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1997 SUMMER BEDDING PLANT TRIAL SUMMARY

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(Readers interested in the full report should contact Doug Bailey at 919.515.1195 [FAX 919.515.7747] and request Horticulture Research Series Number 127; or you can download a version from the NC State University Floriculture website at <http://www2.ncsu.edu/floriculture/>)

Over 450 entries of annual and perennial plants were evaluated during the 1997 bedding plant season at test gardens in Raleigh, North Carolina. The trial gardens are used each year to evaluate bedding plants for landscaper and home owner use.

The trial gardens are located at the Horticulture Field Lab, 4301 Beryl Road, in Raleigh. The site is located on latitude 35°47'N, longitude 78°42'W with an elevation of 400 feet. Transplants were grown in 2.5 inch × 2.2 inch containers, and most were planted in the trial garden on 13 May 1997. A few slower selections were planted when ready. Plant spacing in the trials was 18 inches × 24 inches (in-row × between-row spacing). Seven plants of each entry were used to evaluate the performance of the cultivars with the exception of All America Selections judged entries, which had 14 plants each.

All plants were grown in full sun except for begonias, hypoestes, impatiens, New Guinea

impatiens, setcreasea, and tuberous begonias; these were grown under 55% shade. When needed, water was applied using overhead irrigation.

Temperatures were cooler than normal during May and June and very close -- slightly above in July and slightly below during August and September-- to average for the remainder of the summer season (Table 1, Figure 1). Looking at the entire 5-month season, temperatures were moderate and averaged about 1.5% below normal (73 °F average daily temperature).

Rainfall received during the 5-month period (15.8 inches) was below our average of 21.2 inches (Table 1 and Figure 2) and much below of record 35.3 inches of rainfall during the 1996 season. May was much dryer than average; June and July rainfall was above average. August and September were well below average for rainfall.

Beds were pretreated with Basamid® for weed control prior to planting. Fertilizer was applied as a preplant incorporation and as dry applications during the bedding plant season. No insecticide

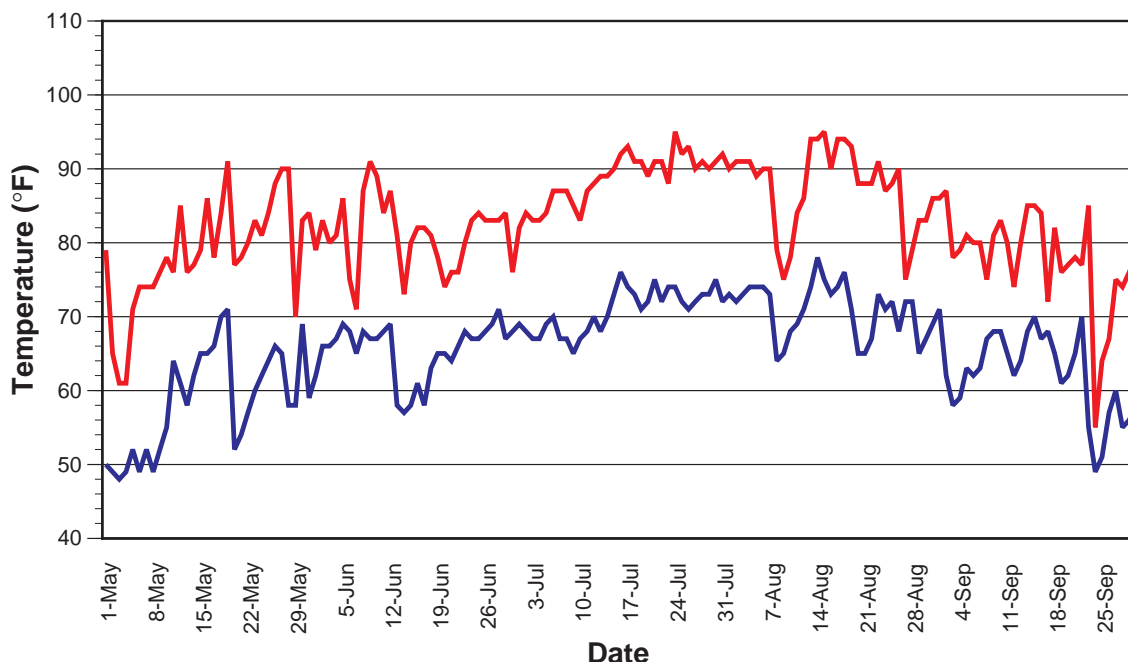


Figure 1. Daily minimum and maximum temperatures for Raleigh, N.C. from 1 May 1 through 30 Sept. 1997.

applications were made during the evaluation in order to document major pest problems. No major pests were noted during the 1997 season, however the Japanese beetle population seems to increase every year in the gardens. Plant diseases were less prevalent in 1996 than in 1995. The major disease problems included Botrytis blight and bacterial leaf spot on geraniums.

