FNGLA Endowed Research Report

Development of New Coleus Cultivars for Shade Tolerance and Cut Foliage Production

David G. Clark and Penny Nguyen
University of Florida
Environmental Horticulture Department

Abstract

Solenostemmon scutellarioidies, commonly known as coleus, is a versatile annual bedding plant that is valued for its brightly colored foliage, rapid growth rate, and superior performance in landscapes in the Southern United States. Surveys conducted at UF at our May 2005 field day showed that 47% of the public (home gardeners and industry) choose foliage color as the main reason for buying coleus, and 21% choose coleus with highly branched growth habit. A tremendous amount of variability in this crop has allowed for the selection of coleus cultivars with many novel foliage colors, leaf shapes and growth habits. In the second year of our breeding program, over 10,000 seedlings from a broad range of germplasm were grown in the greenhouse, then rated for the characteristics of plant vigor, lateral branching, brightness and consistency of foliage color, rooting, and time to induction of flowering. Several new cultivars with excellent performance in all trials for all variables were selected, and several potential challenges were identified that we plan to work on in the upcoming year. Preliminary research to determine whether coleus could potentially be used for cut foliage revealed that water loss through transpiration is so significant in this crop that it is not likely feasible to consider it for use in cut foliage markets. In addition, the production of cultivars with trailing habit and brightly colored foliage by directed genetic crosses has been promising to date. F1 hybrid seedlings with trailing habit and brighter foliage colors have been produced in the past three months, and are now being trialed in the greenhouse.

Objectives and Methods

1. Develop new coleus varieties that perform well in a wide range of landscape environments and are feasible for production by the Florida nursery industry.
Over 10,000 coleus seedlings were grown and evaluated in greenhouses in early spring 2005. Approximately 250 ‘elite’ cultivars were rated (1-5 scale, 1=poor; 5=excellent) based on the following characteristics: bright and novel colors, consistency of color patterning, plant vigor, and lateral branching. In order to eliminate early flowering cultivars that normally display poor foliage characteristics, plants that induced flowering during this period were eliminated from our trials. Based on total scores, approximately 250 ‘elite’ cultivars were selected, then propagated and transplanted outdoors for further evaluations in widely variable environments. These ‘elite’ cultivars were planted outdoors in April 2005, and grown through the summer at three main trialing locations. Main field trials were conducted in the full sun in Citra, Florida (hot sun trial) and Richfield, North Carolina (cool sun trial), and under 30% shade in Gainesville, Florida (cool shade trial).

2. Produce coleus cultivars for use as groundcovers or in hanging baskets.
Currently, there are several excellent standard coleus cultivars being sold in the bedding plant markets of the southern United States. However, the number of coleus cultivars available that are groundcover or trailing habit types is limited to a handful of rangy or weak cultivars with either red or green foliage. The current industry standard for trailing coleus cultivars is 'Red Queen' which flowers continuously and has an open trailing habit with small red leaves. Seedlings produced from self-pollination of 'Red Queen' all have trailing habit with simple red or green leaves. In an effort to introgress bright yellow and orange color with trailing habit, graduate student Penny Nguyen made reciprocal hand pollinations between 'Red Queen' and 'Sedona'. 'Sedona' is a commercial cultivar that has bright yellow and orange foliage, and seedlings produced from self-pollination of 'Sedona' all have upright habit with bright orange and yellow leaves. Self-pollinated seedling populations of both 'Red Queen' and 'Sedona', as well as F1 hybrid seeds resulting from reciprocal crosses of these two cultivars were produced between April and July of 2005, and are now being evaluated in greenhouses in Gainesville.

3. Determine the feasibility for developing coleus cultivars for use as a cut foliage product.
Early in the project, we identified several vigorous coleus cultivars that we thought may have potential for use as a cut foliage product. These cultivars are easy to grow, and have bright colored foliage, novel leaf shapes, and strong stems with upright habit. Five cultivars were propagated and grown for 7 weeks in close proximity to each other in the greenhouses to force production of long straight stems suitable for cutting and use in vases as cut foliage. Control stems of all cultivars were harvested at sunrise and placed in DI water in plastic vases in the 'Apopka' rooms in Gainesville. Stems from all cultivars were also stored in boxes in the dark for 2 or 4 days at 50, 60, and 70 degrees. Stored stems were sequentially moved from storage to vases, and all stems were evaluated for two weeks using a 1-5 scale for the postharvest characteristics of leaf wilting, leaf chlorosis and general appearance.

