban surroundings. Several pollution prevention research projects conducted at the Georgia Station Research and Education Garden will be briefly described here that address the problem of non-point source pollution resulting from run-off containing fertilizers and pesticides.

Results and Discussion: The *Landscape Management Project* is a long-term research and extension project to improve pest management options available to the landscape maintenance industry with an overall goal of reducing the risks from pesticides used in urban landscapes. The project, initiated in Spring 1995, is a collaborative effort of horticulturists Joyce Latimer and Carol Robacker, entomologists Kris Braman and Ron Oetting, plant pathologist Jean Williams-Woodward, and agricultural economist Wojciech Florkowski. The objectives include identifying and quantifying inputs required to maintain a mixed landscape using different pest management regimes and various cultural practices. Pest management strategies include: no pest control, professional management, targeted management, or pest-resistant plant materials. The professional management plot is maintained by researchers from TruGreen-ChemLawn. Data have been collected on insect and disease pest problems, natural enemy species and populations, plant growth and performance. In 1998, the project will be renovated with new plant materials to evaluate the pest regimes with an irrigation variable. Optimizing water use in the landscape will reduce the potential for run-off containing pesticides and fertilizers from urban landscapes while maximizing plant health and performance. The Landscape Management Project demonstrates how plant placement can profoundly affect plant susceptibility to pests. It also emphasizes the value of using pest resistant plant materials developed by cooperators.

Breeding Insect Resistant Deciduous Azaleas is an important research focus because azaleas are the number one landscape plant in Georgia and are susceptible to a number of pests and diseases. Frequent use of pesticides is often required to control azalea lace bugs (ALB), the number one insect pest of azaleas. Plant Breeder Carol Robacker and entomologist Kris Braman have been collecting azalea germplasm in the Garden, and evaluating selections for resistance to ALB. Having identified ALB resistance in some deciduous azaleas, they are trying to transfer that resistance into the more susceptible, but more commonly desirable, evergreen varieties. They are also trying to identify the mechanism of ALB resistance in azaleas and to develop tissue culture screening procedures to maximize the number of selections that can economically be tested. Combining desirable horticultural traits with resistant traits to produce improved cultivars is the goal of Breeding Insect Resistant Deciduous Azaleas. The genetic and physiological basis of resistance to azalea lace bug is being investigated. Three taxa, Piedmont, Pinxterbloom, and Plumleaf have been identified. Resistance to cranberry rootworm has been observed in ‘Delaware Valley White’ and Hammock Sweet.

Recycled Tires as Mulches for Perennial Crops is a project funded by the Georgia Department of Natural Resources to consider the possibility of using chipped scrap tires for mulch. Horticulturists Scott NeSmith, Orville Lindstrom and Gerard Krewer are testing chipped tires for mulch on blueberry plants and Leyland cypress Christmas trees. Over a three-year period, it was compared to pine bark, bare ground, and a grass cover. All mulches were evaluated for their ability to conserve soil moisture, moderate soil temperature, and suppress weed growth. The project has yielded mixed results. The chipped tires have successfully improved soil moisture conditions and reduced weed pressure on both the blueberry and Leyland cypress plants. Chipped tires may be economical for use on perennials crops such as the Leyland cypress that are not typically irrigated during production for Christmas trees. However, after three years of testing the chipped tire mulch, elevated levels of zinc were detected in the soil.

Selection for Small,Stress-Tolerant Ornamental Trees is a part of the Landscape Plant Development Center’s breeding program administered from the University of Minnesota. The program has crossed selections of

Pyrus, Sorbus, and *Aronia* trees which are adapted to northern regions, to produce varieties that are more heat tolerant and disease and insect resistant. The University of Georgia, Griffin Campus participates as regional test center in the south. Plant breeder Carol Robacker and horticulturist Orville Lindstrom have established field plots at the Garden with 60 *Pyrus* hybrids, 29 *Carpinus* and 35 other trees of various species that are considered low maintenance. These plant materials are being evaluated for cold hardiness, heat tolerance, and insect and disease resistance under Georgia conditions.