Plants were given a visual rating by the same individual once a week beginning 4 June 1997,

three weeks after planting through 19 weeks after planting; the final evaluation date was 24 September 1997. The rating was based on plant performance and appearance, including floriferousness, plant size and shape, and freedom from insect and disease problems. The rating scale used ranged from 1 (very poor) to 5 (excellent), with 0.5 unit increments; a 0 rating was given if all seven plants of the cultivar died. Weekly ratings were averaged to provide an

Table 1. Solar energy, temperature and precipitation from May through September 1997 and 30 year temperature and precipitation averages for Raleigh, N.C.

Month	Daily average solar radiation received (Langley/day)	Daily average temperature (°F) and percent change from 30 year avg	30 year average daily temperature (°F)	Monthly precipitation (inches) and percent change from 30 year avg	30 year average monthly precipitation (inches)
May	561	65.0 (-5%)	68.1	2.39 (-43%)	4.22
June	457	71.9 (-4%)	74.9	4.76 (+28%)	3.73
July	499	79.6 (+1%)	78.8	5.63 (+16%)	4.84
August	526	77.0 (-1%)	78.0	0.92 (-80%)	4.52
September	391	71.3 (-1%)	72.1	2.09 (-46%)	3.85

overall rating for the entire season. We used the seasonal average ratings to select the N.C. State Leaders of the Pack and the NCSU Exceptional Performance Winners.

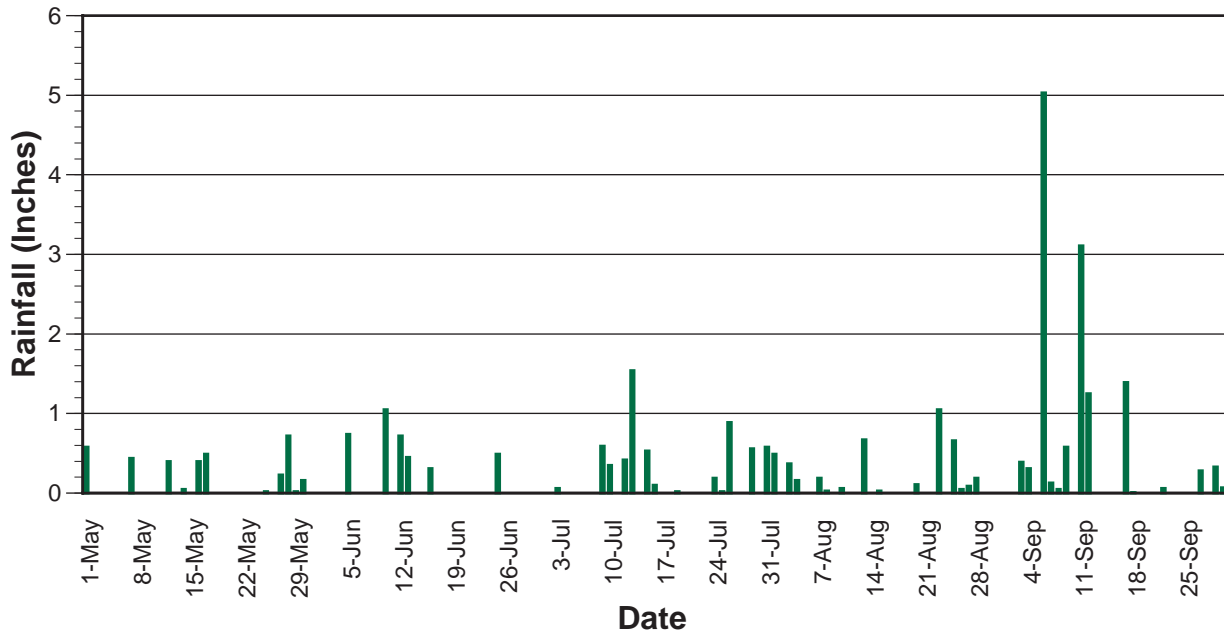


Figure 2. Rainfall received from May 1 through September 30, 1997.

Sources of Seeds and Plants

The following companies graciously sponsored the 1997 trial gardens. The companies are acknowledged in the ratings table and in the listings by the abbreviation that appears to the left of the company name. Appreciation is also given to Fafard, Inc. and to the North Carolina Commercial Flower Growers' Association for their contributions towards the trials.