Results (by objective)

1. Develop new coleus varieties that perform well in a wide range of landscape environments and are feasible for production by the Florida nursery industry.
Through the trialing of over 10,000 seedlings from several background germplasm sources in the greenhouse, we were able to select approximately 250 'elite' coleus cultivars for further vegetative propagation and testing in a wide variety of potential landscape environments in the southeastern United States. Seedlings that were eliminated early on from the program either had uninteresting foliage color, poor non-branching growth habit, or started flowering by the time they reached 8 weeks of age. Selected 'elite' seedlings had good vigor, bright foliage colors, branched growth habit, and had not yet initiated flowering. After vegetative propagation, cultivars that displayed poor rooting characteristics were eliminated from the trialing program (only 5 cultivars), and the remaining 'elite' cultivars were then planted in field soil in the full sun at Citra,

FL and Richfield, NC and in 30% shade in Gainesville, FL. A summary of our observations is as follows:

Plant Vigor and Branched Growth Habit

It is evident that developing a wide range of vigor in coleus is not problematic for our breeding program. Plants that were vigorous growers as seedlings continued to grow strong as mature plants, while weaker growing seedlings were less vigorous mature plants. Plants with less vigor got off to a poor start after planting in the field in April, and continued to grow slowly throughout the season in all locations tested. Although many of these plants reached maturity in Florida plantings, they were usually too weak to avoid being overtaken by weeds in North Carolina. The most vigorous cultivars grew so large under Florida conditions that they would likely require landscape maintenance for pruning, but these cultivars performed well under the cooler conditions of North Carolina. Cultivars that are best suited for growth in Florida that would require low amounts of landscape maintenance often had inconsistent performance in North Carolina.

It also appears that developing coleus cultivars that are highly branched is also achievable through our program. We were able to determine that seedlings showing highly branched plant architecture almost exclusively displayed this characteristic within the first 8 weeks of seedling growth, thus providing an easy method to screen for during the early stages of evaluation. These cultivars continued to be highly branched throughout the season in all trials, thus most 'elite' cultivars had branching patterns suitable for both landscape use and for production of an economically feasible number of vegetative propagules on stock plants.

Late Flowering Cultivars

Coleus cultivars that initiate flowering early and often are usually not desirable for landscape use for two main reasons: 1) Initiation of flowering and seed set induces stored reserves to be mobilized from leaves to these reproductive tissues, thus reducing foliage visual quality, and 2) To avoid reductions in foliage quality due to this altered source:sink ratio, consumers or landscape professionals must spend effort to prune flowers to maintain desirable foliage. Therefore, we have given much attention to the selection of coleus cultivars that either flower late in the season, or do not initiate flowers. Although we have eliminated several seedlings from the program due to early flowering characteristics, we have had little trouble isolating cultivars that flower late in the season. A small number of cultivars that have not flowered as of late August 2005 have also been selected, and many of these have proven to retain excellent foliage color characterstics throughout the season. Unfortunately, these cultivars may prove to be terminal in our breeding program, because ultimately it may prove too difficult to get seeds from these plants to incorporate into the future of our program without conducting work on identifying the flowering signals. We will continue to select against early flowering cultivars in the future to allow for a gradual gains to be made over time.

Color 'Fading' of Foliage

From the inception of this breeding program, we have observed that many brightly colored coleus cultivars grown in warm, sunny environments have foliage that either

burns and becomes necrotic, or transitions to completely dull green or maroon in appearance. It appears that this characteristic may be the most difficult problem for us to solve to date, but we have made significant progress. Full sun trials were conducted in Richfield, NC and Citra, FL to determine whether cooler temperatures (avg. 8 degree F differential) would lead to better foliage color in our 'elite' cultivars. An additional trial was conducted in Gainesville under 30% shade to determine whether lower light intensity would lead to better foliage color development. When all observations were combined, over 80% of our 'elite' cultivars had foliage that transitioned to dull maroon or green in appearance in all trialing locations, while less than 5% of these cultivars displayed burning and necrosis. Approximately 15% of the 'elite' cultivars had foliage color that remained bright and consistent in all locations – most of these plants remain in the breeding program, and seeds are being produced from them for testing in our 2006 crop in order to try and increase the number of cultivars with bright color that is stable in a wide range of environments.

