THE DEVELOPMENT OF A STATEWIDE TRIAL, EVALUATION, AND PROMOTION PROGRAM: TRIALING SUMMER ANNUALS

by

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Abstract

This study focuses on the development of a trial and promotion program for the state of Alabama and the interest of such a program from consumers and industry representatives. There were three parts to this research, a survey of the Green Industry in Alabama, a survey of consumers in Alabama who purchase landscape ornamental plant materials, and a field trial of selected summer flowering annuals for the state. The first portion of this work utilized a survey to gather information about industry perceptions of what consumers want, how they acquire information about new plant materials, their level of interest in Alabama plant promotion program, and their opinions on specific plant cultivar trials. Industry participants for this survey were recruited from among the members of the Alabama Nursery and Landscape Association. It was concluded from this survey that respondents from industry believed consumers most want color and maintainability as their most desired traits in annual plant materials. The survey also showed that industry participants indicated interest in the development of a plant promotion program for Alabama.

The second part of this work was to gather information from consumers on their perceptions and requests of characteristics of plant materials available in the marketplace. Survey participants were initially master gardeners from across the state of Alabama, but to gain more data the survey link was forwarded to other consumers around the state. The questions in this survey were intended to gain consumer preferences of plant characteristics, thoughts on the possible development of a statewide plant promotion program, their level of gardening expertise,

and their opinions about specific annual selections being evaluated in trials. Results showed that 95.2% of consumers surveyed made the decision to purchase plant materials without informed assistance and 88.6% are most likely to make foliage and flower color the most important determinate in their purchasing plant materials.

The third portion of this work consisted of a field trial of *Angelonia angusitolfia* (angelonia) and *Solenostemnon scutellarioides* (coleus) selections. Six cultivars of each species were grown under full sun conditions irrigated for thirty minutes, three days each week. This work was developed to evaluate performance amongst the harsh Alabama summer conditions. Growth index and visual rating were taken every two weeks until termination. At termination leaf are of coleus, fresh weights, and dry weights were taken. Results concluded all AngelMist™ cultivars were the largest in the angelonia study, while Serena™ cultivars remained in compact growth form. Redhead (RH) had the largest leaf area in both 2011 (689.66 cm^2) and 2012 (532.64 cm^2) (Table 4) and was the largest of the six cultivars trialed. .

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CHAPTER I

INTRODUCTION

The "Green Industry" is a term that encompasses many agricultural occupations such as turfgrass production, retail garden centers, ornamental plant production, and the landscape installation and maintenance industry. Two of the predominant areas of the Green Industry are the landscape segment and plant production nurseries (Florkowski et al., 1994; Hubbard et al., 1989; Markus et al., 1992). The introduction of new, well performing plant material supports the growth of the landscape and nursery industries (Dunwell et al., 2001). As might be expected, there is a strong correlation between nurserymen and landscapers, both influencing the other (Garber et al., 1995). Nurseymen impact a landscaper's decision depending on what plant material is available, in turn landscapers sway nurserymen in what to produce due to their demand. While nurserymen and landscapers influence each other, consumers influence both groups and in many ways control what the nurserymen produce and landscapers use (Phillips et al., 2007). According to Manalo (1990), product characteristics are a dynamic part in consumer decision making as to whether or not to purchase a product. Once desired plant characteristics are determined, nurserymen and landscapers then target their plant selection to satisfy consumer needs and demands (Phillips et al., 2007). Consumer demand drives the industry and can therefore, serve as a guide to nursery and landscape professionals in supplying the marketplace.

One way in which the industry could supply the marketplace and respond to the demand of consumers is through the use of a statewide plant promotion program. There currently is no program like this within the state, yet there are several in states that surround Alabama. One of the most well known trial garden programs is at the University of Georgia. That program evaluates many ornamental landscape species including annuals, perennials, and woody ornamental, which are marketed nationwide through a promotion program called AthensSelect™ (Armitage and Green, 2001). The AthensSelect™ program selects plant materials that perform well under the drought and heat conditions of Georgia, and then promotes them nationwide. Having a program like this and having plant materials supplied to the marketplace, labeled by such a program, attracts consumers to their proven performance in rigorous evaluation protocols.

The research conducted in this study was partitioned into three sections, an industry survey, a consumer survey, and a summer annual plant trial. Participants for the first study were recruited from the Alabama Nursery and Landscape Association (ALNLA) and consisted of representatives from landscape or plant production companies. The ALNLA was chosen because it is the largest and most widely recognized Green Industry organization in the state of Alabama. A survey was developed and sent to all participants with the intent of gathering information on industry perception of consumer demand, interest in a state plant promotion program, and opinions on specific annuals trialed. The second part of this study consisted of a consumer survey. Participants for this survey were selected predominately from Master Gardeners across the state. Master Gardeners were encouraged to forward a survey link to non-Master Gardeners within the state of Alabama as well. This survey was developed in order to gain information on preferred consumer characteristics, interest in a plant promotion program,

and opinions of specific annuals trialed. Data collected from this study was compared to industry data to correlate and determine if Alabama's Green Industry understands their consumers' demands.

The third part of this research consisted of a plant trial of two summer annual species, *Angelonia angustifolia* (angelonia) and *Solenostemnon scutellarioides* (coleus). Six cultivars of each species were evaluated in a replicated trial. The study was conducted at the Auburn University Teaching Garden on Woodfield Drive in Auburn, Alabama. The two annual species were trialed under full sun in central Alabama during the summer. A field day was hosted for the industry to directly assess performance of the cultivars of both species.

This research is beneficial for the Green Industry, consumers, and economy in the State of Alabama. If a plant promotion program existed in Alabama, the industry would have first hand knowledge of new plant materials available for production and use. Consumers would have the opportunity to see these plants that are proven to perform well in our area, and based on other state's experience with such programs, be more likely to purchase them.

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CHAPTER II

LITERATURE REVIEW

Overview

The Green Industry encompasses both greenhouse and nursery production facilities as well as design, build, and maintenance landscape businesses. Over the past forty years, production of nursery crops has risen as the Green Industry has grown in the United States (Markus et al., 1992). Just as nursery production has grown, the landscape installation and maintenance businesses have become a large part of the Green Industry (Florkowski et al., 1994; Hubbard et al., 1989). The introduction of new, as well as enhanced, plant materials consisting of better quality flowering, improved light tolerance, increased drought tolerance, and better growth habit continues to encourage growth in the Green Industry (Dunwell et al., 2001). There is a close relationship between nurserymen and landscapers, both influencing the other in plant supply and demand (Garber et al., 1995). While nurserymen and landscapers influence each other, consumer preferences influence both groups and in many ways control what the nurserymen and landscapers produce and use (Phillips et al., 2007). According to Manalo (1990), product characteristics are a dynamic part in consumer decision making while purchasing products. Once desirable plant characteristics are determined, nurserymen and landscapers can then target plant selections to satisfy consumer needs and demands (Phillips et al., 2007).

Consumer demand drives the industry and can therefore serve as a guide to nurserymen and landscapers in production, supply, and utilization of products for the marketplace.

Consumers

The affluent homeowner has typically been the primary target market for horticultural products, but as industry competition increases and industry growth slows under the current economic environment, an investigation of renters as a potentially ignored or underserved market is justified (Behe, 2006). Homeowners typically purchase relatively large quantities of plant materials for their property, whereas renters typically do not put effort into their landscape.

Wholesale growers and retailers in the floriculture industry currently grow and offer annual bedding plant products of varying quality for retail purchase in the State of Alabama. Previous research on consumer preferences for chrysanthemums, geraniums, edible flowers, and bell peppers has been done (Behe et al., 1999). According to Mason et al. (2008), popularity of containerized gardening has grown exponentially from 2003 to 2008. This growth is due to fewer maintenance requirements of containers, ease of mobility, and accessibility from your patio or deck. Phillips et al. (2007) says consumers are less interested in physically demanding projects, making containerized gardening a popular option. Currently the amount of research conducted on annual bedding plant preferences of consumers is limited (Jowkar et al., 2007; Wolnick, 1986). There is little knowledge in the industry as to what product qualities and characteristics consumers seek in making purchasing decisions of annual bedding plant materials. The production industry selects plants through talking to seed and plant representatives, as well as going to trade shows (Harris, 2008). By identifying and focusing on

consumers' plant characteristic preferences, wholesalers and retailers have the opportunity to strengthen sales by providing bedding plants that appeal to consumers.

Previous research shows various consumer perceptions of specific plant characteristics are important (Behe et al., 1999; Frank et al., 2001; Kelley et al., 2001; Phillips et al., 2007; Robertson and Chatfield, 1982; Shafer and Kelly, 1986; Wolnick, 1983). For example, bloom color may be more important to a homeowner in the overall landscape compared to color in planters. The location and purpose of plant materials may also determine the importance of plant characteristics. Other plant characteristics influencing consumer purchase may include: foliage color, number of unopened buds, and plant size. Factors impacting plant preference include: pricing, container size, and seasonal trends in plant sales. The shortage of previous research regarding consumer preference in annual bedding plants supports the need for this research project. In a study by Zadegan et al. (2008), participants expressed an interest in native plant species utilized in naturalistic landscape styles. Many respondents were homeowners who maintained their own landscapes, spending several hours per week in their own garden.

Development of Evaluation and Trial Programs

Before the development of evaluation and trial programs, producers could only guess what qualities consumers desired in plants, or based plant production decisions on previous year's sales, which is not always accurate (Armitage and Green, 2001; Garber et al., 1995; Wolnick, 1983). Also, plant selections sometimes seemed desirable, but were proven to be poor choices when implemented in the garden. Before plant evaluation programs were developed, growers would propagate varieties or cultivars of plant material and grow them knowing little about how they would perform in the landscape. Nursery and landscape companies take risks each year with new plant material that may not be suitable for their area. Plants are introduced

into the industry every year that have only been evaluated in small microclimates, but will be distributed and marketed in much larger regions with little knowledge about the performance of these plants across all areas in which they will be promoted for use in the landscape (Dunwell et al., 2001; Hamilton, 2000). To prevent or reduce losses from occurring, some states such as Texas, Mississippi, Florida, and Georgia among others have begun formal plant evaluation programs to evaluate and monitor new plant material for their constituents. These plant evaluation programs have changed how plant material is developed and marketed (Behe et al., 1999).

In the 1990's, many southern states started to incorporate evaluation and selection programs into their marketing schemes to help consumers select high quality landscape plants (Stegelin, 2001). Many states with marketing schemes, such as plant promotion programs, have partnered with, and relied on, university plant evaluation programs or trial gardens to evaluate plant materials (Anella et al., 2001; Mackay et al., 2001). For a credible evaluation of plant material, there needs to be an unbiased evaluation within different climate zones (Dunwell et al., 2001), hence, the involvement of universities. For a credible evaluation, the states with programs operate trial gardens and plant evaluation programs under a specific set of criteria appropriate for the region in which it is located and the type of plant material being tested. Objectives that are common to most plant evaluation programs are to identify, select, and/or evaluate landscape plant material for production and landscape use, as well as, to collectively and/or individually spread to a broad audience information gained from the plant evaluation programs such as cold/heat tolerance, growth rates, invasiveness, and aesthetic value (Dunwell et al., 2001). A successful plant evaluation garden can impact the Green Industry by providing a

greater understanding of new cultivars or selections of plant materials to be released into the marketplace.

Trial gardens can be used to evaluate all types of plant materials ranging from herbaceous plants to woody shrubs and trees. The trial garden at the University of Georgia evaluates many annuals and perennials, which are marketed nationwide (Armitage and Green, 2001). AthensSelect™ is the plant promotion program partnered with the UGA trial gardens to market evaluated plant material. AthensSelect™ only selects plant material that performs well under drought and extreme heat conditions. Auburn University evaluated shade trees beginning in the 1980's, however no marketing program partnered with this study (Blackwood et al., 2005; Williams et al., 2001). Evaluation criteria for this study consisted of annual growth rates, natural attrition, and aesthetic characterisitcs. Results of these studies were published to provide information to producers, educators, and end users (Williams et al., 1993).

Another successful trial and promotion program is the Texas Superstar™ Program (Mackay et al., 2001). This program was developed to provide the best, environmentally friendly plant materials to consumers and to help make the Green Industry in Texas as profitable as possible. This program tests plant selections for at least three years before promotion to consumers. Once outstanding plants are selected from trials, preparing growers and retail garden centers for production practices and maintainability occurs. This program tracked sales of each Texas Superstar™ cultivar and looks at the impact it has on the Green Industry. There have been 19 plants promoted to date, with $10 million sales in promoted plants from 1989 to 1999.

Trial gardens and plant evaluation programs are active at regional levels, as well as the national level, such as The National Arboretum in Washington D.C. The National Arboretum

has an extensive plant breeding and evaluation program, which is used to assess performance of plant materials ranging from bedding plants and perennials, to woody ornamentals and trees (Pooler, 2001). Several plants are evaluated at the National Arboretum every year, but before the plants may be marketed they must be grown and evaluated among diverse climates and environments. This is accomplished through partnerships with industry and universities across the U. S. Information about these new cultivars and varieties is sent to nursery growers in a wide range of climate zones and cultural conditions across the U.S. Once growers show interest and agree to test new cultivars and varieties they must sign an agreement called a "materials transfer agreement"(MTA). This document states that the plants being trialed are the property of the Agriculture Research Service (ARS) and the U.S. National Arboretum, that the plants may be propagated for research purposes only, and the plants must not be used for breeding until after the plant selections have been released to the public (Pooler, 2001).

Herbaceous plant materials are the most commonly evaluated group of plants among evaluation programs. A study was carried out at Auburn University in 1996 evaluating fifty-seven herbaceous perennial selections (Kessler et al., 2000). The purpose of that study was to evaluate the performance of the selected perennials across two growing seasons. Many studies like this are conducted throughout the country annually.

This study focused on a limited range of summer annual cultivars: to evaluate their performance in east central Alabama, as well as, to serve as a model system for evaluation needs and expectations by means for a plant evaluation program. The summer annual cultivars selected for evaluation in this study were *Solenostemon scutellarioides* and *Angelonia angustifolia*.

Product Characteristics

When asked to rank plant characteristics by importance, variation among consumer responses is inevitable. Plant characteristics such as bloom color, foliage color/variegation, number of buds at time of market, and plant size, among other characteristics, all play a role in the consumers' decision to purchase or not.

Bloom color. Phillips et al. (2007) found that in container gardens, color combination was the second most important factor in the decision to purchase an annual planter. In that study, consumer participants seemed to prefer red color harmonies that offered a greater variety of color within the container; however, it was unclear whether this preference stemmed from the actual preference for more color or the brightness of yellow in the direct complement combinations. Based on their study, consumers preferred containers that use a wide variety of colors for maximum display.

In a 1999 study conducted by Kelley et al. (2001), where participants indicated that color was the most influential factor when evaluating edible flowers, compared to price and container size. When considering edible flowers, choosing which color of edible pansies to sell is not a trivial matter. If a color less preferred by consumers is used, they may be less likely to purchase the product, and the product may remain on the shelf until it is unmarketable (Kelley et al., 2001).

Frank et al. (2001) reported that color was overwhelmingly the most important attribute in selecting bell peppers. Survey respondents were divided into groups and color was the dominant contributor to consumer preference in five of the six groups. The overall consumer sample used in the study viewed color as far more important in the purchase decision than price or vitamin C content.

Behe et al. (1999) reported that, geranium flower color dominated the other two factors evaluated, leaf variegation and price, in importance, accounting for 52% of the buying decision. The practical importance of these results is that flower color is by far the most important feature in purchasing geraniums (Behe et al., 1999). Retail nurseries may not need to stock all possible combinations of leaf variegation and flower color. Instead of stocking unprofitable combinations, nurseries should be able to use that shelf space for the combinations preferred by consumers.

In Wolnick's 1983 article, 83% of survey respondents either "strongly agreed" or "agreed" that the flower color of geranium is important. Wolnick stated that color studies generally confirm that red is more popular than pink among those asked. However, Wolnick noted some studies suggest that growers prefer red, and thus grow red, which then dominates in the marketplace, although consumers may prefer another color. Growing the color varieties preferred by customers can potentially increase sales because consumers are more likely to make purchases.