- **AAS** All-America Selections, 1311 Butterfield Road, Suite 310, Downers Grove, IL 60515
- **BALL** Ball Seed Co., P.O. Box 335, West Chicago, IL 60185
- **BEN** Ernst Benary of America, Inc., 1444 Larson Street, Sycamore, IL 60178
- **BG** Bodger Seeds Ltd., 1800 North Tyler Avenue, Lompoc, CA 91733 3618
- **BWN** Berylwood Nursery, Inc., P.O. Box 2, Lexington, NC 27293-0002
- **DHN** Dæhnfeldt Inc., P.O. Box 947, Albany, OR 97321 98664
- **ECKE** Paul Ecke Ranch, P.O. Box 230488, Encinitas, CA 92023-0488
- **FIS** Fischer USA, Inc., 2955 Balmont Road Suite 110, Boulder, CO 80301
- **GOLD** Goldsmith Seeds, Inc., P.O. Box 1349, Gilroy, CA 95020
- **MI** Henry F. Michell Company, P.O. Box 60160, King of Prussia, PA 19406-0160
- **NCSU** Department of Horticultural Science, Box 7609, North Carolina State University
- **NOV** Novartis Flower Seeds, Inc., 5300 Katrine Avenue, Downers Grove, IL 60515-4095
- **OGL** Oglevee, Ltd., 152 Oglevee Lane, Connellsville, PA 15425
- **PA** PanAmerican Seed Co., P.O. Box 438, West Chicago, IL 60185
- **SAK** Sakata Seed America, Inc., 105 Boronda Road, Salinas, CA 93907

N.C. State Leaders of the Pack

The following were selected in 1997 on their ability to display attractive landscape color throughout the majority of the bedding plant season. At any one time, other species or entries may have made a better short-term showing, but the "Leaders of the Pack" were selected for consistent, dependable full-season performance as a source of color and beauty in the landscape. The cultivar source is shown in parenthesis.

Ageratum

'Blue Hawaii' (BG)

Begonia

Mix: 'Partyfun Mix' (BEN)

Pink: 'Super Olympia Pink' (BEN),
'Ambassador Pink' (DHN), 'Victory Green
Leaf Pink' (GOLD)

Red: 'Inferno Red' (DHN),

Rose: 'Eureka Bronze Rose' (NOV),
'Ambassador Rose Blush' (DHN),
'Ambassador Rose' (DHN)

White: 'Eureka Bronze White' (NOV),
'Inferno White' (DHN)

Celosia

'Prestige Scarlet' (SAK)

Coleus

'Rose Trailer' (NCSU), 'Touchelay' (NCSU),
'Camellia' (NCSU), 'Alabama Sun' (BWN),
'El Brighto' (NCSU), 'Black Trailer' (NCSU)

Dianthus

'Floral Lace Picotee' (BALL), 'Floral Lace
Light Pink' (BALL), 'Floral Lace Cherry'
(BALL)

Geraniums From Cuttings

Coral: 'Lucille' (OGL)

Orange: 'Lollipop' (OGL)

Pink: 'Gypsy' (OGL), 'Melody' (OGL)

Red: 'Melody Red' (OGL), 'Sincerely Yours'
(OGL), 'Tango' (FIS)

Salmon: 'Morning Mist' (OGL), 'Schoene
Helena' (FIS)

White: 'Lotus' (FIS)

Geraniums From Seed

Coral: 'Pinto Coral' (NOV)

Red: 'Maverick Scarlet' (GOLD)

Impatiens

Blue/Violet: 'Dazzler Violet' (BALL), 'Super
Elfin Violet Improved' (PA), 'Accent
Violet' (GOLD)

Coral: 'Tempo Coral' (BG)

Mix: 'Carnival Mix' (DHN), 'Dazzler Merlot
Mix' (BALL), 'Accent Peppermint Mix'
(GOLD)

Orange: 'Tempo Orange' (BG)

Pink: 'Carnival Pink' (DHN), 'Tempo
Watermelon' (BG)

Red: 'Accent Cranberry Punch' (GOLD),
'Impulse Cranberry' (NOV), 'Accent Red'
(GOLD)

Rose: 'Cajun Carmine' (NOV), 'Super Elfin
Rose' (PA), 'Tempo Rose' (BG), 'Victorian
Rose' (GOLD)

Salmon: 'Impulse Coral' (NOV), 'Accent
Salmon' (GOLD)

White: 'Pride White' (SAK)

Lavender

'Lady' (AAS)

Marigold

Gold: 'Antigua Gold' (GOLD), 'Bounty Gold'
(SAK)

Gold/Red: 'Hero Flame' (BG)

Red: '96BP03' (AAS), 'Safari Red' (BG)

Yellow: 'Bonanza Yellow Improved' (PA)

Narrow-Leaf Zinnia

'Crystal White' (AAS)

New Guinea Impatiens

Blue: 'Paradise Aruba' (ECKE)

Orange: 'Paradise Timor' (ECKE)

Orange/Red: 'Paradise Antigua' (ECKE),
'Pure Beauty Apollon' (ECKE)

Pink: 'Pure Beauty Jolana' (ECKE)

Red: 'Paradise Tarawa' (ECKE)

New Guinea Impatiens, continued

Salmon/White: 'Pure Beauty Melissa'
(ECKE)

Nierembergia

'Purple Robe' (AAS)

Ornamental Pepper

'Velvet Elvis' (NCSU)

Osteospermum

'Sunscape Daisy Zimba' (ECKE)

Petunia

Blue/Purple: 'Purple Wave' (PA), 'Celebrity
Lilac Morn' (BG), 'Plum Crazy Madness'
(BALL)

Mix: 'Celebrity Watercolors Mix' (BG)

