FNGLA Endowed Research Report

Development of New Coleus Cultivars for Better Foliage Color Stability and use as Groundcovers

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Abstract
Vegetatively propagated Coleus (*Solenostemmon scutellarioidies*), are versatile annual bedding plants with brightly colored foliage that grow well in summer gardens across the US. A high level of genetic variability in this crop has allowed us to breed and select for new coleus cultivars with many novel foliage colors, leaf shapes and growth habits. In the third year of our breeding program, over 27,000 seedlings from a broad range of open-pollinated coleus germplasm were grown in the greenhouse, then selected for several important horticultural characteristics. The main selection criterion was for brightness and consistency of foliage color in both sunny and shady conditions, while secondary criteria included selection for excellent plant vigor and lateral branching, rotting and propagation and landscape performance. Several 'elite' new cultivars with excellent performance in all trials for all variables have been selected, and three of them will be available for commercial use in 2006-2007. Additionally, we conducted focused genetic hybridizations to introgress bright novel colors into trailing habit germplasm with the goal of producing new hybrid groundcover cultivars with bright colors. After going through the F1 and F2 hybrid generations in this part of the project, we have been able to successfully isolate the first brightly colored trailing habit coleus cultivars. These plants are now being propagated to scale them up for further field trialing in 2006-2007.

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 27,000 coleus seedlings were grown and evaluated in greenhouses in early spring 2006. Approximately 500 '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 500 'elite' cultivars were selected, then propagated and transplanted outdoors for further evaluations in widely variable environments. These 'elite' cultivars were planted outdoors in April 2006, 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 under 30% shade in Gainesville, Florida (hot shade trial), and a greenhouse production trial (cool shade) was conducted in Gainesville. By June 2006, the best 50 of these cultivars had been identified, and were propagated and sent (with MTAs and UF trialing agreements) to two commercial plant companies for further evaluations at locations across the US.

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 dark 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 several hundred F1 hybrid seeds resulting from reciprocal crosses of these two cultivars were produced between April and July of 2005, and were evaluated in the greenhouses in Gainesville in Fall 2005. Individual F1 hybrid

plants showing brighter foliage color than 'Red Queen' and trailing growth habit were selected from this population then self-pollinated in winter 2005-2006 to produce a large F2 seedling population. These seeds were sewn in April-June 2006 and are currently being evaluated in the greenhouses in Gainesville.

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 and growth habit, bright foliage colors, and had not yet initiated flowering. After vegetative propagation, the remaining 'elite' cultivars were then planted in field soil in the full sun at Citra, FL and in 30% shade in Gainesville, FL. A summary of our observations is as follows:

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. This characteristic has provided us with the most difficult problem for us to solve in Coleus to date, but made significant progress in 2005-2006. Full sun trials were conducted in Citra, FL and in Gainesville under 30% shade to determine whether varieties could be identified that had brightly colored foliage that did not change when grown in sun or shade. When all observations were combined, over 80% of our 500 '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 25% of the 'elite' cultivars had foliage color that remained bright and consistent in all locations in 2006. This was a significant gain for this characteristic in our elite breeding population which had only 15% of plants showing this characteristic in our 2005 crop. All of these plants currently remain in the breeding program, and seeds are being produced from them for testing in our 2007 crop in order to try and continue to increase the number of cultivars with bright color that is stable in a wide range of environments.

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 always eliminate seedlings from the program due to early flowering characteristics, most of the elite germplasm we have tested in the field initiates flowering by July-August. A small number of cultivars that had not flowered as of late October of 2005 were selected last year, and many of these have proven to retain excellent foliage color characteristics throughout the season. Fortunately, we were able to collect several seeds off these plants in November of 2005 for planting in our 2006 field trials and many of the offspring from these plants have not flowered as of late August 2006. We are continuing to evaluate these plants and have requested FNGLA funding for 2006-2007 to continue developing low maintenance coleus varieties that do not need pruning of seed heads to avoid dropping their leaves. We think this is one of the most important characteristics leading to long season performance of our varieties.

Our new commercial coleus releases from 2006 are shown below. Each of them have foliage that does not change color when grown in sun or shade, and each of them flower late in the season.

Figure 1. UF 03-6-1 – Released by UF in 2006 and commercialized in 2006-7 as *Solenostemon* hybrid 'Twist n' Twirl' by ProvenWinners Company.

Figure 2. UF 03-6-1 – Released by UF in 2006 and commercialized as Solenostemon hybrid 'Royal Glissade' by ProvenWinners Company.

Figure 3. UF 04-33-5 – US plant patent in process and licensed by Ball Horticultural Company.

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

In the coleus market, 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 compared with seedlings produced from self-pollinating the two parents. Several of the F1 hybrid seedlings had both trailing habit and brighter foliage color than 'Red Queen' or seedlings produced from self-pollinating it. However, none of these F1 seedlings had foliage color as bright as the seedlings produced from self-pollinating 'Sedona'. Next selected trailing habit F1 hybrids with the brightest colored foliage and self-pollinated them to produce F2 generation seedlings which are currently being evaluated in our greenhouses in Gainesville. Preliminary results indicate that we now have a number of brightly colored trailing habit varieties with good horticultural performance characteristics, and these cultivars have been moved into our elite screening program. One particular variety (we now refer to it as 'Copper Penny') has a nice trailing habit with equivalent leaf color characteristics to the original parent brightly colored parent 'Sedona'. Since this plant was considered to be the model plant we were trying to achieve, we are particularly pleased with this result and hopeful that it performs well in field testing in the upcoming year.

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 27,000 seedlings in 2006, we were able to select for several 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. We have received a great deal of interest in these cultivars from several 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.

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 brightly colored trailing habit hybrid cultivars in the past few 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.