Foliage color/leaf variegation. Behe et al. (1999) evaluated consumer preferences for geranium flower color, leaf variegation, and price. Results indicate that flower color was the most important factor with leaf variegation being second. So, while foliage color/variegation is somewhat important, it is not as important as the flower color in the eyes of the consumer. One of the plant characteristics studied by Wolnick (1983) was leaf shape and marking. The combination of plants paired together in the study dictated which leaf marking were preferred. In some of the studies, cultivars with highly variegated leaves were preferred. In one study no difference occurred between the leaf colors. It can be concluded from these results that variegated leaf cultivars were preferred.

Plant size. Hardy et al. (2000) conducted a study to evaluate consumer preferences for plant size, type of plant material, and design sophistication in residential landscaping. The results of the study showed that plant size was the most important factor evaluated in their study. While large sized plants used alone in the landscape offsets the overall aesthetic of a foundation planting by causing discordance, it was noted that smaller sized plants negated the value gained by using a more sophisticated landscape design. In that article, sophistication was based on larger and diverse plant materials arranged in a complex and intricate way. The researchers found that the respondents were willing to simplify the landscape design to gain an increase in plant size. Additionally, survey respondents were willing to exchange medium sized plants for those of a smaller size in return for an upgrade from an evergreen landscape to one that incorporates deciduous plants, more annual color, and hardscapes.

Behe et al. (2005) found that plant size was of less importance to consumers compared to other plant characteristics when purchasing plants, even though it was the most important in previous research published by Hardy et al. (2000). The report suggests that the largest affordable plant size should be used in the landscape because it consistently provided a higher perceived value in all markets (Behe et al., 2005). Even though Behe (2005) said consumers view plant size as less important, Behe et al. (2005) found that when evaluating home values smaller plant sizes were perceived by survey respondents to reduce home values, while larger plant sizes were perceived to increase home values. Respondents indicated that medium-sized plants produced no change in existing home value.

Wolnick (1983) looked at plant height as one characteristic impacting plant preference for survey respondents. Studies were inconclusive, according to Wolnick indicating that respondents may have had difficulty perceiving differences among the plants or maybe height

differences in the range tested are not an important factor related to choosing one geranium over another.

The first two studies mentioned provide information regarding plant sizes in the landscape. These studies concluded that although consumers might not always select the larger plant material when purchasing plants, they prefer larger plant materials when viewing a home (Behe, 2005; Behe et al., 2005; Hardy et al., 2000). In the third study containerized plants were used to determine importance of plant size, resulting in inconclusive results.

Price. In a 2004 study to determine interest in value-added planters, researchers found that price had the biggest influence on consumer preference for the planters evaluated (Phillips et al., 2007). Value-added planters are pre-planted containers, which consumers can buy. In that study, price ultimately influenced whether or not a consumer decided to purchase any given product. Robertson and Chatfield (1982) conducted three experiments to study fresh flower merchandising characteristics involving bunch composition, flower color, and price. In experiment one, color and price had equal influence on younger persons and lower-income groups. In the second experiment, little price sensitivity was exhibited between bunches ranging in price from $2.95 to $6.95. In the third experiment, consumers found the mid-price bunch to be the most acceptable and met the most expensive bunch with resistance (Robertson and Chatfield, 1982). Robertson and Chatfield (1982) found over the three experiments collectively that price was more important with mixed flower bunches. The optimum price range for a mixed bunch of flowers was $5.95 to $7.95 and for a homogeneous bunch was $2.95 to $4.95.

Phillips et al. (2007) found that few consumers purchased annual planters in 2003. The majority of those opting not to purchase the planters preferred to create their own instead of purchasing pre-made annual planters. For this reason, it would seen that retailers need to focus

on selling annuals that will appeal to consumers for use in residential landscapes and annual planters. One annual becoming popular in container use, as well as landscape use, is *Angelonia angustifolia*.

Angelonia, *Angelonia angustifolia*

Angelonia angustifolia is a summer annual plant that can be propagated vegetatively or by seed. Angelonia is in the Scrophulariaceae family which is a family of annual and perennial herbs known for having opposite leaf arrangement, and bell or tube shaped flowers. *Angelonia* species range in height from 1.0 to 2.5 feet (Bailey and Bailey, 1976; Huxley, 1992). Inflorescence is a terminal raceme, with a two lipped corolla, giving it the nickname the "summer snapdragon" (Griffiths, 1994). Predominate pollinators are bees (Buchman, 1987), which are attracted in abundance, other plant species in the garden can benefit from presence of angelonia.

Angelonia is comprised of around thirty species, few of which are cultivated. However, two species that are cultivated are *A. angustifolia* and *A. integerrima*. Of these two species, *A. angustifolia* is more widely cultivated. *A. angustifolia* is a perennial species that is native to Latin America and the West Indies. This species grows 1.0 to 2.5 feet tall, with glabrous stems, lanceolate leaves, and racemes containing deep red-violet flowers. It flowers during the summer season and is often used to naturalize areas in the landscape. (Bailey and Bailey, 1976; Griffiths, 1994; Huxley, 1992). This plant is versatile within the landscape because it can be used in mass plantings, hanging baskets, and mixed containers.

Susceptibility to the cucumber mosaic virus in the early 1900's (Bailey, 1906), reduced *Angelonia* production by growers. However, in the late 1990's several new cultivars of

Angelonia were released in a series called AngelMist™. AngelMist™ is considered to be one of the first series to be clean of all disease problems. Several cultivars are now available commercially, all of which are vegetatively propagated except the Serena™ series which is propagated by seed. Flower colors range from white, pink, lavender, dark blue, or purple, to bi-colored.

Coleus*, Solenostemon scutellarioides*

S. scutellarioides, commonly known as coleus, is a popular bedding plant throughout the United States due to its vibrantly colored, often variegated foliage. *S. scutellarioides* is a member of the mint family, Lamiaceae, characterized by square stems, simple leaves, and opposite leaf arrangement (Toogood, 1971). *S. scutellarioides* is mainly native to tropical areas such as the Caribbean and Central America (Bailey and Bailey, 1976), but it is very easily produced and grown throughout North America (Seymour, 1970). Coleus is distinguished by richly colored leaves that often have serrated or shallow toothed leaf margins; it is often colored with deep shades of red, yellow, green, and/or purple (Toogood, 1971). It is widely used as a foliage plant with either solid or variegated leaves (Garland et al., 2010). Plants may reach 3.0 feet when grown in filtered or indirect light depending on the cultivar. Plants receiving full sun are on average, more compact with little vibrant colored foliage and with leaves tending to wilt on hot days. Plants can be propagated sexually or asexually. For seeds to germinate, light is required. Humid conditions and air temperatures between 69.8^{o}F and 80.6^{o}F improve rooting (Bubel, 1989; Lebowitz, 1985).

A study in 1995 showed variegation in coleus reduced photosynthetic rates and plant growth (Yang and Sadof, 1995). Variegation is often a highly desirable characteristic in ornamentals. Variegation is caused by physiological, morphological, or pathological means (Kirk and Tilney-Bassett, 1978). Variegation within coleus is controlled by anthocyanins and chlorophyll levels within the plant (Beckwith et al., 2004; Lamprecht et al., 1975; Marcotrigiano et al., 1990; Oren-Shamir and Levi-Nissim, 1997). Variegation in coleus is cultivar dependent, much like light requirements.

Commonly known as a shade plant, coleus has many cultivars that are now suitable for sun (Garland et al., 2010). Each cultivar can tolerate different light intensities, with some growing well in shade while others grow better in full sun (Armitage, 2001; Rogers and Hartlage, 2008; Stack, 2009). Sun coleus has become a popular annual plant for use in full sun bedding areas as well as for container gardening (Cavins et al., 2002). As of 2002, there were over 200 cultivars of sun coleus commercially available. While most shade loving cultivars of coleus are propagated by seed, sun coleus is mainly propagated vegetatively through stem cuttings. Sun coleus is known for its vigorous growth habit and ability to tolerate full sun conditions without wilting.

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CHAPTER III

PERCEPTION BY GREEN INDUSTRY ON CONSUMER PREFERENCES IN ANNUAL BEDDING PLANT CHARACTERISTICS AND PLANT PROMOTION PROGRAM

Abstract

The Green Industry, specifically landscape and plant production professionals, rely on consumer demand to determine which cultivars to grow each year (Dunwell et al., 2001; Phillips et al., 2007). More importantly the industry relies on new plant releases and trials to further increase consumer demand. The introduction of new, well performing plant material continues to support the growth of the nursery/landscape industry (Dunwell et al., 2001). Because of the reliance on trials and new cultivars and due to the impact such programs can have on the Green Industry, the Alabama Nursery and Landscape Association (ALNLA) expressed interest in beginning a trial and plant promotion program in Alabama. Trial gardens normally partner with plant promotion programs, for example the University of Georgia trial gardens partnered with AthensSelect™ for plant promotion. Two surveys were conducted to gather information regarding ALNLA interest in, and perceptions of such a program. The results of this study showed that the industry believes consumers are predominately focused on physical characteristics of plant materials. Foliage color (61%) and flower color (58.5%) were the most prevalent responses byindustry perceptions in the survey when asked what they thought

consumers look for in purchasing foliage and flowering annuals. The majority of participants (89.7%) expressed interest in the development of a statewide plant promotion effort, and most respondents (76.9%) wanted to be able to obtain plant promotion and trial information from a website. When asked about specific selections for trials of *Solenostemnon scutellarioides* (coleus) and *Angelonia angustifolia* (angelonia), 80% of respondents indicated that they currently grow or use coleus and 75.6% currently grow or use angelonia. Interest in learning about new cultivars and varieties of angelonia (87.2%) and coleus (77.5%) was also very strong among those surveyed. The results of this study showed that the industry is consistent in their assumption that consumers are mainly interested in aesthetic appeal. The survey also indicates industry participants are interested in the development of a plant promotion program, and they are interested in learning about new cultivars and varieties that are being evaluated and introduced through such a program.

Introduction

The introduction of new, high performance plant material continues to support growth of the nursery and landscape industry (Dunwell et al., 2001). There is a strong relationship between nurserymen and landscapers, with both influencing the other in plant selections (Garber et al., 1995). While nurserymen and landscapers influence each other, consumers influence both groups and in many ways control what the nurserymen and landscapers produce and use (Phillips et al., 2007). According to Manalo (1990), product characteristics are a dynamic part in a consumers' decision on whether or not to purchase a product.

Meeting consumer demand and providing the best quality plant material should be the goal of all landscape and production businesses. Consumer demand guides the plant selection

choices producers and landscapers make. Until the 1980s, producers and landscapers guessed as to what consumers wanted because consumer preferences had not yet been analyzed (Wolnick, 1983). More recently evaluation and promotion programs have been put in place to help determine suitable plant material for a given area (Dunwell et al., 2001; Stegelin, 2001). The majority of these programs have partnered with universities to provide evaluation of plant materials (Anella et al., 2001). One of the most prominent university trial gardens is located at the University of Georgia in Athens, Georgia. This program is known for testing new cultivars and varieties of annuals and perennials to assess performance under natural drought and high heat conditions. UGA has partnered with AthensSelect™, a plant promotion program, that markets all the new releases across Georgia (Armitage and Green, 2001).

If a state trial and evaluation program is to be developed in Alabama, input from the Green Industry is needed. Because ALNLA is the largest and most widely recognized Green Industry professional organization in the state of Alabama, members were surveyed to gather the following information:

- interest in development of a statewide trial, evaluation, and promotion program
- perception of consumers' preferred plant characteristics
- industry criteria for selection of plant material
- ways industry would prefer to get results from trials.

Materials and Methods

This study was designed to evaluate Green Industry perception regarding consumer demand, promotion program characteristics, and preference of annuals. Members selected for participation were landscape, nursery production, or greenhouse production professionals within the ALNLA who are located in the state of Alabama. A survey titled "Determining Best Characteristics for Bedding Plants" consisting of twenty-one questions was developed (Appendix A; Figure 1). Survey questions were developed assessing industry perceptions of what consumers prefer, how industry collects information about new plant materials in trials, and level of interest in a possible Alabama plant promotion program. The survey also selected opinions of specific cultivars being trialed. Once Institutional Review Board (IRB) approval was obtained, an IRB approved letter from researchers containing information regarding the benefits to the industry and instructions for returning the survey in a pre-paid envelope (Appendix B). A second letter included in the survey packet was from the Executive Director of ALNLA, and served as a cover letter giving an overview of the research being conducted and expressing potential benefits of completing the survey (Appendix C).

The population consisted of 193 members of the ALNLA; the survey was mailed on August 17, 2011 with a response deadline of October 30, 2011. Following the deadline, only 25 completed surveys had been collected. In an attempt to obtain more responses, the survey was posted online (Appendix A; Figure 2). Upon IRB approval for modification the survey was uploaded to www.surveymonkey.com and sent with follow up notifications to the remaining 168 subjects who had not responded to the original mailed survey. The same cover letters were used in the online version as the initial mailing with the ALNLA cover letter sent in an email to the remaining participants and the second cover letter appearing on the first page of the survey. To

accept and participate in the survey, the respondents were asked to click to the second page and continue through the survey.

A second survey titled "Cultivar Preference Survey of Select Coleus and Angelonia Varieties" was developed to assess industry preferences of six cultivars of *Solenostemnon scutellarioides* (coleus) and six cultivars of *Angelonia angustifolia* (angelonia) (Appendix D; Figure 1). The survey consisted of seven questions asking for familiarity of respondents with the cultivars tested and their preference for the six cultivars of each species. The initial survey sample was collected from attendees of the 2011 Auburn University Department of Horticulture Landscape School event. The survey was administered at the Auburn University Trial Gardens located on Woodfield Drive, Auburn AL on August 8, 2011. This location of survey administration allowed participants to see the coleus and angelonia cultivars in vivo. Fifteen surveys were distributed and collected at this event and after IRB modification approval the survey was uploaded to www.surveymonkey.com in order to increase the survey response numbers. The online version of this survey consisted of the same questions as the landscape school version and included pictures of each cultivar (Appendix D; Figure 2). After checking the landscape school participants against the list of the 193 ALNLA members to ensure there was no overlap, the survey was emailed to the remaining ALNLA participants.

Due to low response rate on both surveys, an extension was granted by the IRB. Weekly reminders were emailed to those that had not responded to encourage more participation (Appendix E). After the survey deadline, the data were entered into an Excel spreadsheet (Microsoft for Mac, 2011) and uploaded into SPSS 19 (SPSS, 2011). In SPSS, variables were coded and labeled for frequency and descriptive calculations.

Results and Discussion

For the two surveys utilized in this study, there were two separate respondent groups. The first survey conducted was "Determining Best Characteristics for Bedding Plants." The sample for this survey was drawn from ALNLA members who are located within Alabama (N=193). There were 35 respondents to the survey. Twenty-three of the respondents represented landscape companies and twelve participants represented production companies. According to the sample size calculation, with a 15% margin of error, 95% confidence interval, and 50% response distribution the recommended sample size was thirty-six. When respondents were asked about their company's gross yearly revenue 41% said their business fell in the $1,000,000 - $4,999,999 bracket, with over 55% saying their company grossed more than $1,000,000 each year (Table 3.1). When discussing the respondents' company's yearly income from seasonal color, over 65% said they made $249,999 or less, with 43.6% making $99,999 or less and 23.1% making $100,000-$249,999. The majority of respondents (33.3%) said their clientele average income was $75,000 or greater, while 25.6% said $65,000-$74,999. This shows bedding plants are preferred more by a higher income clientele.

Overall respondents expressed a positive reaction to the survey and the research being conducted. Several of the questions were open to multiple answers by respondents, therefore the percentages did not always equal 100%. A rating scale of one to five (one being least important, five being most important) was used when asking what characteristics of foliage bedding plants industry respondents think consumers feel are important in their purchasing decisions. The mean score is provided in parenthesis following each characteristic. The characteristics industry respondents thought most important to consumers are in order of most preferred: foliage color

(4.39), maintainability (3.71), mature plant size (3.10), foliage texture (2.41), and "other" (1.38). Industry respondents were asked to select three out of eight choices that represented the most important flowering bedding plant characteristics to consumers. The three characteristics of flowering bedding plants identified by the industry respondents as most preferred by consumers were: flower color (2.24), flower time (1.56), and flower size (0.83). All three of these characteristics relate to aesthetic appeal, much like the preferred characteristics for foliage bedding plants. This indicates that industry perception is that consumers are primarily focused on the aesthetic value of plant materials.