Pink: 'Pink Wave' (PA), 'Hurrah Pink' (NOV),
'Fantasy Pink' (GOLD), 'Fantasy Pink
Morn' (GOLD), 'Eagle Pink' (SAK)

Red: 'Fantasy Crystal Red' (GOLD)

Rose: 'PrimeTime Rose' (GOLD)

White: 'Hurrah White' (NOV), 'White
Madness' (BALL)

Yellow: 'Celebrity Chiffon Morn' (BG)

Plectranthus

'Silver' (BWN), 'Variegatus' (NCSU)

Salvia

Blue: 'Signum' (BG)

Purple: 'Salsa Light Purple' (GOLD)

Red: 'Red Vista' (PA)

Red/White: 'Salsa Scarlet Bicolor' (GOLD)

Rose: 'Salsa Rose' (GOLD)

White: 'Salsa White' (GLC)

Sweet Potato

'Sulfur' (NCSU), 'Pink Frost' (NCSU),
'Blackie' (NCSU)

Verbena

Blue/Purple: 'Imagination' (AAS)

Red: 'Quartz Scarlet' (PA)

Vinca

Blue/Purple: 'Blue Pearl' (PA), 'Grape Cooler'
(PA), 'Heat Wave Grape' (BG)

Pink: 'Orchid Cooler' (PA), 'Blush Cooler'
(PA), 'Icy Pink Cooler' (PA)

Rose: 'Rose Cooler' (PA)

Zinnia

'Profusion Orange' (AAS), 'Profusion Cherry'
(AAS)

NCSU Exceptional Performance Winners

Each year, the best of the best, those cultivars that exemplify outstanding performance during the trials, will be recognized as Exceptional Performers. The winners are judged on full-season performance and are recommended as outstanding selections for our region. Growers, retailers and landscapers are encouraged to consider these cultivars first for their color needs. Only six cultivars were selected from over 450 entries in the 1997 trial garden:

1997 Winners

1. *Begonia*, 'Ambassador Rose Blush' (DHN)
2. *New Guinea Impatiens*, 'Paradise Aruba' (ECKE)
3. *Sweet Potato*, 'Sulfur' (NCSU)
4. *Begonia*, 'Inferno Red' (DHN)
5. *Begonia*, 'Eureka Bronze Rose' (NOV)
6. *Zinnia*, 'Profusion Orange' (AAS)

1997 POINSETTIA TRIALS AT NC STATE UNIVERSITY

Roy A. Larson and Ingram F. McCall
Department of Horticultural Science

Each year we wonder what we can do to improve our cultivar evaluations but the matter largely is out of our hands. It's the improvements that the plant breeders have made with their new cultivars and numbered selection that have the greatest impact. We just apply the cultural knowledge and proper environmental conditions. We can make a beautiful cultivar look homely, but we can't make a homely cultivar look beautiful. We proved the latter to be true in some instances in 1997.

In 1997 the poinsettia breeders sent us their cultivars and selections when they thought it would be best for us to get them so they would be appropriate in size and the flowering time would be right (see Table 1 for dates cultivars were received and potted). In several instances the breeders underestimated what good growing conditions we have in North Carolina. For several years we have avoided the use of chemical growth retardants by using optimum potting and pinching dates but we thought we might have to use a growth retardant in 1997. We decided not to, some of the vigorous cultivars became somewhat crowded on a 14" x 14" spacing, but all plants would have been salable in a market with high standards. In 1998 we will be going back to our longtime practice of potting the rooted cuttings in late August and pinching by September 15. Plant heights are shown in Table 2, so readers can see what success we achieved without resorting to growth retardants.

Cultural Procedures

Plants that were potted on July 16 were pinched on July 30, those potted August 13 were pinched on August 27, those planted August 21 were pinched September 4, and those potted August 28 were pinched September 11.

The plants were potted in 6.5" plastic azalea pots in Fafard 4P. They were grown under natural daylengths in a double-layered polyethylene house, at a night temperature of 65 °F. A tube watering system was used. Osmocote 14-14-14 was applied one week after potting, at a rate of one teaspoon/pot. The primary fertilizer used was a combination of calcium nitrate (33 oz/100 gallons of water) and potassium nitrate (18 oz/100 gal), at weekly intervals, but 20-10-20 at 2 lbs/100 gallons was applied every third week. Sodium molybdate was applied as a drench at 2.5 oz/100 gallons on October 27, and Epsom salts at 2 lbs/100 gallons was applied on October 29. Marathon was applied on October 1 for whitefly control. We did not encounter bract necrosis, botrytis, powdery mildew, whitefly or fungus gnat problems or any nutritional disorders on the plants.