Reducing Greenhouse Wastewater through Recycling will be conducted at the new production greenhouse at the Research and Education Garden by horticulturist Marc van Iersel. A new ebb-flow production system is being evaluated as a means to reduce surface water run-off from greenhouses. The goal is to find economical ways to reduce water use and the production of wastewater, which generally carries excess nutrients and pesticides, while maximizing plant quality and production. Initial studies have focused on cultural conditions, including fertilizer concentrations, timing of watering and different growing media. Greenhouse runoff can be virtually eliminated if recirculating watering systems are used. Economical means of incorporating these systems into existing commercial greenhouse operations must be determined.

Significance to Industry: Practicing pollution prevention in landscape management safeguards the quality of the landscape while protecting the surface water quality of the state. Reducing the environmental effects of pesticides and fertilizers in surface run-off is an important goal of these research projects. In addition to conducting research, The Georgia Station Research and Education Garden provides training and educational programs to teach pollution prevention strategies based on research results. Use of pest resistant plant materials, cultural practices, and integrated pest management are a number of strategies that are demonstrated through programs, workshops and seminars. Emphasis is placed on hands-on activities so industry people, homeowners and students can learn by doing. As both the research plots and Demonstration Area develop, more and more programs will become available. Accessibility to research results provides for the rapid transfer of information from scientists to industry and the consumer thereby benefiting both the quality of urban landscapes as well as the quality of surface waters in Georgia.

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Landscape Evaluation of Lantana Cultivars - 1997
(Poster)

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Nature of Work: A landscape trial evaluating the performance of lantana cultivars has been conducted by the LSU Agricultural Center annually since 1995. The primary criteria in these trials includes the evaluation of plants for floral impact, growth habit, pest resistance (spider mites, lantana lace bug, aphids, white flies) and fruiting resistance.

Lantanas are continually increasing in popularity among professional landscapers and home owners. Trailing type lantanas are very popular because of their almost continual flowering and winter hardiness. The new Patriot series of lantana are also being grown to some degree in Louisiana, but have not made significant inroads into the commercial market.

Cultivars evaluated in 1997 landscape trials included Samantha, New Gold, Weeping White, Spreading Sunset, Lemon Drop, Gold Mound, Golden King, Irene, Lone Star Growers Red-Orange, Silver Mound, Patriot Firewagon, Lemon Swirl, Patriot Rainbow, American Red Bush, Imperial Purple, Radiation, Dallas Red, White Lightnin’, Confetti, Patriot Cherry, Patriot Desert Sunset, Cream, Patriot Dove Wings, Patriot Sunburst, Patriot Tangerine, Lady Olivia, Patriot Honeylove, New Bronze, and Dwarf Pink.

Lantanas previously established in landscape beds during the spring of 1995 or 1996 were used in the 1997 evaluation (lantanas are winter hardy in south Louisiana - USDA hardiness zones 8b-9a). Plants were pruned to 4" to 6" above the soil line in early March and remulched with two inches of baled pine straw.

Raised landscape beds were composed of an Olivier silt loam amended with composted rice hulls and aged pine bark. The beds were located in full sun and plants received irrigation as needed throughout the growing season. Plants were previously spaced on 2.5' centers in single rows and received fertilization in 1997 in the form of a topdressing of StaGreen Nursery Special 12-6-6 at the rate of 1 lb. N/1000 ft^2 in late March, late May and late July. Plants were not dead-headed or pruned during the growing season and no pesticides were applied for insect/ disease control/or prevention.

Flowering percentage, pest resistance ratings, and fruiting resistance ratings were taken monthly from May through October. Flowering percentage was expressed as a percentage of the plant canopy fully covered by open blossoms. Pest resistance was based on a rating scale from 1 to 9 where 1= major pest population (least resistance), 5= marginal pest population, and 9= no pest population (most resistance). Pests monitored for were aphids, spider mites, whiteflies and lantana lace bugs. Resistance to fruiting was based on a rating scale from 1 to 9 where 1= heavy fruit set, 5= marginal fruit set, and 9= no fruit set.

Results and Discussion: Top performing lantana cultivars in Louisiana landscape trials from 1995-97 have been New Gold, Gold Mound, Imperial Purple, Dallas Red, Silver Mound, Patriot Dove Wings, Lemon Drop, Confetti, Patriot Sunburst, and Patriot Honeylove. The worst performing cultivars over the same period have been Weeping White, Golden King, Patriot rainbow, Cream, Patriot Cherry, Dwarf Pink, and New Bronze. Poor performance was typically due to significant fruit set, poor vigor, undesirable growth habit, and poor winter hardiness. In 1997, average flowering percentage for the season ranged from 17-42% (Table 1). Pest resistance ratings for 1997 ranged from 6.8-8.8, while fruit resistance ratings ranged from 4.8-9.0 (Table 2).