Industry plant selection is an important part of meeting consumers' demand. When industry participants were asked how they determine which plant varieties to grow or buy each year: 43.6% stated that they talk to consumers, 43.6% go to trade shows, 33.3% talk with seed representatives, 33.3% read publications, 25.6% use in-house trials, 23.1% use seed catalogs, and 17.9% use plant promotion programs from other states. When asked to what publications participants refer in making plant selections, three used Grower Talks, two used Greenhouse Grower and Southern Living, while one respondent each mentioned Alabama Gardener and Garden Center. The fact that 43.6% of participants say they talk to consumers about varieties to offer each year supports the belief that consumers drive plant selection decisions for the Green Industry. Both production and landscape companies are aware that if consumers are not satisfied they are not likely to make return purchases. Networking with other industry professionals such as through trade shows, can also give insight into consumer demand.

The majority of respondents (89.7%) were interested in learning about new plant selections through a possible state trial and promotion program. This positive response supports

the need for such a program in Alabama. When asked how participants might like to access information from this potential state trial program, 76.9% wanted a website, 53.8% wanted a field day, 46.2% wanted to learn information from trade shows, and 41% wanted to gain information from mailed publications. Participants indicated no other ways in which they might prefer to obtain information from future trials.

When participants were asked if they had ever grown or used *Angelonia angustifolia* (angelonia), 75.6% indicated that they had. When asked if they currently grow or use angelonia, 67.5% answered affirmatively. Participants were asked if they were interested in learning more about the angelonia cultivars being tested at Auburn University and 87.2% expressed positive interest. Of the four main colors of angelonia produced, purple, pink, white, and indigo blue, participants were asked which ones they currently grow or use. In the survey a percentage range was provided for participants to select the range of plants they grow or use from among the ranges indicated. The industry respondents produce all four colors of angelonia in a quantity over 50%: purple (21.1%), white (15.8%), indigo blue (13.2%), and pink (2.4%) (Table 3.2).

When asked if participants grew or used *Solenostemnon scutellarioides* (coleus) varieties, 80% responded that they had. Participants were asked to select all attributes they thought consumers looked for when purchasing coleus. Foliar color was the most important characteristic according to 97.5% of respondents (Table 3.3). When asked which colors they grow or sell 42.5% of participants indicated red (Table 3.4). Ninety percent of participants indicated that they were familiar with sun coleus, and 82.5% had grown or used sun coleus varieties prior to this questionnaire. When asked if interested in learning more about sun coleus and other coleus varieties 77.5% of participants indicated that they were. Seventy percent of partipants indicated

that they currently grow or use coleus because of high consumer demand, dependable performance, and excellent foliar color.

When asked if they had particular interest in other summer annuals, 48.7% of participants answered affirmatively. Four annuals were each mentioned by two participants: *Calibrochoa* spp., *Vinca* spp., *Zinnia* spp., and *Pentas* spp. The following annuals were each mentioned by one participant each: *Portulaca* spp., *Begonia* spp., *Torenia* spp., *Petunias* spp., *Impatiens* spp., and *Scaevola* spp. Four perennials were mentioned by one participant each: *Rudbeckia* spp., *Echinacea* spp., *Caladium* spp., and *Lantana* spp.

The second questionnaire titled, "Cultivar Preference Survey of Displayed Coleus and Angelonia Varieties," was administered on August 8, 2011, to participants at a field day hosted as part of a landscape workshop providing education for professionals in the horticultural industry. Sixteen completed surveys were gathered from this field day: six landscape and three production professionals along with six Alabama Cooperative Extension System (ACES) regional extension agents and one state government official. Following the initial landscape school survey, the same 193 ALNLA members from the previous survey were added to the sample group. There were four options, landscaper (41.2%), grower (26.5%), both (5.9%), and other (26.5%).

Participants were asked to indicate all cultivars of angelonia and coleus that they grow or have grown in the past, 57.6% indicated that they had grown or used Serena™ Purple angelonia (Table 3.5) and 32.4% had grown Florida Sun Jade coleus (Table 3.6). A list of symptoms and problems typically associated with angelonia was provided in the questionnaire. Respondents were asked to indicate any of the symptoms or problems that they had observed in angelonia and

coleus (Table 3.7). The most frequently identified problem with angelonia was plant wilting with 18.2% of respondents indicating they have experienced this. The most frequently selected symptom in coleus was insect damage (38.2%) while sun scorch (26.5%) was the second most frequent. Participants were asked to rank six cultivars from one to six (1 being best and 6 being worst). Results were reverse coded, giving six points for being the best, five points for second best and so on. The Industry most preferred Serena™ Purple angelonia (3.79 rating) and Redhead coleus (5.17 rating) (Table 3.8).

Conclusion

This study surveyed members of the ALNLA, gathering information on their perceptions of consumers' preferred characteristics of plant materials, industry thoughts on a plant promotion program for the state, and their opinion about selected annuals evaluated in a field trial. The results indicated that industry participants think consumers are mainly looking for foliage color (61%) and flower color (58.5%). Respondents indicated great interest in the development of a plant promotion program, wanting to access information from this program predominately through a website and field days. Having such a program could greatly benefit the Green Industry within the state of Alabama. The majority of participants that offer both coleus and angelonia plants said they provide it because of the high consumer demand and excellent color. Overall this study shows there is a demand for a plant promotion program for the state of Alabama even though the industry does have extensive knowledge of what consumers consider important in their plant selection decision.

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Table 3.1. Company demographics of participants in the "Determining Best Characteristics for Bedding Plants" survey.

Company Demographic	Percent Range Chosen	Actual Percentages	N
Gross Yearly Revenue	≤ $99,999	12.8%	5
	$100,000-$249,000	5.1%	2
	$250,000-$499,999	7.7%	3
	$500,000-$999,999	15.4%	6
	$1,000,000-$4,999,999	41%	17
	$5,000,000-$9,999,999	5.1%	2
	≥$10,000,000	2.4%	1
	No Response	10.3%	5
Gross Yearly Income from Seasonal Color	≤ $99,999	43.6%	18
	$100,000-$249,000	23.1%	10
	$250,000-$499,999	7.7%	3
	$500,000-$999,999	2.6%	1
	≥$1,000,000	7.7%	3
	No Response	15.4%	6
Average Clientele Income	≤ $35,000	2.6%	1
	$35,001-$54,999	7.7%	3
	$55,000-$64,999	17.9%	7
	$65,000-$74,999	25.6%	11
	≥$75,000	33.3%	14
	No Response	12.8%	5
			Total- 41

Table 3.2. Industry response when asked to give total yearly percentages of the different flower colors of angelonia produced or used.

Angelonia Color	Percent Range Chosen	Actual Percentages	N
Purple	0	31.7%	13
	≤ 10%	13.2%	5
	11%-25%	10.5%	4
	26%-50%	21.1%	8
	51%-74%	13.2%	5
	≥75%	7.9%	3
Pink	0	39.5%	15
	≤ 10%	18.4%	7
	11%-25%	18.4%	7
	26%-50%	21.1%	8
	51%-74%	0%	0
	≥75%	2.4%	1
White	0	26.3%	10
	≤ 10%	15.8%	6
	11%-25%	18.4%	7
	26%-50%	23.7%	9
	51%-74%	10.5%	4
	≥75%	5.3%	2
Indigo Blue	0	47.4%	18
	≤ 10%	21.1%	8
	11%-25%	10.5%	4
	26%-50%	7.9%	3
	51%-74%	7.9%	3
	≥75%	5.3%	2
Other	0	92.1%	35
	≤ 10%	2.6%	1
	11%-25%	2.6%	1
	26%-50%	2.6%	1
	51%-74%	0	0
	≥75%	0	0
			Total- 41

Table 3.3. Industry perceptions of attributes consumers look for when purchasing coleus.

Characteristic	Actual Percentages	N
Foliar Color	97.5%	40
Sun and Shade Tolerance	85%	35
Maintainability	60%	24
Plant Height	42.5%	17
Leaf Size	37.55	15
Variegation	30%	12
Hardiness	27.5%	11
Other	2.5%	1
		Total-41

Table 3.4. Colors of coleus grown or sold by Green Industry survey respondents.

Coleus Foliar Color	Actual Percentages	N
Red	42.5%	17
Purple/Green Variegation	30%	12
Green	25%	10
Green/Red Variegation	12.5%	5
Purple	10%	4
Other	10%	4
		Total-40

Table 3.5. Angelonia cultivars grown or used by Green Industry survey respondents.

Angelonia Cultivar	Actual Percentages	N
Serena™ Purple	57.6%	23
AngelMist™ Deep Plum	30.3%	12
AngelMist™ White	27.3%	11
Serena™ White	27.3%	11
Serena™ Lavender	27.3%	11
AngelMist™ Dark Pink	24.2%	9
		Total-41

Table 3.6. Coleus cultivars grown or used by Green Industry survey respondents.

Coleus Cultivar	Actual Percentages	N
Florida Sun Jade	32.4%	13
Rustic Orange	26.5%	10
Redhead	23.5%	9
Bellingrath	20.6%	8
Merlot	20.6%	8
Florida Sun Splash	17.6%	7
		Total-41

Table 3.7. Industry's experience with disease and physical problems with angelonia and coleus species.

Angelonia Characteristics	Actual Percentages	N (41)	Coleus Characteristics	Actual Percentages	N (41)
Wilting	18.2%	7	Insect Problem	38.2%	15
Low Flower Count	15.2%	6	Sun Scorch	26.5%	11
Plant Growth Regulation	12.1%	5	Foliage Discoloration	23.5%	9
Stem Breakage	12.1%	5	Wilting	17.6%	7
Powdery Mildew	6.1%	2	Defoliation	8.8%	3
Other	6.1%	2	Other	17.6%	7

Table 3.8. Industry ratings of angelonia and coleus cultivars.

Angelonia Cultivar	Rating (1 to 6)	Coleus Cultivar	Rating (1 to 6)
Serena™ Purple	3.79	Redhead	5.17
AngelMist™ Dark Pink	3.68	Rustic Orange	3.47
AngelMist™ Deep Plum	3.61	Merlot	3.43
AngelMist™ White	3.43	Florida Sun Jade	3.17
Serena™ Lavender	3.36	Florida Sun Splash	3.17
Serena™ White	3.14	Bellingrath	2.77

CHAPTER IV

CONSUMER PREFERENCES OF ANNUAL BEDDING PLANTS AND DEVELOPMENT OF A PLANT PROMOTION PROGRAM

Abstract

The Green Industry incorporates several areas of agriculture; two primary areas being landscape and plant production companies. Both of these areas influence one another and are also influenced by an even larger force, consumers. Consumers drive Green Industry production decisions each year (Dunwell et al., 2001; Phillips et al., 2007; Markus et al., 1992). This study focused on consumers' preference of plant characteristics when purchasing, thoughts on the development of a state plant promotion program, level of gardening expertise, and opinions about specific cultivars selected for evaluation. A survey was developed to gather the above information, from Master Gardeners and non-master gardeners throughout Alabama. The survey yielded 542 responses, with the majority of the respondents being age 65 or older (30.8%) and being Master Gardeners (61%). Color (88.6%) was the primary characteristic participants look for when purchasing plant materials. Plant use (63.1%) was also important to them in selecting materials. Almost all of the participants (95.2%) made the decision of purchasing plant materials themselves versus someone else in their household. If plant materials were offered

through a promotion program, 88.4% of participants said they would buy the program's plant material with 69.1% saying they would be willing to pay more for these plants. This study documented consumer preferences for plant material that has brilliant color and that performs well in Alabama.

Introduction

The Green Industry encompasses greenhouse and nursery plant production facilities as well as landscape businesses. Over the past 40 years, production of nursery crops has represented a rising segment of the Green Industry in the United States (Markus et al., 1992). Just as nursery production has grown, the landscape installation and maintenance fields have become a large part of the Green Industry (Florkowski et al., 1994; Hubbard et al., 1989). The introduction of new, high performance plant material supports growth of the nursery and landscape industries (Dunwell et al., 2001). There is a strong relationship between nurserymen and landscapers, both influencing the other (Garber et al., 1995). While nursery and landscape professionals influence each other, consumers drive both groups by influencing what nurserymen and landscapers produce and use (Phillips et al., 2007). According to Manalo (1990), product characteristics represent a dynamic part of consumer purchase decisions. Once desired plant characteristics are determined, nursery and landscape professionals can target plant selection to satisfy consumer needs and demands (Phillips et al., 2007). Consumer demand drives the industry and can therefore guides nursery and landscape professionals in supplying the marketplace.

Wholesale growers and retailers in the Green Industry currently grow and offer annual bedding plant products of varying quality for consumer purchase. Previous research targeting

consumer preferences for various aspects of chrysanthemums, geraniums, edible flowers, and bell peppers has been published (Behe et. al., 1999). According to Behe (1993), very little research has been done to measure consumer preferences among the floriculture industry. Shafer and Kelly (1986) and Jowkar et al. (2007) also determined that little market research had been conducted on mums or other horticultural crops. Currently, there is almost a complete lack of published research in the industry relative to product qualities and characteristics consumers value in annual bedding plant materials. By identifying and addressing consumer preferences, wholesalers and retailers could strengthen sales by providing bedding plants that appeal to consumers.

The affluent homeowner has been the primary target market for horticultural products, but as industry competition increases and industry growth has slowed due to the current economic environment, an investigation of renters as a potentially ignored or underserved market is justified (Behe, 2006). Previous research has shown which specific plant characteristics are important to consumers (Behe et al., 1999; Frank et al., 2001; Kelley et al., 2001; Phillips et al., 2007; Shafer and Kelly, 1986; Robertson and Chatfield, 1982; and Wolnick, 1983). For example, bloom color may be more important in the overall landscape compared to the importance of color found in planters. Other plant characteristics influencing consumer purchase decisions may include foliage color, number of unopened buds, and plant size. Pricing, container size, and seasonal trends in plant sales, may also influence consumer demand of annual bedding plants. The limited amount of previous research regarding consumer purchase preference of annual bedding plants prompted the need for this research project. This study was designed to gain insight into consumers' perceptions of plant characteristics, thoughts on the development of a

state promotion program, level of gardening expertise, and collect opinions about two specific annual species, coleus and angelonia being trialed.

Materials and Methods

The sample population came predominately from Master Gardener groups across Alabama. However, the Master Gardener survey respondents were encouraged to forward the survey to non-Master gardener adults within the state of Alabama. A survey titled "Consumer Preference of Summer Annuals" was developed consisting of twenty-seven questions (Appendix F; Figure 1). Results of this survey are expected to provide a better understanding of consumers preference and demand.

After receiving approval for conducting the survey from the Auburn University Institutional Review Board (IRB), a questionnaire was sent to all Master Gardener presidents in local associations throughout Alabama. The questionnaire was distributed on April 30, 2012 in an email providing a link to an online survey through www.surveymonkey.com. An overview of the research was included in the email to the Master Garden presidents (Appendix G; Figure 1). Upon opening the survey link, respondents were directed to an introduction page giving an overview of the research and an invitation for their participation (Appendix H; Figure 1). If participants consented to the survey, they were directed to the first page of the survey (Appendix H; Figure 2).

On July 26, 2012 the survey link was closed to further participation. After the survey closed, the data were entered into an Excel spreadsheet (Microsoft for Mac, 2011) and uploaded into SPSS 19 (SPSS, 2011). In SPSS, variables were coded**,** labeled, and given values for

frequency and descriptive calculations, and analyzed as nonparametric independent sample t-tests.

Results and Discussion

The survey population consisted of consumers throughout the state of Alabama, predominately those associated with Master Gardener organizations within the state. Within 3 months of activation, this survey had collected 542 responses, which exceeded minimum sample size parameters of 385 based on the Rasoft sample size calculator when surveying the Alabama population of 4,802,740. Of the sample population, 82.4% were women, 11.8% were men, and 5.7% did not respond. Ethnicity of the respondents consisted of 88.7% Caucasian, 3.0% African American, 1.1% Native American, 0.7% Hispanic, and 0.6% "other". Of respondents, 5.8% chose not to indicate their ethnicity. The age of most survey participants was 65 or older (30.8%), while there were participants in the following age brackets: 56-64 (29.0%), 46-55 (26.9%), 36-45 (8.8%), 26-35 (4.1%), and 19-25 (0.4%). When asked about participants' involvement in a Masters Gardeners organization, 61% indicated that they were involved in an organization while 39% were not. Out of the 542 participants, 90.4% said they were homeowners, 5.7% did not respond, and 3.9% said they rent.