Results and Discussion

We had an abundance of cultivars and selections with red bracts in 1997. Some of the numbered selections (data not shown) seemed to have more orange in the bracts than cultivars such as Freedom but that's a judgment in the eyes of the beholder and probably not scientifically accurate. In the early 1960s Danny Thomas of Carroll's Greenhouses in Raleigh and the senior author would argue as to which cultivar was the best red, 'Indianapolis Red' or 'Barbara Ecke Supreme'. Sometimes I think we forgot which one we had favored in the previous argument. It would be difficult now to pick out the best red, based solely on bract color, when there are so many from which to choose. (The senior author was hospitalized the day after the Poinsettia Open House and at 4:30 AM one day a nurse's aide came into the room to empty the waste basket, a task which seems to require a great deal of noise

Table 1. Suppliers, cultivars, and potting dates for poinsettias evaluated in the NC State University 1997 trials.

Breeder	Potting date			
	July 16	August 13	August 21	August 28
Ball Flora Plant			Jolly Red Red Splendor	
Dümmen				Spotlight Dark Red Spotlight Pink Starlight White
Fischer		Bonita Cortez Cortez Candy Cortez Pink Cortez White Marblestar Picacho Silverstar Silverstar Pink Silverstar White	Flirt Maren Nobelstar Puebla Sonora Sonora Jingle Sonora Marble Sonora Pink Sonora White Whitestar	
Oglevee				Dynasty Red Festival Red Nutcracker Pink Nutcracker Red Nutcracker White
Paul Ecke Ranch	Pepride	Angelika Marble Angelika White Bright Red Freedom Candy Cane Celebrate 2 Red Darlyne Pink Freedom Jingle Bells Freedom Marble Freedom Pink Freedom Red Freedom White Jingle Bells 3 Monet Pearl Peterstar Jingle Bells Peterstar Marble Peterstar Pink Peterstar Red Peterstar White Petoy Pink Peppermint Red Sails Success Supjibi V-14 Glory	Bright Red Freedom Heirloom Snowcap Variegated Lilo	

Table 2. Final height, number of flowering shoots per plant, and flowering date data for poinsettias in the NC State University 1997 trials.

Cultivar	Final height (")*	No. flowering shoots*	Average date for:		
			Bract color	Cyathia	Anthesis
Bonita	17.0	6.0	10/7	10/28	11/20
Bright Red Freedom (8/13)	17.5	7.5	10/19	10/26	11/15
Bright Red Freedom (8/21)	12.0	5.0	10/22	10/27	11/18
Candy Cane	17.5	6.0	10/28	10/30	11/22
Celebrate 2	14.5	4.5	10/17	10/27	11/18
Cortez	15.5	7.0	10/21	10/27	11/22
Cortez Candy	14.5	6.0	10/25	10/27	11/19
Cortez Pink	14.5	5.0	10/25	10/27	11/19
Cortez White	14.5	7.5	10/24	10/28	11/19
Darlyne Pink	17.0	6.0	10/27	10/28	11/23
Dynasty Red	11.5	6.0	10/22	11/3	11/30
Festival Red	12.0	5.5	10/22	10/28	11/21
Flirt	15.0	6.0	10/28	10/30	11/21
Freedom Jingle Bells	18.5	6.5	10/22	10/26	11/15
Freedom Marble	17.5	6.5	10/26	10/27	11/17
Freedom Pink	17.5	8.0	10/24	10/26	11/14
Freedom Red	15.0	6.0	10/12	10/24	11/14
Freedom White	16.0	7.0	10/24	10/25	11/15
Heirloom	11.5	6.5	10/27	10/30	11/27
Jingle Bells 3	16.0	7.0	10/22	10/30	11/23
Jolly Red	14.5	9.0	10/20	10/30	11/28
Marblestar	16.0	7.0	10/22	10/27	11/20
Maren	16.0	6.5	10/24	10/29	11/20
Monet	13.5	8.5	10/25	10/29	11/20
Nobelstar	16.0	6.0	10/22	10/29	11/22
Nutcracker Pink	13.0	7.0	10/29	11/3	11/27
Nutcracker Red	12.0	6.5	10/27	11/2	11/28
Nutcracker White	14.0	7.5	10/29	11/3	11/27
Pearl	13.5	7.0	10/25	10/28	11/19
Pepride	20.0	8.5	10/7	10/9	11/9

* Final height and number of flowering shoot data taken on 20 November 1997.



Figure 1. 'Candy Cane' on 5 December 1997.



Figure 2. 'Silverstar Pink' on 5 December 1997. Variegated foliage adds interest to this cultivar.



Figure 3. 'Spotlight Pink' on 5 December 1997.



Figure 4. 'Snowcap' on 5 December 1997.



Figure 5. 'Silverstar White' on 5 December 1997. The variegation of the foliage was not as pronounced as on 'Silverstar Pink' or 'Silverstar Red'.



Figure 6. 'Variegated Lilo' on 4 December 1997. The foliage has a creamy / yellow edge.

Table 2, continued.