Significance to Industry: Ornamental plant cultivar evaluations being conducted by the LSU Agricultural Center are positively received by green industry personnel in the state. The lantana evaluations lead to Silver Mound, New Gold, Dallas Red, Trailing Purple, and Confetti being named Louisiana Select cultivars for 1997. Continuation of lantana trials through 1998 will finalize this effort.

Table 1. Flowering percentage of landscape planted lantana cultivars - 1997.

	Flowering %						
Cultivar	May	June	July	August	September	October	Average
Samantha	30	30	15	10	10	30	21
New Gold	25	30	40	15	15	30	26
Weeping White	20	15	15	15	40	35	23
Spreading Sunset	60	35	25	10	10	30	28
Lemon Drop	25	45	45	35	25	35	35
Gold Mound	35	50	50	35	30	25	38
Golden King	20	20	20	10	10	25	17
Irene	20	35	30	20	15	35	26
LSG Red-Orange	40	40	45	35	25	35	37
Silver Mound	30	55	55	15	15	65	39
Patriot Firewagon	35	30	25	20	10	30	25
Lemon Swirl	10	20	25	20	15	45	23
Patriot Rainbow	10	25	25	30	40	40	28
American Red Bush	15	35	30	30	20	40	28
Imperial Purple	30	20	25	35	65	75	42
Radiation	40	30	40	10	10	60	32
Dallas Red	40	40	45	25	10	50	35
White Lightnin'	20	20	25	20	60	50	33
Confetti	25	35	40	25	15	50	32
Patriot Cherry	15	30	30	30	20	15	23
Patriot Desert Sunset	15	25	25	35	30	40	28
Cream	30	35	40	45	30	40	37
Patriot Dove Wings	15	40	55	65	20	20	36
Patriot Sunburst	30	35	30	60	40	50	41
Patriot Tangerine	25	40	45	55	40	15	37
Lady Olivia	35	35	25	10	10	10	21
Patriot Honeylove	25	40	35	20	15	50	31
New Bronze	20	20	35	25	15	40	26
Dwarf Pink	25	35	15	40	30	35	30

Note: Flowering percentage is expressed as the percent of the plant covered by open blossoms.

Table 2. Pest resistance ratings and fruiting resistance ratings of landscape planted lantana cultivars - 1997.

Cultivar	Average of Monthly Pest Resistance Rating	Average of Monthly Fruiting Resistance Rating
Samantha	8.0	8.0
New Gold	8.0	7.2
Weeping White	8.5	8.3
Spreading Sunset	7.8	6.7
Lemon Drop	8.0	8.0
Gold Mound	8.5	7.7
Golden King	7.3	6.3
Irene	8.0	6.5
LSG Red-Orange	7.3	7.5
Silver Mound	7.2	8.2
Patriot Firewagon	7.5	6.5
Lemon Swirl	8.0	7.8
Patriot Rainbow	7.5	4.8
American Red Bush	7.5	6.8
Imperial Purple	8.8	9.0
Radiation	6.8	6.8
Dallas Red	7.2	6.7
White Lightnin'	8.5	9.0
Confetti	7.5	7.2
Patriot Cherry	7.8	6.7
Patriot Desert Sunset	7.5	7.2
Cream	7.5	7.2
Patriot Dove Wings	8.5	7.7
Patriot Sunburst	8.0	7.5
Patriot Tangerine	7.8	7.7
Lady Olivia	7.8	7.7
Patriot Honeylove	7.5	7.8
New Bronze	7.3	7.0
Dwarf Pink	7.5	6.8

Note: Pest resistance rating based on a scale from 1 to 9 where 1 = major pest population, 9 = no major pests present. Pests monitored for were aphids, white flies, spider mites and lantana lace bugs. Fruiting resistance rating based on a scale from 1 to 9 where 1 = heavy fruit set, 5 = marginal fruit set, and 9 = no fruit set. Both ratings are averages of monthly data collected from May through October.