Consumers were asked a variety of questions relative to product characteristics that are important to them in making purchasing decisions. Many of the questions were open to multiple answers from consumers, therefore not all percentages will equal 100%. When asked what consumers prefer in annual plant materials, 88.6% said they look for color, 63.1% said the look for plant use, 47.6% look at flower size, 41.9% consider the mature size of plant material, and 17.9% chose "other." Of the 97 "other" responses the top four characteristics represented were

sun requirements (25.7%), water requirements (19.5%), price (11.3%), and suitability for use as butterfly and bird attractants (7.0%). When making the decision about plant materials, 95.2% of consumers said they make the decision themselves, while 17.5% allow the spouse to make the decision, 2.2% look to garden center employees for guidance, 1.3% let the landscaper make decisions, 0.9% let friends decide for them, and 1.5% chose "other." Out of the eight consumers that chose "other" the majority (5) said they let a non-spouse family member decide.

If a plant promotion program was developed in the state, 88.4% of respondents said they would be more likely to buy plant material endorsed through such a program, with 80.4% of them saying it was because these plants were proven to grow well in Alabama. Fifty two percent of respondents indicated they would purchase promoted plant material because there would be less maintenance, 51.2% said they would because of disease and pest resistance, and 47.1% because plant would be more water efficient. Forty five percent of respondents said they would purchase these materials because they had previously been trialed, and 29.2% were interested in the high aesthetic appeal. When asked if consumers would be willing to pay more for plants promoted from this program 75.6% of Master Gardeners and 69.8% of non Master Gardeners said they would be willing to pay more. Having both Master Gardeners and non Master Gardeners responding similarly proves positive and useful for sales of plants promoted in the state.

Consumers were asked about their gardening activities in this survey. When asked how they classify themselves as gardeners, 39% were "intermediate", 36.2% said they were "avid", 16.1% "novice", 5.4% did not respond, and 3.3% said they were "not gardeners". Most (40.7%)

said they worked in the yard daily or weekly, while 7.6% said they did monthly yard work, 5.4% did not respond, 5.2% said once a season, and 0.6% said they never do yard work.

Several questions in this survey were directed toward assessing knowledge and soliciting opinions on two summer annuals species, the first being *Angelonia angustifolia* (angelonia). When asked about angelonia, 55.8% of participants indicated that they are familiar with angelonia and 36.6% have previously purchased angelonia. When asked why they purchased angelonia, 28.7% said that it was because of flower color, while 19.2% purchased angelonia for the aesthetic appeal, 17.7% liked the ease of growing, 12.2% chose angelonia because of the size, and 3.9% chose "other." Twenty-one participants selected "other," giving more characteristics such as: excellent bloom time (8), drought tolerance (4), heat tolerance (4), growth habit (2), ease of growing (1), price (1), and butterfly and bird attractant (1). Angelonia colors purchased by consumers in the past were purple (29.2%), white (21.6%), pink (14.4%), variegated (2.2%), and 0.7% "other," all of which said blue. When asked what colors of angelonia consumers would like to purchase, 55.5% said purple, 46% would buy white, 42% said they would buy pink, 32% would buy variegated varieties, and 2.6% would purchase "other" colors, such as yellow, blue, red, or peach. There are some cultivars that have a blue hue to them, but there currently are no yellow, red, or peach colored varieties available. Angelonia is used in both containers and in flower beds, with 66.5% of consumers surveyed indicating they would grow it in flowerbeds and 42.7% saying they would grow it in containers. When asked to rate angelonia cultivars trialed, consumers were presented with a picture of each cultivar. They were asked to ranked selections from 1 to 6 (one being their least favorite, six being their most favorite). In order of most important to least important sorted by mean score participant

preference was as follows: Serena Lavender (3.67), Serena White (3.54), Serena Purple (3.30), AngelMist Dark Pink (2.82), AngelMist White (2.80), and AngelMist Deep Plum (2.71).

The second annual in the survey was *Solenostemnon scutellarioides* (coleus). When asked if they were familiar with coleus, 93.5% of participants indicated that they are familiar with it. Most (76.8%) consumers had previously purchased coleus. The coleus characteristics that attracted consumers were foliage color and variegation (71.2%), ease of growing (36.7%), overall aesthetic appeal (31.4%), mature size (12.5%), and "other" (5.4%). There were twenty-nine participants that chose "other," 18 of which said they liked coleus because there are both sun and shade varieties. The following characteristics were all mentioned once in the "other" section: growth habit, container use, ability to blend well with other colors, and price. Coleus is available for purchase in several different solid and variegated colors. When consumers were asked what colors they have purchased before, 52.2% indicated that they have purchased red coleus, 43.9% of participants bought red and green variegated coleus, 42.1% green, 40.2% purchased red and yellow variegated coleus, 38,4% said they purchased purple varieties, and 7.2% chose "other." Out of the thirty-nine participants choosing "other," pink was the most popular answer with seven responses, five people said green and yellow variegated and four said orange variegated coleus. When asked to rate coleus cultivars trialed, consumers ranked the selections from 1 to 6 (one being least favorite, six being the most favorite). Placing in order of most preferred to least preferred the mean score from all participants was: Bellingrath (3.56), Florida Sun Jade (3.39), Florida Sun Splash (3.35), Merlot (3.18), Redhead (2.73) and Rustic Orange (2.48).

Conclusions.

The study was based on consumers' desired plant characteristics, interest in a plant promotion program and familiarities with specific cultivars of annuals. Ultimately, participants said they look for color (88.6%) and plant use (63.1%) when purchasing plant materials, and almost all of the participants (95.2%) make the decision of plant material purchases themselves. These results confirm the theory that aesthetic appeal is the preferred characteristic consumers look for when purchasing plant materials (Behe et al., 1999; Frank et al., 2001; Kelley et al., 2001; Phillips et al., 2007). It was determined consumers ultimately look for color, flower of foliage, when making purchase decisions on plant materials. This provides opportunities for growth in the Green Industry by promoting high performance plant materials proven to perform well in our climate. It was also found that implementing a plant promotion program statewide would interest consumers, in turn increasing plant demand and creating growth in the Green Industry. Overall, consumers want plants that are proven to perform well, produce brilliant color, and serve the appropriate purpose.

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CHAPTER V

FIELD EVALUATION OF COLEUS AND ANGELONIA PERFORMANCE IN EAST CENTRAL ALABAMA

Abstract

Experiments conducted in 2011 and 2012 evaluated growth and performance of six cultivars each of coleus (*Solenostemon scutellarioides*) and angelonia (*Angelonia angustifolia*) at Auburn University Teaching Demonstration Garden on the campus of Auburn University in Auburn, Alabama. Selections of both species were planted in full sun conditions to simulate moisture extremes and high summer temperatures typical of landscape conditions in the deep south. Coleus selections used were all classified as sun coleus cultivars, however after one week in the landscape, symptoms of sun scorch began to appear. Coleus cultivars experienced plant die back until irrigation rates were elevated from four days a week at 15 minutes, 0.39in/week (0.99cm/week), to four days a week at 45 minutes, 1.17 in/week (2.97 cm/week). Plots were evaluated every 14 days throughout the summer until termination of the study on November 11, 2011 and September 5, 2012. Coleus cultivars tested performed well in conditions presented in this study once irrigation rates were increased.

'Redhead' coleus (RH) was the largest cultivar in both 2011 and 2012. The fresh weight (FW) and dry weight (DW) of RH indicated that it was the largest cultivar in 2011(FW=1004.6g,

DW=505.2g) and 2012 (FW=1122.15g, DW-291.77g). Visual ratings of coleus taken were: foliage appearance, insect resistance, disease resistance, and sun tolerance. When evaluating foliage quality in 2011, 'Merlot' (M) (4.1), RH (4.0), 'Florida Sun Jade' (FLSJ) (4.1), 'Rustic Orange' (RO) (4.0), and'Florida Sun Splash' (FLSS) (3.9) were all similar, while 'Bellingrath' (B) (3.2) was significantly different, while in 2012, B(3.0) had a significantly lower rating. Insect and disease resistance were very strong in all coleus cultivars having no significant differences in 2011 or 2012. The highest rated cultivars for sun tolerance in 2011 were RH (4.4) and FLSJ (4.1), both sharing similarities among each other.

Overall, AngelMist™ cultivars were the largest in the trial, with 'AngelMist™ White' (AMW) and 'AngelMist™ Dark Pink' (AMDPk) being the largest in 2011 and 2012, respectively. The Serena™ series cultivars have a more compact growth habit making it the smaller cultivars in the study. 'Serena™ Lavender' (SL) was the largest Serena™ cultivar in the trial in both 2011 and 2012. Visual ratings taken consisted of: flower quality, insect resistance, disease resistance, and sun tolerance. In 2012, SP (5.0), was significantly different from SW (4.7) in flower quality. Insect resistance in 2011 showed similarities between AMW (3.8), AMDPk (3.8), AMDPl (3.8) SW (3.7), and SL (3.7), while in 2012 proved to have no significant difference. Disease resistance in 2011 had a significant difference between SP (4.0) and AMW (3.6), AMDPk (3.5), AMDPl (3.7) and SW (3.7) sharing similarities with SL (3.8). Disease resistance in 2012 showed similarities between SL (4.0), SP (3.7), SW (3.8) and AMDPl (3.7), as well as similarities between SP (3.7), SW (3.8), AMDPl (3.7), and AMDPk (3.5). Angelonia cultivars showed no significant difference in 2011 or 2012 when evaluating for sun tolerance.

Introduction

The "Green Industry" is a term that encompasses several different fields, two of which are nursery production and landscaping businesses. In the past 40 years, production of nursery crops has been a rising component of the Green Industry in the United States (Markus et al., 1992). Just as nursery production has grown over the past 40 years, the landscape installation and maintenance fields have become important parts of the landscape/nursery Green Industry (Florkowski et al., 1994; Hubbard et al., 1989). The introduction of new plants that perform well under diverse landscape and environmental conditions supports growth of the landscape and nursery industry (Dunwell et al., 2001).

Angelonia angustifolia is a summer annual plant that can be propagated vegetatively or by seed. Angelonia is in the Scrophulariaceae family, which includes annual and perennial herbs known for having opposite leaf arrangement and bell or tube shaped flowers. *Angelonia* species range in height from 1.0 to 2.5 feet (0.3 to 0.76 m) (Bailey and Bailey, 1976; Huxley, 1992). The inflorescences consist of a terminal raceme, with a two lipped corolla, giving it the nickname the "summer snapdragon" (Griffiths, 1994). Predominate pollinators are bees (Buchman, 1987), and angelonia tends to serve as an attractant of pollinators for other plant species in the garden.

Angelonia is comprised of around thirty species, but few of these are cultivated. Two species that are cultivated are *A. angustifolia* and *A. integerrima*. Of these two species, *A. angustifolia* is more widely cultivated due to ease of propagation and hybridizing. *A. angustifolia* is a perennial species that is native to Latin America and the West Indies. This species grows 1.0 to 2.5 feet (0.3 to 0.76 m) tall, with glabrous stems, lanceolate leaves, and

racemes containing deep red-violet flowers. It flowers during the summer season and is often used to naturalize areas in the landscape (Bailey and Bailey, 1976; Griffiths, 1994; Huxley, 1992). This plant is versatile within the landscape because it can be used in mass plantings, hanging baskets, and mixed containers.

Susceptibility to the cucumber mosaic virus in the early 1990's (Bailey, 1906), reduced *Angelonia* production by growers. However, in the late 1990's several cultivars of *Angelonia* were released in a series called AngelMist™ which is considered to be one of the first series to be clean of all disease problems. Several cultivars are now available commercially, all of which are vegetatively propagated except the Serena™ series. The Serena™ series is a more compact growing variety of angelonia, with several inflorescences tightly formed together. Flower colors are very diverse among different cultivars, ranging from white, pink, lavender, dark blue, or purple, to bi-colored.

Solenostemnon scutellarioides, commonly known as coleus, is a popular bedding plant throughout the United States due to its vibrantly colored, often variegated foliage. Coleus is a member of the mint family, Lamiaceae, characterized by square stems, simple leaves, and opposite leaf arrangement (Toogood, 1971). Coleus is mainly native to tropical areas such as the Caribbean and Central America (Bailey and Bailey, 1976), but is very easily produced and grown throughout North America (Seymour, 1970). Plants may reach 3.0 feet (0.91 m) when grown in filtered or indirect light. Plants receiving full sun on average are smaller, more compact with little vibrant colored foliage and leaves tending to wilt on hot days. Propagation is accomplished either sexually or asexually. Light is required for seed germinatation, while humid conditions and air temperatures between 69.8^{o}F (21^{o}C) and 80.6^{o}F (27^{o}C) are required in rooting

stem cuttings (Bubel, 1989; Lebowitz, 1985). Coleus is distinguished by richly colored leaves that often have serrated or shallow toothed leaf margins often colored with deep shades of red, yellow, green, and/or purple (Toogood, 1971). It is widely used as a foliage plant with either solid or variegated leaves (Garland et al., 2010).

Sun coleus has become a popular annual plant for use in full sun bedding areas as well as for container gardening (Cavins et al., 2002). As of 2002, there were over 200 cultivars of sun coleus commercially available. While most shade loving cultivars of coleus are propagated by seed, sun coleus is mainly propagated vegetatively through stem cuttings. Sun coleus is known for its vigorous growth habit and ability to tolerate full sun conditions without wilting. The objective of this work is to evaluate growth and ornamental growth performance of six angelonia and six coleus cultivars under full sun conditions in east central Alabama.

Materials and Methods

This study consisted of two experiments, the first being conducted in 2011 and the second in 2012. On May 17, 2011 and April 5, 2012, six cultivars of coleus (*Solenostemon scutellarioides)* liners in thirty-six 3.0 in (7.6 cm) cell flats were planted for evaluation of landscape performance under Alabama's climatic conditions. Coleus (*S. scutellarioides*) cultivars chosen for evaluation were: 'Redhead,' 'Florida Sun Jade,' Florida Sun Splash,' 'Merlot,' 'Bellingrath,' and 'Rustic Orange.' Six cultivars of angelonia (*Angelonia angustifolia*) were also chosen for evaluation. They were planted from 4 in (10.16 cm) containers for evaluation. Cultivars were: 'AngelMist™ Dark Pink,' 'AngelMist™ Deep Plum,' 'AngelMist™ White,' 'Serena™ Lavender,' 'Serena™ Purple,' and 'Serena™ White.'

Solenostemnon and *Angelonia* species were planted in 15 ft (4.5 m) by 15 ft (4.5 m) raised beds, with each cultivar planted in a separate row consisting of eight plants each spaced 18 in (45.72 cm) apart both within and between rows. The soil in each raised bed was an alluvial river soil dredged from the banks of the Alabama river in 2009. Soil samples were taken and tested at the Auburn University Soil Testing Laboratory. In both 2011 and 2012, the soil was amended according to the soil analyses results. In 2011 and 2012, the plots required triple superphosphate (0-34-0) at 9 oz/100 ft^2, garden grade fertilizer (8-8-8) at 16 oz/100ft^2, and ammonium nitrate (34-0-0) at 9 oz/100 ft^2, while per soil treatments, dolomitic limestone was only required in 2011 at rates of 0, 10.33, or 35 lbs/acre. The amendments were incorporated into the soil by tiller and watered in prior to planting. Landscape fabric with a thickness of 1.6 mm (2011) and 10.6 mm (2012) was used for weed control. Irrigation rates were initially set at 15 minutes four days a week providing 0.39 in. (0.99 cm) per week in 2011. Due to plant dieback irrigation rates were increased to 45 minutes four days a week, providing 1.17 in. (2.97 cm) per week.