Cultivar	Final height (")*	No. flowering shoots*	Average date for:		
			Bract color	Cyathia	Anthesis
Peterstar Jingle Bells	17.0	5.0	10/22	10/28	11/21
Peterstar Marble	16.5	7.0	10/25	10/28	11/19
Peterstar Pink	16.5	6.5	10/22	10/27	11/18
Peterstar Red	15.5	6.0	10/20	10/27	11/20
Peterstar White	16.5	8.5	10/26	10/28	11/22
Petoy	16.0	6.0	10/23	10/28	11/23
Picacho	15.5	7.5	10/16	10/26	11/16
Pink Peppermint	19.0	8.0	10/23	10/27	11/18
Puebla	17.0	6.0	10/26	10/27	11/17
Red Sails	18.5	7.5	10/22	10/26	11/22
Red Splendor	16.0	7.0	10/27	10/27	11/18
Silverstar Pink	14.0	8.0	10/26	10/27	11/19
Silverstar Red	15.5	6.0	10/21	10/27	11/21
Silverstar White	13.0	8.0	10/28	10/29	11/27
Snowcap	12.5	7.0	10/27	10/29	11/21
Sonora	11.5	7.0	10/21	10/28	11/22
Sonora Jingle	12.5	7.0	10/20	10/27	11/19
Sonora Marble	12.5	7.0	10/25	10/27	11/22
Sonora Pink	15.0	7.5	10/25	10/27	11/20
Sonora White	11.5	7.5	10/25	10/27	11/20
Spotlight Dark Red	13.5	9.0	10/21	10/30	11/27
Spotlight Pink	13.5	8.0	10/27	11/1	11/25
Starlight White	12.0	7.5	10/26	10/28	11/21
Success	16.5	7.0	10/20	10/29	11/24
Supjibi	14.0	7.5	10/20	10/27	11/19
V-14 Glory	16.5	7.5	10/19	10/28	11/20
V-17 Angelika Marble	19.0	9.0	10/26	10/27	11/18
V-17 Angelika White	18.0	10.0	10/26	10/28	11/19
Variegated Lilo	8.5	8.0	10/25	10/28	11/24
Whitestar	17.0	5.5	10/27	10/30	11/23

* Final height and number of flowering shoot data taken on 20 November 1997.



Figure 7. An overview shot of the 1997 NC State University poinsettia trials. Roy and Ingram (as always) did a great job!

and bright lights. She saw a poinsettia on the window sill and said, "Isn't that a bright red!" and I thought that someone at Eckes had named it right, based on her observation, because it was 'Bright Red Freedom'.)

How a red bract looks in the greenhouse is almost irrelevant because most customers will never be able to match the light intensity or natural light quality we have in greenhouses. Whether the lights in the home, office or other sites are incandescent or fluorescent will have a big impact on the amount of orange or blue in the red bracts. At the 1998 Poinsettia Open House we will display red cultivars under both types of lighting in the cooler adjacent to the greenhouse at the Horticultural Field Laboratory. Visitors then can get another assessment of the cultivars.

Foliage color seemed to increase in importance in the 1990s and dark green seemed to be preferred. The foliage of 'V-14 Glory' was too light a green to suit many growers, while a cultivar such as 'Lilo' might have seemed unduly dark, and the number of lateral breaks from a pinch generally is less with the very dark cultivars. Perhaps foliage color is overemphasized because too many poinsettias are sold still in the original sleeves used by the growers for shipping, and the final customer doesn't know what the color of the foliage might be or if the plant even has any.

The number of new introductions each year is getting overwhelming and poinsettia breeders have become extremely competitive, almost equalling the African violet frenzy of the 1950s. A consequence of the rush to develop new

cultivars has been the appearance of some cultivars which should have been improved before they were named and available commercially. This particularly true with the novelty types, such as the marbles, jingle bells and those with variegated foliage and / or bracts.

The proliferation of poinsettia cultivars also has increased the need and value of cultivar evaluations. Appreciation of this value and need is indicated by the increasing number of visitors we have been getting each year at our Open House, and at Open Houses held elsewhere. We had over 130 people at our event in 1997. In 1998 the Poinsettia Open House will be Thursday, December 3, but we also will have one on Sunday, December 6, for growers who cannot attend during the week, and also for retail florists who might give their assessment of the cultivars. It seems we will have several new introductions in 1998 so we will not grow some of the long established cultivars which people already know quite well, as there is a space limitation. We will keep some of the "standard" cultivars of long standing, however, so the new ones can be compared with them.

Pictures of new cultivars are included in this article. Color cannot be evaluated, except for the

cultivars with white bracts, but plant form and vigor can be (*You can view these pictures in color by downloading the version of the Bulletin placed on the internet located at the NC State Floriculture Web Site--address is given on the back page of every issue of the Bulletin. Electronic copies of the Bulletin are posted on the Internet approximately 30 days after printed copy is sent to the Association membership.*) Figures 1–5 were taken by the junior author on December 5 and 6 and 7 were taken by Doug Bailey during the Poinsettia Open House on December 4.