2. Produce coleus cultivars for use as groundcovers or in hanging baskets.

In surveys of the many coleus cultivars on the market, it is clear that there is a significant shortage of plants that have bright foliage color and trailing growth habit suitable for use as a ground cover or in a hanging basket. Standard trailing type cultivars such as 'Red Queen' or 'Trailing Nova' have good trailing habit and vigor, but have small leaves that are dull green or red in color. In an effort to introgress bright colored foliage with trailing habit, crosses were made between 'Red Queen' (trailing habit, red foliage) and 'Sedona' (upright habit, orange/yellow foliage) resulting in the production of F1 hybrid seeds. Over 300 seedlings of each reciprocal cross were planted four weeks ago, and are being compared with seedlings produced from self-pollinating the two parents. Preliminary observations confirm that several of the F1 hybrid seedlings have both trailing habit and brighter foliage color than 'Red Queen' or seedlings produced from self-pollinating it – none of these seedlings have foliage color as bright as the seedlings produced from self-pollinating 'Sedona'. We are currently screening all of these plants in the greenhouse, and will produce F2 generation seeds by self-pollinating F1 individuals with trailing habit and brighter foliage color than 'Red Queen'. A small number of these seedlings will have trailing habit and bright yellow and orange foliage similar to 'Sedona'. We hope to trial these selections in hanging baskets, and in our sun and shade trials in 2006.

3. Determine the feasibility for developing coleus cultivars for use as a cut foliage product.

Early in this project, we felt that some of the 'elite' cultivars with strong, upright growth habit and brightly colored foliage may have potential for use in vases as a cut foliage product. These plants can be quickly produced in beds or containers by methods used for standard cut flower production, and have foliage colors that match and accentuate a wide array of flower colors used in the florist industry. After growing five 'elite' cultivars with these characteristics, we stored cut stems at combinations of three temperatures and three storage durations to determine whether coleus cut stems could withstand postharvest conditions normally encountered in the marketing chain.

Cold storage of any stems below 50 degrees (F) results in blackening of foliage due to cold injury – a reflection of the tropical nature of coleus. We also observed that all cultivars, whether they were stored or not, immediately wilted and remained wilted in vases for at least five days after harvest and had poor visual appearance. After 5-7 days, all stems from all cultivars produced adventitious roots in the vases, then re-hydrated and lasted in the vases for up to six weeks longer without significant changes in visual quality. We were able to reduce transpiration of these stems by 50% through the use of foliar anti-transpirants, but this was still not enough to significantly reduce the wilting observed in the first 5-7 days after harvest.

Conclusions and Recommendations

It is apparent to us that the incredible amount of genetic variation available in coleus is capable of producing a number of excellent cultivars for use in the cutting propagated bedding plant industry. Advanced cultivars that have highly branched plant architecture and late-season flowering are attainable through standard selection practices for these characteristics. A more difficult characteristic to obtain in these cultivars is brightly colored foliage that stays bright and consistent over a wide range of environmental conditions. After screening over 10,000 seedlings in 2005, we were able to select for approximately 40 cultivars that had the complete combination of characteristics we are looking for. These cultivars are well branched and have brightly colored foliage in sun and shade under both hot Florida conditions, and cooler conditions of North Carolina. We have received a great deal of interest in these cultivars from three major bedding plant breeding/production companies and we are currently working to allow each company to test these cultivars independently to determine whether they can be used successfully in the bedding plant industry. In 2006, we hope to have initial data back from these companies to determine whether any of these cultivars have commercial utility.

Tests to determine the feasibility for use of coleus as a potential cut foliage product proved that major water loss due to transpiration leads to problems in postharvest handling that appear to be too major to solve at the current time. Although coleus stems will form adventitious roots after one week in vases then last for up to six weeks, they are completely wilted during the first week after harvest. If this one week barrier can be overcome, coleus may still prove to be a valuable cut foliage product.

Directed genetic crosses to produce coleus cultivars with bright colored foliage and trailing habit for use in hanging baskets and as groundcovers have been quite successful to date, resulting in the production of several new cultivars in the past three months. Tests to determine color stability of these plants are currently underway, and cultivars with the best trailing habit and brightest foliage colors are being advanced in our breeding program for the upcoming year. Cultivars resulting from these efforts will fill a valuable niche in the landscape industry which is continuously searching for groundcover plants that produce good color in shady environments.