Growth index (GI) measurements were taken at the initial planting date and every 14 days throughout the summer until termination. GI consisted of plant height and two widths perpendicular to each other, then divided by 3 to achieve a standardized measurement for plant size. Plants were evaluated by a single evaluator that based ratings on a 0 to 5 scale with 0 showing no display of characteristic and 5 being an exceptional display of characteristic. The evaluation of coleus contained criteria such as, overall foliage appearance, insect damage, disease damage, and sun tolerance. The evaluation of angelonia contained criteria such as, flower appearance, insect resistance, disease resistance, and sun tolerance. Flower appearance was evaluated based on the number of flowers per cultivar, noting flower discoloration, and

overall appearance of the flower display. Insect and disease resistance evaluations involved looking for physical damage or signs of insect and disease problems. Sun tolerance was assessed by looking for sun scorch on foliage, in turn determining cultivars suitable for full sun conditions. Ratings were taken at initial planting and every 14 days at the time GI measurements were taken. Maintenance beyond irrigation was limited intentionally to determine how well cultivars adapted to their environment. Pinching was implemented on coleus varieties once a month beginning four weeks after planting until August to inhibit reproductive growth. Some staking was required for angelonia during the first month due to stem breakage in 2011. In 2012 cultivars were planted earlier, and as smaller plants therefore acclimating to conditions much easier and preventing excessive stem breakage.

At termination, final GI and subjective visual ratings were taken and plants were then harvested. Leaf area (cm^2) was determined by taking 15 of the newest, fully expanded leaves from each plant in each cultivar and scanning with a LICOR LI-3000 leaf area machine. Once leaf area data was collected leaf samples were added back to each plant sample to determine total shoot fresh weights (FW). Total shoot dry weights (DW) were determined after samples were oven dried for 72 hours at 76.7C (170°F).

Analysis of variance was performed on all data using PROC MIXED in SAS version 9.2 (SAS Institute, Cary, NC). The experimental design was a split-plot with the cultivars in the main plot and time in the sub-plot. The homogeneity of variance assumption for ANOVA was tested for all responses using the null model likelihood ratio test. Appropriate correction for heterogeneity of variance over time was applied using the REPEATED statement and the covariance structure that minimized the Akaike information criterion. Linear regression

equations relating growth over time for each cultivar were generated within the statistical design framework. Contrast statements were used to determine differences among the y-intercepts and linear slopes for the six cultivars. All significances were at α=0.05.

Results and Discussion

Growth Indices (GI). The six cultivars of angelonia were included three from the AngelMist™ series and three from the Serena™ series. The AngelMist™ series is a larger cultivar, therefore having a higher GI from the cultivars in the Serena™ series. Linear regression analysis of angelonia cultivars showed over time that all cultivars increased in GI in 2011 (Fig. 1) and all but 'Serena™ White' (SW) increased in GI in 2012 (Fig. 2). In 2011, cultivars were very similar within each series. Cultivars ranked in 2011 from largest to smallest at study termination were as follows: 'AngelMist™ White' (AMW) (76.5 cm), 'AngelMist™ Dark Pink' (AMDPk) (73.3 cm), 'AngelMist™ Deep Plum' (AMDPl) (71.4 cm), 'Serena™ Lavender' (SL) (69.1 cm),'Serena™ White' (SW) (57.5 cm), and 'Serena™ Purple' (SP) (50.6 cm). In 2012 all cultivars were similar to previous year, except SW, which had a GI decrease over time, due to plant dieback. The size ranking of angelonia cultivars in 2012 were as follows: AMDPk (75.1 cm), AMDPl (61.0 cm), AMW (59.2 cm), SL (55.3 cm), SP (52.1 cm), and SW (22.4 cm).

The coleus cultivars trialed were selected for their comparable mature sizes, but due to full sun conditions, in this study, variability in cultivar size occurred. Linear regression analysis showed GI increase over time in all coleus cultivars with 'Redhead' (RH) being the largest and 'Bellingrath' (B) smallest (Fig. 3). Cultivar rank in 2011 from largest to smallest at study termination was: RH (81.7 cm), 'Florida Sun Jade' (FLSJ) (68.6 cm), 'Merlot' (M) (65 cm), 'Florida Sun Splash' (FLSS) (64.5 cm), 'Rustic Orange' (RO) (60.7 cm), and B (32.3 cm).

Ranking of coleus cultivars in 2012 were as follows: RH (64.6 cm,) FLSJ (60.4 cm,) M (50.9 cm), RO (46.6 cm), FLSS (40 cm), and B(11 cm) (Fig. 4). Bellingrath was the smallest and poorest performing cultivar in both growing seasons, most likely from the full sun conditions presented in this study.

Fresh and Dry Weights. In 2011, AMW had both the greatest FW (1789.4 g) and DW (552.61 g), while SP was the least in both FW (506.6 g) and DW (152.0 g) (Table 5.1). In 2012, AMDPk had the greatest FW (1451.49 g) and DW (367.28 g), while SW had the least FW (331.5 g) and DW (53.9 g). AMW, though not the largest cultivar in 2012, still performed well with the second largest FW (1075.0 g) and DW (283.2 g), both higher than the remaining four cultivars.

Among coleus cultivars in the 2011 test, RH had the greatest FW (1004.6 g), while B had the least (113.3 g) (Table 5.2). When examing DW in 2011, RH (505.2 g) had the largest, but similar to FLSJ (464.7 g) and FLSS (401.8 g), which had the second and third largest but was similar to M and RO DW, respectively. Bellingrath, consistent with FW results, had the least DW (104.0 g). In 2012, FW were similar with the 2011 results, with RH (1122.2 g) having the greatest and B (75.4 g) the least. The DW results were less clear, with RH (291.8 g) still having the greatest numeric DW, but similar to M (254.7 g). Bellingrath (42.2 g) again had the least DW, though there was no significant difference between it and the three remaining cultivars: RO (123.0 g), FLSS (92.2 g), and FLSJ (68.2 g). There was a significant decrease in 2012 DW compared to 2011 DW because the growing season was shorter in 2012.

Coleus Leaf Area. In 2011, RH (689.7 cm^2) had the largest mean leaf area, but was similar to FLSJ (556.3 cm^2) (Table 5.3). Bellingrath (313.0 cm^2) had the smallest mean leaf area, yet was not significantly smaller than M (460.2 cm^2) or RO (378.4 cm^2). In 2012, RH

(532.6 cm^2) had the largest leaf area but not different from FLSJ (514.5 cm^2). Bellingrath (101.2 cm^2) had the smallest leaf area. These results were similar in both years showing leaves on RH and FLSJ are larger than the other four cultivars, while B had the smallest leaf size.

Visual Ratings. Visual ratings of angelonia consisted of: flower quality, insect resistance, disease resistance, and sun tolerance. All ratings were 0.0 to 5.0, with 5.0 meaning cultivar presented excellent displayed of a given characteristic and 0.0 meaning there was no display of given characteristic. When evaluating angelonia flower quality in 2011, SP (4.9), AMW (4.9), SW (4.8), SL (4.7), and AMDPl (4.7) were all similar (Table 5.4). In 2012, SP (5.0), was significantly different from SW (4.7), yet they were both shared similarities to SL, AMDPk, AMDPl, and AMW. Insect resistance in 2011 showed similarities between all AM series cultivars and was greater than SP. In 2012, SP (4.0), SL (3.8), SW 3.8), AMDPl (3.9), and AMDPk (3.6) showed no differences. Disease resistance in 2011 proved to have a difference between SP (4.0) and AMW (3.6), AMDPk (3.5), AMDPl (3.7) and SW (3.7) sharing similarities with SL (3.8). Disease resistance in 2012 showed similarities between SL, SP, SW, and AMDPl, as well as similarities between SP, SW, AMDPl, and AMDPk. There was also no difference between AMDPl, AMDPk, and AMW. Angelonia cultivars showed no differences in 2011 or 2012 when evaluating for sun tolerance. The only insects present during study were aphids and only disease present was powdery mildew.

Visual ratings of coleus consisted of: foliage appearance, insect resistance, disease resistance, and sun tolerance. All ratings were 0.0 to 5.0, with 5.0 meaning cultivar presented excellent displayed of a given characteristic and 0.0 meaning there was no display of given characteristic. Foliage quality in 2011, M, RH, FLSJ, RO, and FLSS having similarities , while

B had a lower foliar rating (Table 5.5). Insect resistance was strong in all coleus cultivars exhibiting no insect damage for any cultivars in 2011 or 2012. Disease resistance also had no significant difference in 2011 or 2012 . The highest rated cultivars for sun tolerance in 2011 were RH and FLSJ. B had a lower rating for sun tolerance compared to the other five cultivars. In 2012, RO (3.9), M (3.9), FLSJ (3.7), FLSS (3.7), and RH (3.6) were similar, while B (2.5) was significantly different from all other cultivars.

In this study the angelonia cultivars as a whole performed well. The AngelMist™ series had a larger GI than the Serena™ series cultivars. All of the angelonia cultivars trialed are excellent plants for promotion within our state, for flexible garden use, high performance in full sun, excellent flower display, and larger mature size. Most coleus cultivars trialed, with the exception of B, did very well under full sun conditions. B was the poorest performing coleus cultivar in this study for visual rating, size, and sun tolerance. RH was the best performing cultivar in the study, based on mature size, foliage size, insect/disease resistance, and sun tolerance rating taken from this study. Trials in full sun containing new cultivars of sun coleus and angleonia should be continued. Research should be continued to determine amount of shade tolerance on angelonia cultivars and difference in performance of coleus cultivars under different light levels.

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Figure 1. Linear regression analyses of growth indices over time of six *Angelonia angustifolia* (angelonia) cultivars in 2011.

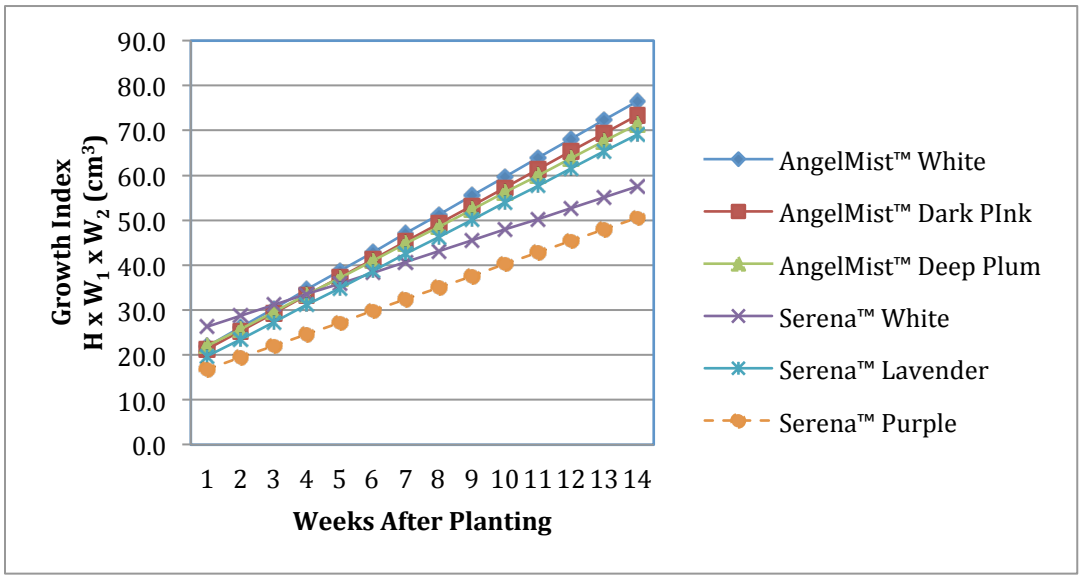

Figure 2. Linear regression analyses of growth indices over time of six *Angelonia angustifolia* (angelonia) cultivars in 2012.

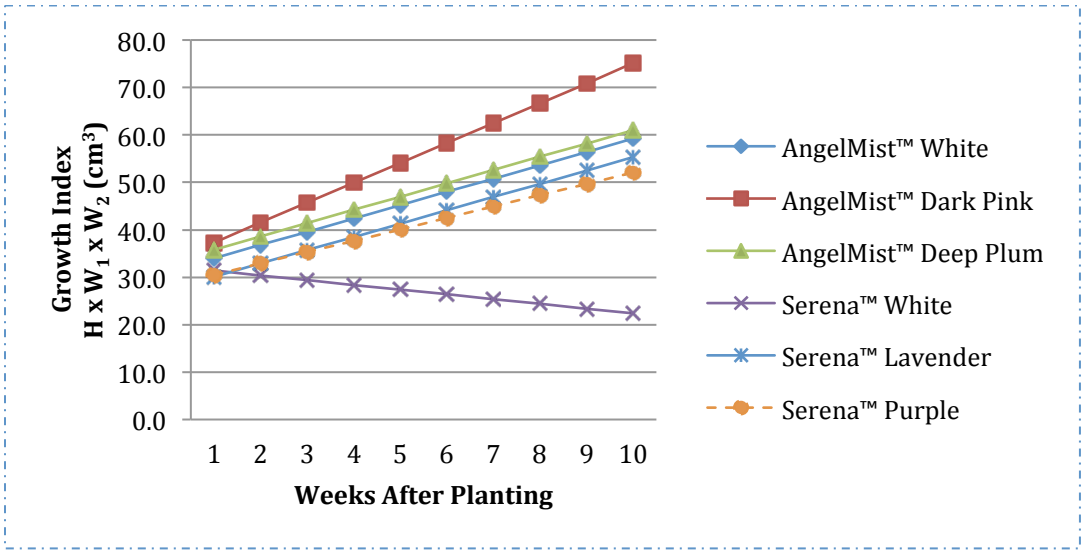

Figure 3. Linear regression analyses of growth indices over time of six *Solenostemnon scutellarioides* (coleus) cultivars in 2011.

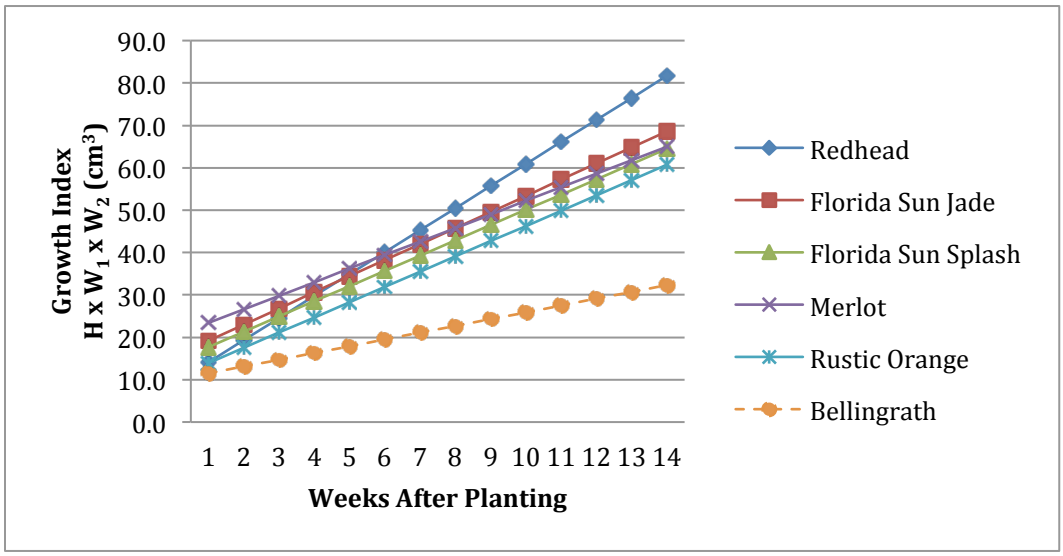

Figure 4. Linear regression analyses of growth indices over time of six *Solenostemnon scutellarioides* (coleus) cultivars in 2012.