We do express appreciation to the companies which supplied us with plant material (Ball Floraplant, Dümme Young Plants, Fischer USA, Oglevee Ltd., and Paul Ecke Ranch), Scott's Seed for the fertilizer, Fafard for the potting substrate, the N.C. Commercial Flower Growers' Association for the refreshments at the Open House and for the role the Association and the N.C. Agricultural Research Service played in the construction of the greenhouse years ago. The senior author especially acknowledges the many contributions Ingram McCall made in 1997 to make the evaluations successful, as illness in the Larson family made his participation on a daily basis very difficult.

Calendar of Events

Event	Date	Time	Location and contacts
Southeast Greenhouse Conference and Trade Show	Wednesday–Saturday 25–27 June		Palmetto Expo Center, Greenville, S.C. Contact Charles Hall at 800.453.3070 for further information.
NCCFGA Board Meeting	Friday June 26	TBA	At the SGCTS in Greenville, S.C. Contact Bonnie Holloman for further details at 919.779.4618.

SUBMISSION PROCEDURES FOR SUBSTRATE, WATER, FERTILIZER SOLUTION, AND PLANT TISSUE SAMPLES

Brian E. Whipker, Extension Floriculturist

Department of Horticultural Science, NC State University

Providing the proper nutrition program for your plants is important for optimal growth. Sampling the substrate or plant tissue is a simple check of the nutritional status of the crop and can provide clues about a crop's performance often before deficiency or toxicity symptoms appear. Plant tissue analysis is especially useful when one needs to determine micronutrient levels in the plant. Testing your irrigation water allows for the determination of pH, electrical conductivity (EC), and alkalinity levels. High alkalinity can significantly increase the substrate pH over time. The pH of your substrate dramatically influences the availability of various nutrients to your plants. In addition, growers may want an analysis of their fertilizer solution to double check their mixing procedures and to check the calibration of their injectors. The purpose of this article is to provide instructions to growers who want to take representative samples for laboratory analysis. A selected list of labs specializing in greenhouse substrate, irrigation water, fertilizer solution, and plant tissue samples is listed in Table 1.

Testing Greenhouse Substrates

Conducting routine substrate analysis is essential in determining the nutrient status of your crop. It is recommended that samples be sent to a lab every 3 to 4 weeks to check nutrient levels. A standard analysis usually includes: pH, EC, NO₃-N, NH₄-N, P, K, Ca, and Mg. In some cases growers may also want to test for sulfur (S) and micronutrients (B, Cu, Fe, Mn, Mo, and Zn) in their substrate. Generally, testing for micronutrient concentration in the substrate is recommended only under special circumstances

and not for routine analysis. Plant tissue analysis is a better indicator of micronutrient concentration.

Sampling Procedure:

- ① ☞ The substrate sample should be representative of the crop or problem you wish to analyze.
 - ☞ For routine analysis, samples should be collected from 5 to 10 pots and combined into a single sample.
 - ☞ Thoroughly mix the subsamples together to make a single homogeneous sample.
 - ☞ Problem pots or benches should be sampled individually.
 - ☞ Remember to follow the same procedure every time you sample so you can compare results and detect trends over time.
- ② ☞ The sample should be collected from the top to the bottom of the pot, excluding the top 1/2 inch of the substrate.
- ③ ☞ One to 2 pints of substrate are required for conducting analysis; smaller volumes can be submitted, but the results may not be as accurate.
- ④ ☞ Samples should be sent in a plastic bag, which is labeled with your name, address, the crop, and location of sample.
- ⑤ ☞ New substrate should be wetted to container capacity by placing the sample in a growing container, watering it until drainage occurs, and after drainage stops the sample can be bagged and mailed. With mail delivery time, this allows 2 days for the lime to react and correct pH readings can be obtained.

Testing Irrigation Water

Alkalinity is the main factor affecting pH changes in the substrate. The higher the alkalinity

Table 1. A selected list of labs specializing in greenhouse substrate, irrigation water, fertilizer solution, and plant tissue samples. Check with the individual labs about the type of analysis conducted and if a submission form is required.