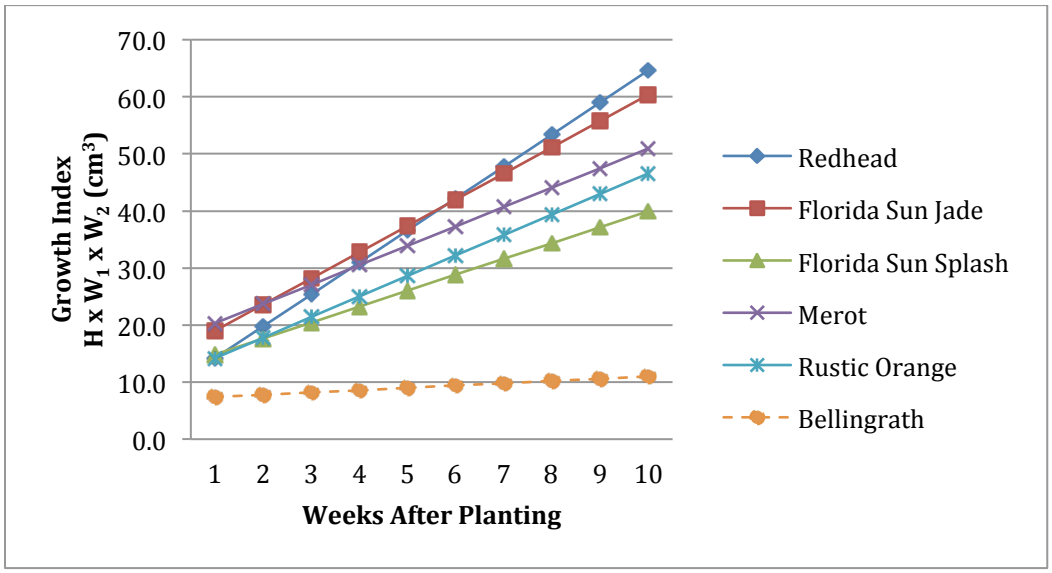

Table 5.1. Mean fresh (FW) and dry (DW) weights of six angelonia cultivars in 2011 and 2012

Angelonia Cultivar[z]	FW(g)		DW(g)	
	2011	2012	2011	2012
AMW	1789.4a[Y]	1075.0b	552.6a	283.2b
AMDPk	1431.5b	1451.5a	466.7b	367.3a
AMDPl	1175.9c	890.7c	382.6c	226.9c
SW	1154.6c	331.5e	343.1c	53.9e
SL	1018.1c	637.8d	222.7d	123.9d
SP	506.6d	661.4d	152.0e	146.2d

[z]AMW = 'AngelMist™ White'; AMDPk = 'AngelMist™ Dark Pink'; AMDPl = 'AngelMist™ Deep Plum'; SW = 'Serena™ White'; SL = 'Serena™ Lavender'; SP = 'Serena™ Purple'

[Y]Means within each column followed by the same letter are not different based on Duncan's Multiple Range test, α = 0.05.

Table 5.2. Average fresh (FW) and dry weights (DW) of six coleus cultivars in 2011 and 2012.

Coleus Cultivar[Z]	FW(g)		DW(g)	
	2011	2012	2011	2012
RH	1004.6a[Y]	1122.2a	505.2a	291.8a
FLSJ	588.4b	603.9bc	464.7a	68.2b
FLSS	452.2bc	674.5b	401.8a	92.9b
M	420.6bc	510.7c	327.0ab	254.7a
RO	299.1cd	374.9d	307.0ab	123.0b
B	113.3d	75.4e	104.0b	42.2b

[Z]RH = 'Redhead', FLSJ = 'Florida Sun Jade', FLSS = 'Florida Sun Splash', M = 'Merlot', RO = 'Rustic Orange', and B = 'Bellingrath.'

[Y]Means within each column followed by the same letter are not different based on Duncan's Multiple Range test, $\alpha = 0.05$

Table 5.3. Mean Leaf Area of twenty leaf samples from six coleus cultivars in 2011 and 2012.

Coleus Cultivar[z]	Leaf Area (cm^2)	
	2011	2012
RH	689.7a[y]	532.6a
FLSJ	556.3ab	514.5ab
FLSS	474.2bc	436.7bc
M	460.2bcd	375.2cd
RO	378.4cd	309.6d
B	313.0d	101.2e

[z]RH = 'Redhead', FLSJ = 'Florida Sun Jade', FLSS = 'Florida Sun Splash', M = 'Merlot', RO = 'Rustic Orange', and B = 'Bellingrath.'

[Y]Means within each column followed by the same letter are not different based on Duncan's Multiple Range test, α = 0.05.

Table 5.4. Visual ratings, of one to five, on foliage appearance, insect resistance, disease resistance, and sun tolerance of six cultivars of angelonia in 2011 and 2012 [X]

Angelonia Cultivar[z]	Flower Quality		Insect Resistance		Disease Resistance		Sun Tolerance	
	2011	2012	2011	2012	2011	2012	2011	2012
AMW	4.9ab[y]	4.8ab	3.8a	3.5b	3.6b	3.4c	5.0a	4.9a
AM Dk Pk	4.7b	4.9ab	3.8a	3.6ab	3.5b	3.5bc	5.0a	5.0a
AM Dp Pm	4.7ab	4.8ab	3.8a	3.9ab	3.7b	3.7abc	5.0a	5.0a
SW	4.8ab	4.7b	3.7ab	3.8ab	3.7b	3.8ab	5.0a	5.0a
SL	4.7ab	4.9ab	3.7ab	3.8ab	3.8ab	4.0a	5.0a	5.0a
SP	4.9a	5.0a	3.5b	4.0a	4.0a	3.7abc	5.0a	5.0a

[z]AMW = AngelMist™™™™ White; AM Dk Pk = AngelMist™™™™ Dark Pink; AM Dp Pm = AngelMist™™™™ Deep Plum; SW = Serena™™™ White; SL = Serena™™™ Lavender; SP = Serena™™™ Purple

[Y]Means within column followed by the same letter are not significantly different based on Duncans Multiple Range test at $\alpha = 0.05$

[X] Rating developed was 1-5 Likert scale

Table 5.5. Visual ratings of foliage appearance, insect resistance, disease resistance, and sun tolerance of six cultivars of coleus in 2011 and 2012. [X]

Coleus Cultivar[z]	Foliage Appearance		Insect Resistance		Disease Resistance		Sun Tolerance	
	2011	2012	2011	2012	2011	2012	2011	2012
RH	4.0a[y]	3.5a	5.0a	5.0a	4.8a	5.0a	4.4a	3.6a
FLSJ	4.0a	3.5a	5.0a	5.0a	4.9a	5.0a	4.1ab	3.7a
FLSS	3.9a	3.6a	5.0a	5.0a	4.8a	5.0a	3.8b	3.7a
M	4.1a	3.6a	5.0a	5.0a	4.7a	5.0a	3.9b	3.9a
RO	4.0a	3.5a	5.0a	5.0a	4.8a	5.0a	4.0b	3.9a
B	3.2b	3.0b	5.0a	5.0a	4.8a	5.0a	3.0c	2.5b

[z]RH = Redhead, FLSJ = Florida Sun Jade, FLSS = Florida Sun Splash, M = Merlot, RO = Rustic Orange, B = Bellingrath

[Y]Means within column followed by the same letter are not significantly different based on Duncans Multiple Range test at $\alpha = 0.05$

[X]Rating developed was 1-5 Likert rating.

CHAPTER VI

FINAL DISCUSSION

Determining and meeting consumer demand is one of the most important factors in developing a successful business, and the Green Industry is no exception. One of the most common ways to accomplish this is the development and implementation of plant evaluation and promotion programs. The purpose of our work was to gain knowledge from industry and consumers in Alabama regarding promotion program interest, plant preference, and desired characteristics, as well as, evaluate full sun tolerant cultivars of coleus and angelonia in the Alabama.

Fulfilling the first objective, we evaluated information collected from the Green Industry (Chapter 3) and consumers (Chapter 4) across the state of Alabama. These studies are significant because they gain knowledge from the largest and most prominent landscape and production companies, as well as consumers, in the state of Alabama. Surveys were developed, consisting of questions regarding preferred plant characteristics, plant preferences of *Solenostemnon scutellarioides* (coleus) and *Angelonia angustifolia* (angelonia) cultivars, and plant promotion and marketing information. Survey respondents in the Green Industry believed that consumers are predominately looking for foliage color (4.39 out of 5) and flower color (2.14 out of 3). Color was believed to be the most important factors consumers look for. Consumers (88.6%) said they look at foliage and flower color the most often when purchasing annuals. Having this

consistency betweenIndustry and consumers confirms that the industry's assumptions on consumers' desired characteristics are accurate. This shows the industry has knowledge of such characteristics and could prove to be an incentive for producing the cultivars that offer more color and longer flowering periods. This adds to previous findings confirming consumers predominately look at color when purchasing plant materials (Behe et al., 1999; Kelley et al., 2001; Phillips et al., 2007; Wolnick, 1983). When ranking the angelonia cultivars trialed, the industry preferred Serena™ Purple (3.79) and consumers preferred Serena™ Lavender (3.67). Although the Serena™ series was smaller than the AngelMist™ series, the Serena™ series had a greater flower display and was more preferred. When the industry and consumers ranked coleus cultivars, the most preferred were 'Redhead' (5.17 out of 6) by the industry and 'Bellingrath' (3.56 out of 6) by the consumers. The industry may have chosen 'Redhead' because of their knowledge of that cultivar, growth habits, and excellent foliage color. This supports the research conducted by Wolnick (1983), in which he found that growers prefer flower and foliage that is red the most, therefore they produce more red plant materials. Consumers chose 'Bellingrath', a yellow and pink variegated cultivar, which had the smallest growth indices, leaf area, and poorest visual ratings in the study. Cultivar pictures which consumers viewed in survey were prime growing season pictures, not end of season pictures. 'Bellingrath' coleus is named after Bellingrath Gardens in Mobile, Alabama, which might have influenced the consumers' selections. .

The Alabama Nursery and Landscape Association and consumers alike showed much interest in the development of a plant promotion and evaluation program, with the industry wanting information from this program predominately from a website and field days. This

program could prove to be very beneficial to the Green Industry and also to consumers looking for new cultivars and varieties proven to grow well in the state of Alabama. Interest from both groups could encourage a successful plant promotion program and possibly help support continued growth of Alabama's Green Industry.

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APPENDICES

APPENDIX A

Figure 1. "Determining Best Characteristics for Bedding Plants" Survey

1. Are you a landscaper or a grower?
   - □ Landscaper
   - □ Grower

2. What attributes of **foliage bedding plants** are consumers looking for? (Rate from 1 to 5, 1=Most Important, 5=Least Important)
   _____ Foliage Color _____ Foliage Texture
   _____ Maintainability _____ Size/Height
   _____ Other (please specify)_____

3. What attributes of **flowering bedding plants** are consumers looking for? (Rate the top 3, 1=Most Important, 2=2nd most important, 3=3rd most important)
   _____ Flower Size _____ Duration of flower time
   _____ Flower Color _____ Flower/Bloom Characteristics
   _____ Flower Fragrance _____ Maintainability
   _____ Size/Height
   _____ Other, (please specify) _____

4. Do you grow or use any Coleus (*Solenostemon scutellarioides*) varieties?
   - □ Yes
   - □ No

5. What attributes do you think a consumer looks for when purchasing Coleus? (Check all that apply)
   - □ Color
   - □ Variegation
   - □ Leaf Size
   - □ Plant Height
   - □ Maintainability
   - □ Hardiness
   - □ Sun/Shade Characteristics
   - □ Other (please specify)_____

6. What color of Coleus do you grow or sell the most of?
   - □ Green
   - □ Purple/Green Variegated
   - □ Red
   - □ Green/Red Variegated
   - □ Purple
   - □ Other (please specify)_____

7. Have you heard of "Sun Coleus?"
   □ Yes
   □ No

8. Have you grown or used "Sun Coleus?"
   □ Yes
   □ No

9. Would you be interested in learning more about "Sun Coleus" or other varieties?
   □ Yes
   □ No

10. Have you ever grown or used Angelonia?
   □ Yes
   □ No

11. Do you currently grow or use Angelonia (*Angelonia angustifolia)*?
   (Please explain why you chose to grow Angelonia)
   □ Yes, why_____
   □ No, why_____

12. If you grow or use Angelonia, what percentage of each flower color do you grow/sell?

Grow/Use Now? Check the box below if you grow/use this color in Angelonia.		**What percent of all each color** of Angelonia do you grow/use?
€	Purple	%
€	Pink	%
€	White	%
€	Indigo Blue	%
€	Other(s), please specify:	%
		%
		100%

13. Would you be interested in learning about new cultivars of Angelonia?
   □ Yes

□ No

14. Are there any other summer annuals you are interested in learning more about?
    □ Yes, (please specify) _____
    □ No

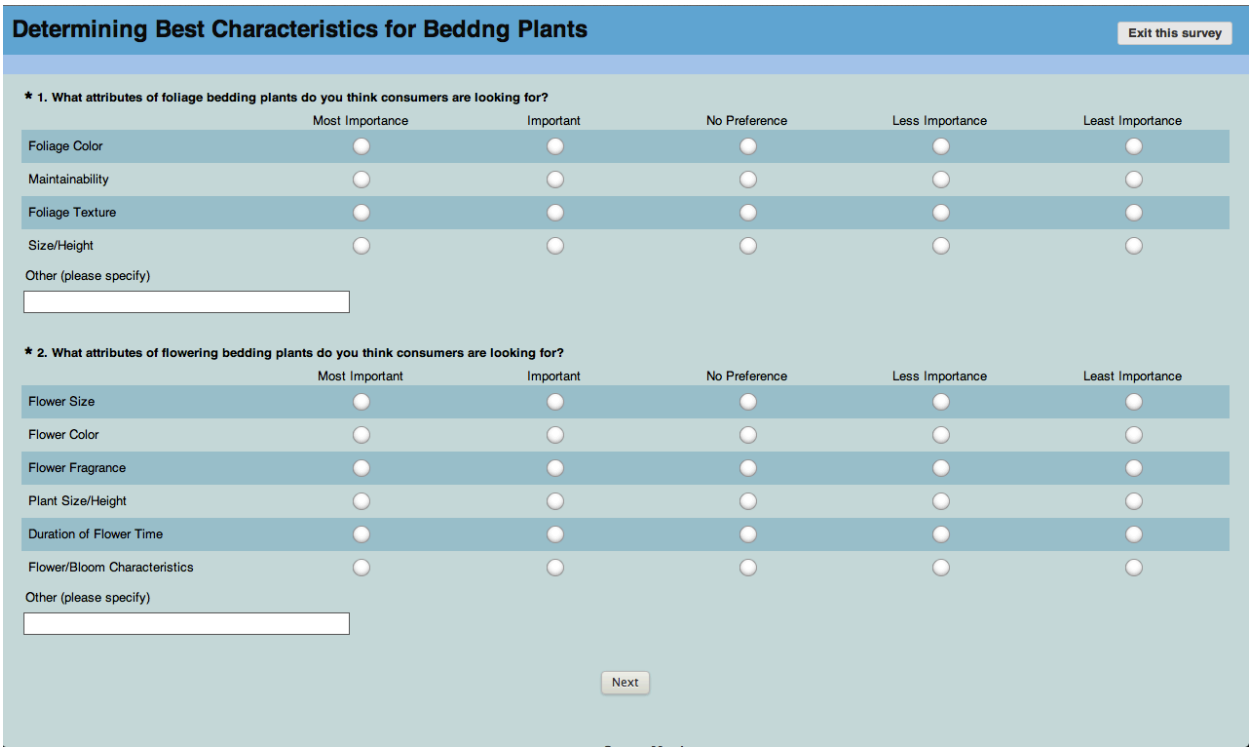
15. Please provide your company's approximate income for 2010 before taxes.
    □ ≤ $99,999
    □ $100,000-$249,999
    □ $250,000-$499,999
    □ $500,000-$999,999
    □ $1,000,000- $4,999,999
    □$5,000,000-$9,999,999
    □ ≥ $10,000,000

16. What is your company's yearly income for seasonal color?
    □ ≤$99,999
    □ $100,000-$249,999
    □ $250,000-$499,999
    □ $500,000-$999,999
    □ ≥$1,000,000

17. What is the average socio-economic status of your clientele?
    □ Low Income (≥$35,000)
    □ Low to Moderate Income ($35,001-$54,999)
    □ Moderate Income ($55,000-$64,999)
    □ Moderate to High Income ($65,000-$74,999)
    □ High Income (≤$75,000)

18. Would you be interested in receiving information collected from this research?
    □ Yes (If so, please insert address below)
        ○ _____
        ○ _____
    □ No

Figure 2. ”Determining Best Characteristics for Bedding Plants” Survey Monkey Screenshot.



Determining Best Characteristics for Beddng Plants

Exit this survey

* 1. What attributes of foliage bedding plants do you think consumers are looking for?

	Most Importance	Important	No Preference	Less Importance	Least Importance
Foliage Color	○	○	○	○	○
Maintainability	○	○	○	○	○
Foliage Texture	○	○	○	○	○
Size/Height	○	○	○	○	○

Other (please specify)

* 2. What attributes of flowering bedding plants do you think consumers are looking for?

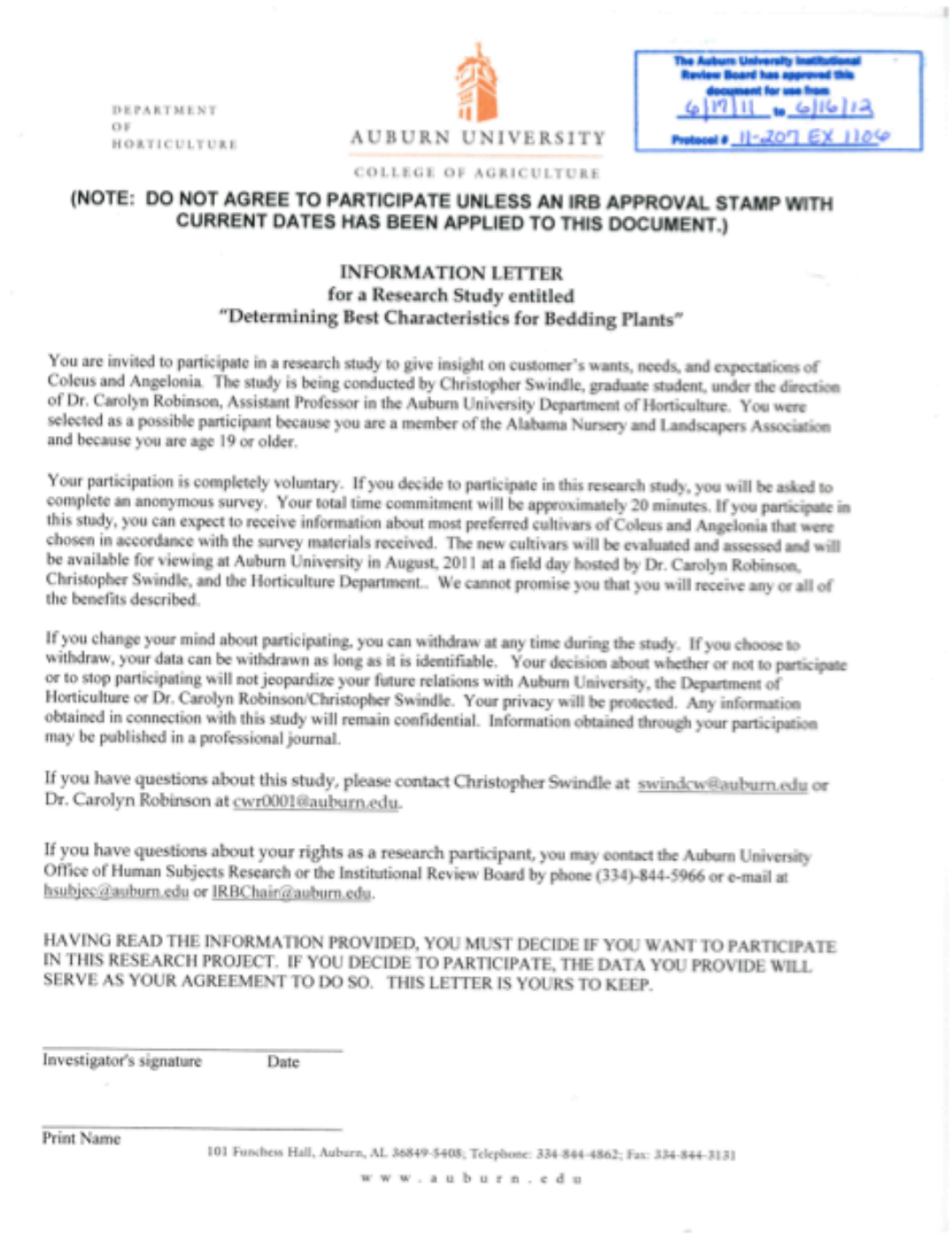
	Most Important	Important	No Preference	Less Importance	Least Importance
Flower Size	○	○	○	○	○
Flower Color	○	○	○	○	○
Flower Fragrance	○	○	○	○	○
Plant Size/Height	○	○	○	○	○
Duration of Flower Time	○	○	○	○	○
Flower/Bloom Characteristics	○	○	○	○	○

Other (please specify)

Next

APPENDIX B

Figure 1. Information letter for "Determining Best Characteristics for Bedding Plants."



DEPARTMENT OF HORTICULTURE

AUBURN UNIVERSITY
COLLEGE OF AGRICULTURE

The Auburn University Institutional Review Board has approved this document for use from 6/17/11 to 6/16/12 Protocol # 11-207 EX 1106

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

INFORMATION LETTER
for a Research Study entitled
"Determining Best Characteristics for Bedding Plants"

You are invited to participate in a research study to give insight on customer's wants, needs, and expectations of Coleus and Angelonia. The study is being conducted by Christopher Swindle, graduate student, under the direction of Dr. Carolyn Robinson, Assistant Professor in the Auburn University Department of Horticulture. You were selected as a possible participant because you are a member of the Alabama Nursery and Landscapers Association and because you are age 19 or older.

Your participation is completely voluntary. If you decide to participate in this research study, you will be asked to complete an anonymous survey. Your total time commitment will be approximately 20 minutes. If you participate in this study, you can expect to receive information about most preferred cultivars of Coleus and Angelonia that were chosen in accordance with the survey materials received. The new cultivars will be evaluated and assessed and will be available for viewing at Auburn University in August, 2011 at a field day hosted by Dr. Carolyn Robinson, Christopher Swindle, and the Horticulture Department.. We cannot promise you that you will receive any or all of the benefits described.

If you change your mind about participating, you can withdraw at any time during the study. If you choose to withdraw, your data can be withdrawn as long as it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the Department of Horticulture or Dr. Carolyn Robinson/Christopher Swindle. Your privacy will be protected. Any information obtained in connection with this study will remain confidential. Information obtained through your participation may be published in a professional journal.

If you have questions about this study, please contact Christopher Swindle at swindcw@auburn.edu or Dr. Carolyn Robinson at cwr0001@auburn.edu.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO. THIS LETTER IS YOURS TO KEEP.

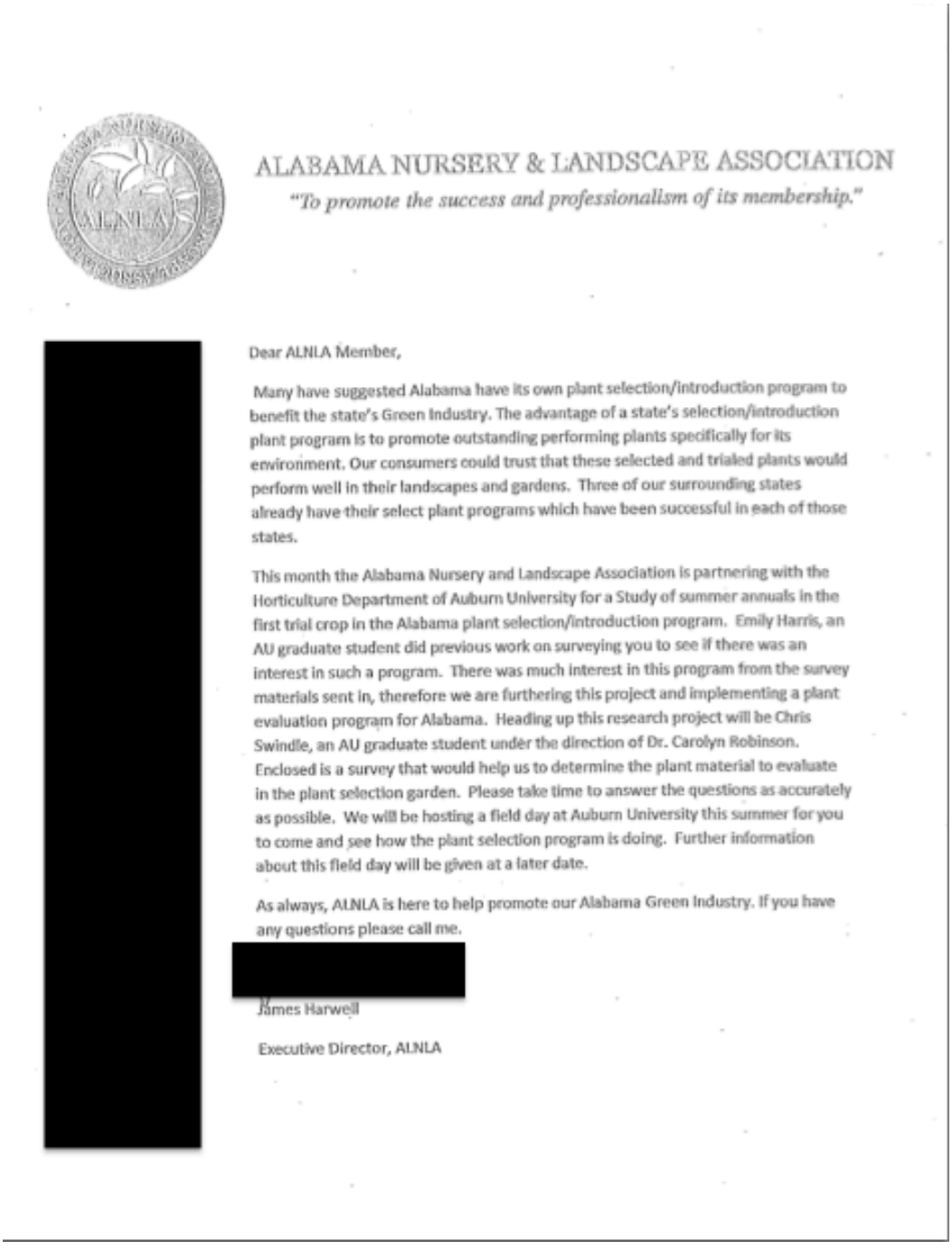
Investigator's signature Date

Print Name

101 Funchess Hall, Auburn, AL 36849-5408; Telephone: 334-844-4862; Fax: 334-844-3131
www.auburn.edu

APPENDIX C

Figure 1. ALNLA Executive Director Information Letter.



ALABAMA NURSERY & LANDSCAPE ASSOCIATION

"To promote the success and professionalism of its membership."

[redacted]

Dear ALNLA Member,

Many have suggested Alabama have its own plant selection/introduction program to benefit the state's Green Industry. The advantage of a state's selection/introduction plant program is to promote outstanding performing plants specifically for its environment. Our consumers could trust that these selected and trialed plants would perform well in their landscapes and gardens. Three of our surrounding states already have their select plant programs which have been successful in each of those states.

This month the Alabama Nursery and Landscape Association is partnering with the Horticulture Department of Auburn University for a Study of summer annuals in the first trial crop in the Alabama plant selection/introduction program. Emily Harris, an AU graduate student did previous work on surveying you to see if there was an interest in such a program. There was much interest in this program from the survey materials sent in, therefore we are furthering this project and implementing a plant evaluation program for Alabama. Heading up this research project will be Chris Swindle, an AU graduate student under the direction of Dr. Carolyn Robinson. Enclosed is a survey that would help us to determine the plant material to evaluate in the plant selection garden. Please take time to answer the questions as accurately as possible. We will be hosting a field day at Auburn University this summer for you to come and see how the plant selection program is doing. Further information about this field day will be given at a later date.

As always, ALNLA is here to help promote our Alabama Green Industry. If you have any questions please call me.

[redacted]

James Harwell

Executive Director, ALNLA

APPENDIX D

Figure 1. ALNLA Cultivar Preference Survey.

1. How would you classify your operation?
   - € Landscaper
   - € Grower
   - € Both
   - € Other _____

2. Check all cultivars of **Coleus** below that you currently or have grown before.
   - € Redhead
   - € Rustic Orange
   - € Merlot
   - € Bellingrath
   - € Florida Sun Jade
   - € Florida Sun Splash

3. Have you had any of the following problems growing these cultivars of coleus?
   - € Sun Scorch
   - € Foliage Discoloration
   - € Wilting
   - € Defoliation
   - € Insect Problems
   - € Other, _____

4. Rank the six cultivars of coleus displayed by personal preference and personal experience. (1 being best and 6 being worst)
   - — Redhead
   - — Rustic Orange
   - — Merlot
   - — Bellingrath
   - — Florida Sun Jade
   - — Florida Sun Splash

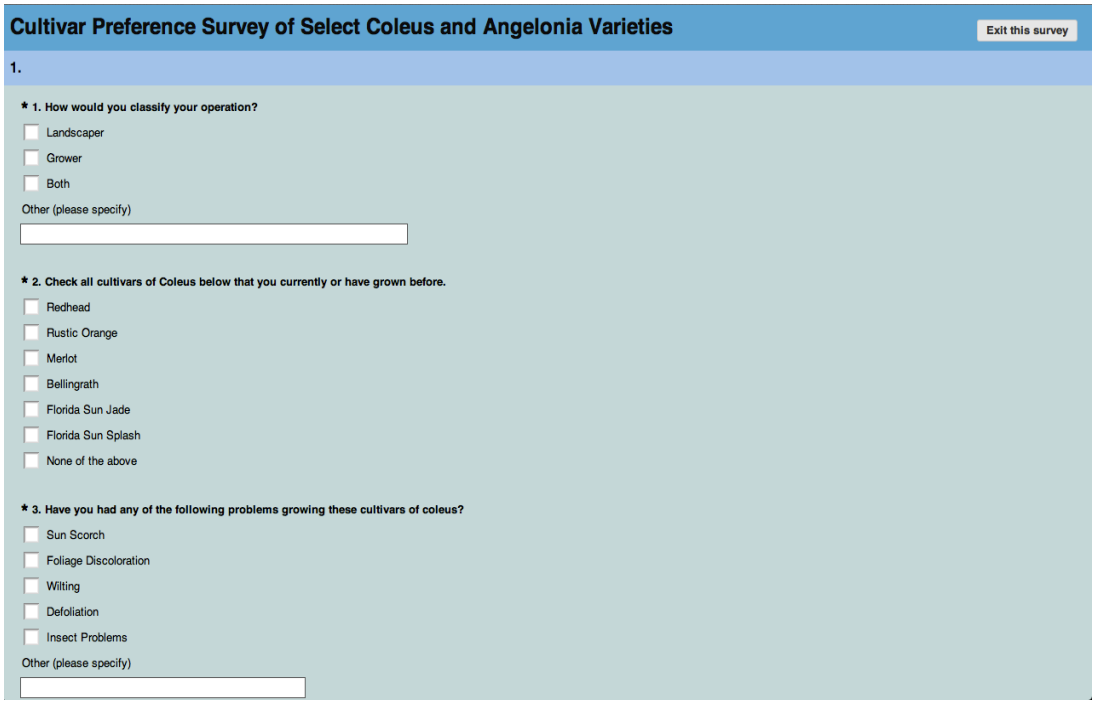
5. Check all cultivars of **Angelonia** below that you currently or have grown before.
   - € AngelMist™™ White
   - € AngelMist™™ Deep Plum
   - € AngelMist™™ Dark Pink
   - € Serena™ White
   - € Serena™ Lavender
   - € Serena™ Purple

6. Have you had any of the following problems growing these cultivars of angelonia?
   - € Stem Breakage
   - € Wilting
   - € Powdery Mildew
   - € Low Flower Count
   - € Plant Growth Regulation
   - € Other, _____

7. Rank the six cultivars of angelonia displayed by personal preference and personal experience. (1 being best and 6 being worst)

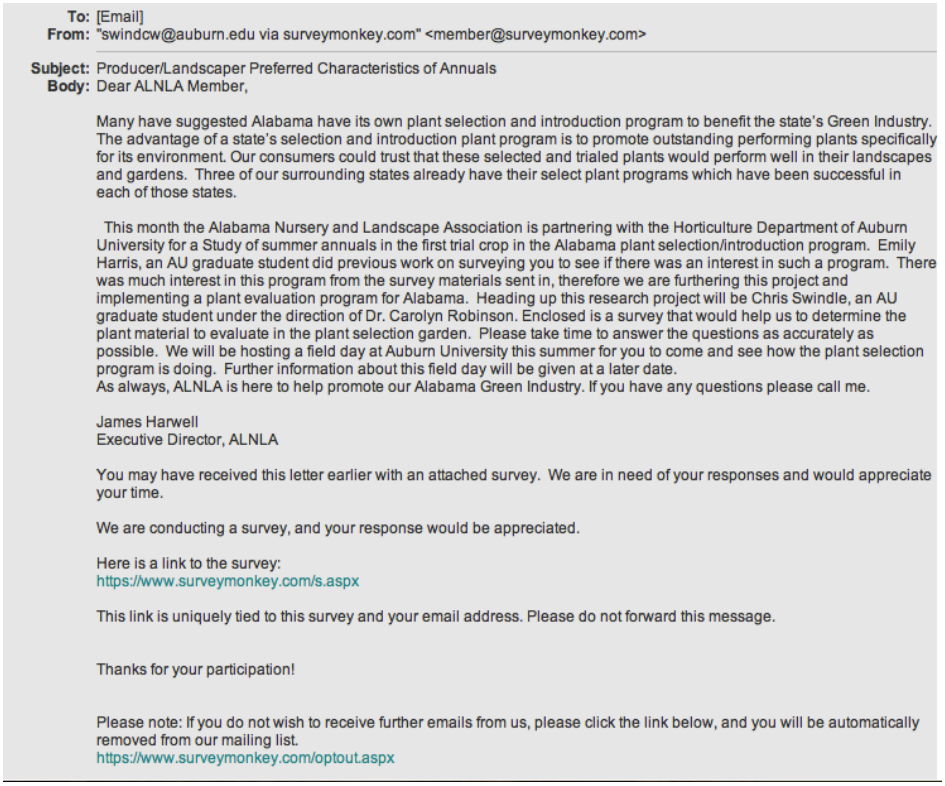
— AngelMist™™ White
— AngelMist™™ Deep Plum
— AngelMist™™ Dark Pink
— Serena™ White
— Serena™ Lavender
— Serena™ Purple

Figure 2.



APPENDIX E

Figure 1.



To: [Email]
From: "swindcw@auburn.edu via surveymonkey.com" <member@surveymonkey.com>

Subject: Producer/Landscaper Preferred Characteristics of Annuals
Body: Dear ALNLA Member,

Many have suggested Alabama have its own plant selection and introduction program to benefit the state's Green Industry. The advantage of a state's selection and introduction plant program is to promote outstanding performing plants specifically for its environment. Our consumers could trust that these selected and trialed plants would perform well in their landscapes and gardens. Three of our surrounding states already have their select plant programs which have been successful in each of those states.

This month the Alabama Nursery and Landscape Association is partnering with the Horticulture Department of Auburn University for a Study of summer annuals in the first trial crop in the Alabama plant selection/introduction program. Emily Harris, an AU graduate student did previous work on surveying you to see if there was an interest in such a program. There was much interest in this program from the survey materials sent in, therefore we are furthering this project and implementing a plant evaluation program for Alabama. Heading up this research project will be Chris Swindle, an AU graduate student under the direction of Dr. Carolyn Robinson. Enclosed is a survey that would help us to determine the plant material to evaluate in the plant selection garden. Please take time to answer the questions as accurately as possible. We will be hosting a field day at Auburn University this summer for you to come and see how the plant selection program is doing. Further information about this field day will be given at a later date.
As always, ALNLA is here to help promote our Alabama Green Industry. If you have any questions please call me.

James Harwell
Executive Director, ALNLA

You may have received this letter earlier with an attached survey. We are in need of your responses and would appreciate your time.

We are conducting a survey, and your response would be appreciated.

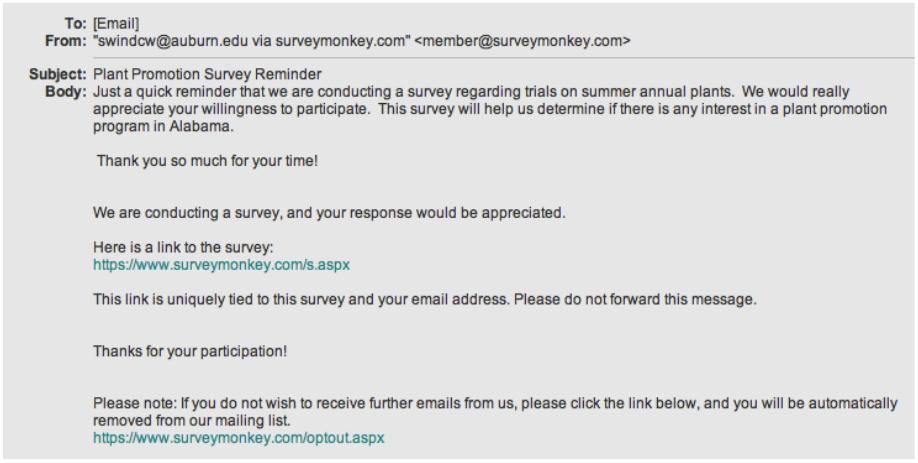
Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thanks for your participation!

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
https://www.surveymonkey.com/optout.aspx

Figure 2.



To: [Email]
From: "swindcw@auburn.edu via surveymonkey.com" <member@surveymonkey.com>

Subject: Plant Promotion Survey Reminder
Body: Just a quick reminder that we are conducting a survey regarding trials on summer annual plants. We would really appreciate your willingness to participate. This survey will help us determine if there is any interest in a plant promotion program in Alabama.

Thank you so much for your time!

We are conducting a survey, and your response would be appreciated.

Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thanks for your participation!

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
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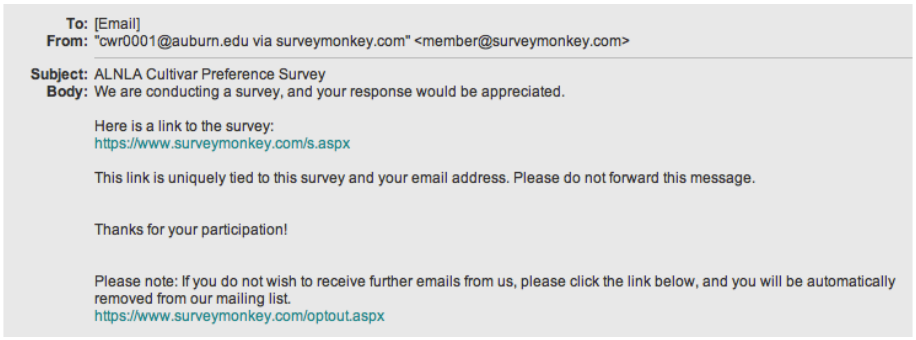
Figure 3.



To: [Email]
From: "cwr0001@auburn.edu via surveymonkey.com" <member@surveymonkey.com>

Subject: ALNLA Cultivar Preference Survey
Body: We are conducting a survey, and your response would be appreciated.

Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

This link is uniquely tied to this survey and your email address. Please do not forward this message.

Thanks for your participation!

Please note: If you do not wish to receive further emails from us, please click the link below, and you will be automatically removed from our mailing list.
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APPENDIX F

Figure 1. “Consumer Preference on Summer Annuals” survey.

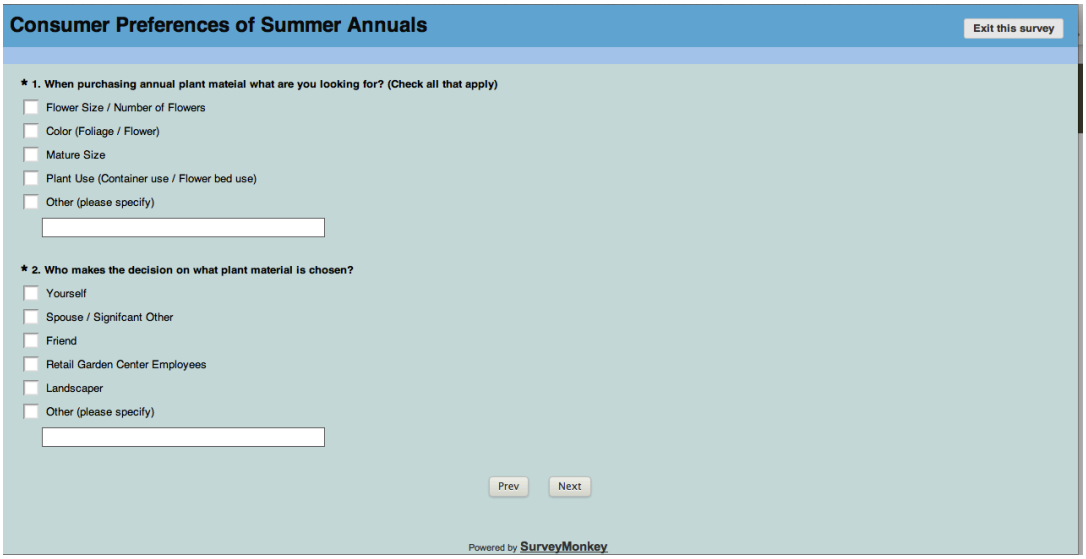
- When purchasing annual plant material what are you looking for?
    - Flower Size/Number of Flowers
    - Color (foliage/flower)
    - Mature Size
    - Plant Use (Container use/Bed Use)
    - Other, Please Specify
- Who makes the decision on what plant material is chosen?
    - Yourself
    - Spouse / Significant Other
    - Friend
    - Retail Garden Center Employee
    - Landscaper
    - Other, Please Specify
- Are you familiar with Coleus? ((INSERT PICTURE HERE))
    - Yes
    - No
- Have you ever purchased Coleus?
    - Yes
    - No
- If YES, What characteristics of Coleus attracted you to it?
    - Foliage Color/ Variegation
    - Mature Size
    - Ease of growing
    - Overall Aesthetic Appeal
    - Other, Please specify
- What colors of Coleus have you purchased?
    - Red
    - Green
    - Red/Yellow
    - Purple
    - Red/Green
    - Other, Please specify
- What colors of Coleus would you like to purchase?
    - Red

        - Green
        - Red/Yellow
        - Purple
        - Red/Green
        - Other, Please specify
    - Did you buy Coleus for containerized planting or for landscape beds?
        - Container
        - Beds
- Could you please look at the 6 different Coleus varieties and rate them from Most Favorite to Least Favorite:
    - Merlot
    - Rustic Orange
    - Redhead
    - Florida Sun Splash
    - Florida Sun jade
    - Bellingrath
- Are you familiar with Angelonia? ((INSERT PICTURE HERE))
    - Yes
    - No
- Have you ever purchased Angelonia for your home?
    - Yes
    - No
    - If YES, What characteristics of Angelonia attracted you to it?
        - Flower Color
        - Size
        - Ease of growing
        - Overall Aesthetic Appeal
        - Other, Please specify
    - What colors of Angelonia have you purchased?
        - Purple
        - White
        - Pink
        - Variegation
        - Other, please specify
    - What colors of Angelonia would you like to purchase?
        - Purple
        - White
        - Pink
        - Variegation

    - Other, please specify
- Did you buy Angelonia for containerized planting or for landscape beds?
    - Container
    - Beds
- Could you please look at the 6 different Angelonia varieties and rate them from Most Favorite to Least Favorite:
    - AngelMist™ White
    - AngelMist™ Dark Pink
    - AngelMist™ Deep Plum
    - Serena™ White
    - Serena™ Lavendar
    - Serena™ Purple
- Other states have plant promotion programs, such as Mississippi Medalions and Athens Select. These programs introduce hardy plant materials that perform well in the state.
    - If Alabama had a program like this, would you be more likely to buy this plant material?
        - Yes
        - No
- If yes, is it because of any of the following? (Select all that apply)
    - High aesthetic value
    - Proven to grow well across Alabama
    - Water Efficient
    - Less maintenance
    - Disease and pest resistance
    - Plants were trialed prior to release
- Would you be willing to pay slightly more for plants that had been chosen in a program like these?
    - Yes
    - No
- How would you classify yourself as a gardener?
    - Avid, lots of experience
    - Intermediate
    - Novice/Beginner
    - Not a gardener
- Would you classify yourself as an avid gardener?
    - Yes
    - No
- How often do you work in your yard?
    - Daily (Weather permitting)

    - Weekly
    - Monthly
    - Once a season
    - Never
- Do you own or rent your primary residence?
    - Rent
    - Own
- Gender:
    - Male
    - Female
- Ethnicity:
    - African American
    - Asian
    - Caucasian
    - Hispanic
    - Native American
    - Other
- Age:
    - 19-25
    - 26-35
    - 36-45
    - 46-55
    - 56-64
    - 65 or older
- Are you a member of a Master Garden Organization?
    - Yes
    - No`

Figure 2. “Consumer Preference on Summer Annuals” Survey Monkey Screenshot



APPENDIX G

Figure 1.

From: Christopher Swindle [redacted]
Sent: Monday, April 30, 2012 11:06 AM
To: Kerry Smith
Subject: Master Gardener Survey

Dear Master Gardeners and Gardeners in general,

My name is Chris Swindle, I am an Auburn University Masters student in Horticulture. I am conducting research on consumers' preference of summer annuals through surveys. This survey consists of questions regarding your gardening activities, your plant color selection, and a series of pictures for you to rank. Participating in this survey will not only help me with my research, but also help you, as it will give insight to nursery and greenhouse growers as to what you, the consumer, are looking for. Below is the survey link, and it should take no more than 10 minutes to complete.

https://www.surveymonkey.com/s/AUsummerannuals

Thanks so much for your participation!

Sincerely,
Chris Swindle
Masters Student
Auburn University
[redacted]

APPENDIX H

Figure 1.

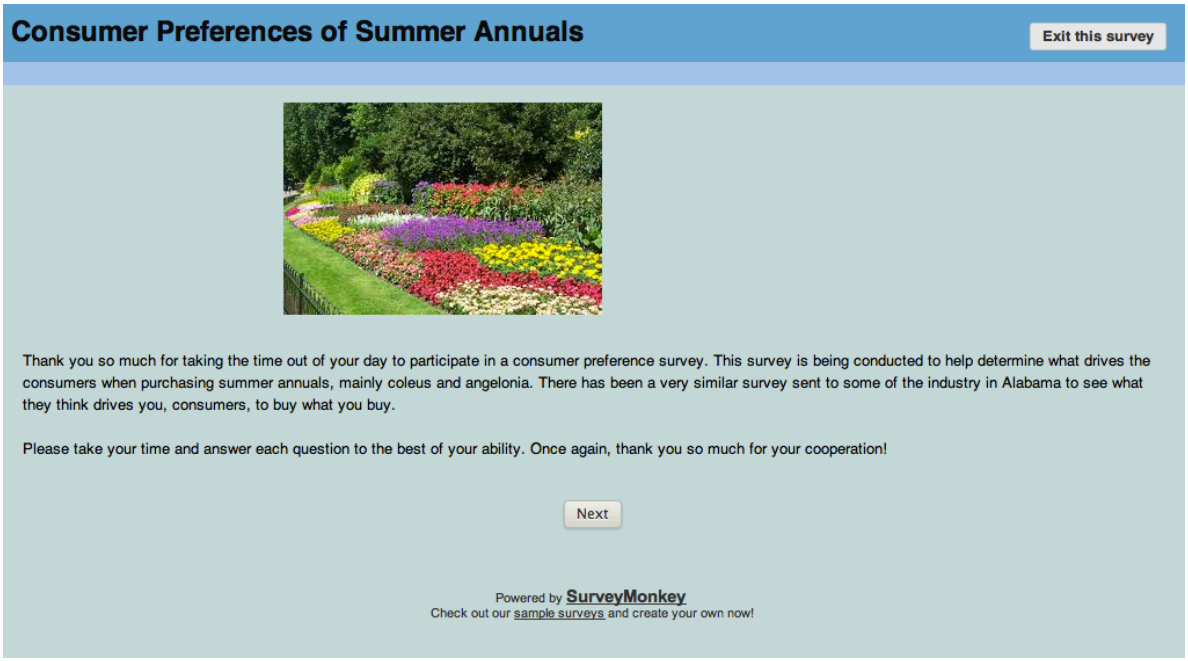


Figure 2.