Lab / Address / Phone	Analysis Available / Cost
Cornell Nutrient Analysis Laboratories Plant Science Unit, 21A Plant Science Building Ithaca, NY 14853-5908 607.255.4532	Substrate and fertilizer solutions at \$20/sample for pH, EC, microelements and macroelements. Plant tissue \$25/sample for macroelements and microelements. Irrigation water acid injection test and rates at \$10/sample.
Fafard Analytical Services 183 Paradise Blvd., Suite 106 Athens, GA 30607 800-457-3301	\$24/sample for substrate, irrigation water, fertilizer solution, or plant tissue. Analysis includes a complete testing for macroelements and microelements. <i>Slightly lower prices for Fafard customers.</i>
Horticulture Plant Nutrition Lab 238 Horticulture Hall Iowa State University Ames, IA 50011 515.294.1870	Substrate and fertilizer solutions at \$10/sample for the macroelements, pH and EC. Micronutrients analysis cost an additional \$10/sample. Irrigation water at \$5 for pH, EC, and alkalinity, and an additional \$15 for the macroelements and microelements. <i>Micronutrients are only run on the 1st and the 15th of the month. Plant tissue samples are not done.</i>
MMI International Laboratory, 183 Paradise Blvd., Suite 108, Athens, GA 30607 800.837.8664	\$30/sample for substrate, irrigation water, fertilizer solution, or plant tissue. Analysis includes a complete testing for macroelements and microelements.
North Carolina Dept. of Agriculture 4300 Reedy Creek Road Raleigh, NC 27607-6465 919.773.2656	Plant tissue analysis for macroelement and microelements at \$4/sample. Services available to only North Carolina residents. <i>The extraction method used for soilless substrates is not the saturated paste extract.</i>
Ohio State University Research-Extension Analytical Laboratory, OARDC 1680 Madison Ave. Wooster, OH 44691 330.263.3760	Substrate at \$12/sample and includes pH, EC, NO ₃ -N, P, K, Ca, and Mg. The standard tests with microelements is \$16/sample. NH ₄ -N is an additional \$7/sample. Volume discounts available. Nutrient solutions and irrigation water testing available. Prices vary with tests conducted. Plant tissue analysis is \$14/sample for N, P, K, Mg, Mn, Fe, Cu, B, and Zn.
Purdue University Root Media Testing Lab 1165 Horticulture Bldg. Purdue University West Lafayette, IN 47907-1165 765.494.6619	Costs are based on the number of samples submitted during a monthly billing cycle. Substrate and fertilizer solutions, for 1 to 3 samples are \$10/sample, for 4 to 10 are \$9/sample, and for >10 samples are \$8/sample. Samples analyzed for the macroelements, pH and EC. <i>Microelements and plant tissue samples are not done.</i> Irrigation water at \$6/sample for pH, EC, and alkalinity.
Scott's Testing Laboratory, 6656 Grant Way Allentown, PA 18106 800.743.4769	\$28/sample for substrate, irrigation water, fertilizer solution, or plant tissue. Analysis includes a complete testing for macroelements and microelements.

level, the quicker there will be an increase in pH of soilless substrate. Water tests are recommended for each well that you have and should be done one to two times a year. A standard analysis usually includes: pH, EC, and alkalinity.

Growers may also want to test for macro- and micronutrients (N, P, K, Ca, Mg, S, B, Cl, Cu, Fe, Mn, Mo, and Zn) in their water. Testing for macro- and micronutrients should be done for each well at least once a year. Growers with excessive alkalinity levels will need to neutralize it by acid addition. *(For more information on water quality and acidification, acquire Hort. Info. Lflt's. #557, Water Considerations for Container Production of Plants and #558, Alkalinity Control for Irrigation Water Used in Nurseries and Greenhouses--both are available on the NC Floriculture web site and from County Extension Centers).*

Sampling Procedure:

- ① ☞ Run the hose for 5 minutes to clear the line.
- ② ☞ Rinse a clean plastic 16 oz. container 2 to 3 times with the water to be tested.
 - ☞ Fill the container completely and cap tightly.
 - ☞ Label bottle with your name, address, and type of analysis requested.
- ③ ☞ Mail the sample within 24 hours.

Testing Fertilizer Solutions

Fertilizer solution tests are recommended for checking the accuracy of your injector and your mixing rates. Testing should be done 2 to 4 times a year. A standard analysis usually includes: pH, EC, $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$, P, K, Ca, and Mg. Before submitting a sample, growers should accurately weigh out their fertilizer and thoroughly mix it to have a representative sample.

Sampling Procedure:

- ① ☞ Run the hose for 5 minutes to obtain a representative sample from the injector.
- ② ☞ Rinse a clean plastic 16 oz. container 2 to 3 times with the water to be tested.

☞ Fill the container completely and cap tightly.

☞ Label bottle with your name, address, and type of analysis requested.

- ③ ☞ Mail the sample within 24 hours.

Plant Tissue

Plant tissue analysis can be conducted to determine the nutrient status of the crop or for problem solving. Plant tissue analysis is especially useful when one needs to determine micronutrient levels in the plant. A standard analysis usually includes: macroelements (N, P, K, Ca, and Mg) and micronutrients (B, Cu, Fe, Mn, Mo, and Zn).

Sampling Procedure:

- ① ☞ The tissue samples should be representative of the crop or problem you wish to analyze.
 - ☞ For routine analysis, leaves should be collected from 20 to 30 plants (more leaves are required for plants with small leaves) and combined into a single sample.
 - ☞ Problem plants or benches should be sampled individually. Plant analysis standards for many of the minor floriculture crops have not been established. Submit a problematic and a non-problematic sample for a comparison.
 - ☞ If foliar nutrient sprays have been used, gently wash the leaves in distilled water for 10 to 20 seconds to remove surface contaminants.
 - ☞ Remember to follow the same procedure every time you sample so you can compare results and detect trends over time.
- ② ☞ Generally, the most recently matured, fully expanded leaves are collected from the upper part of the plant.
- ③ ☞ Samples should be sent in a paper bag, which is labeled with your name, address, the crop, and location of sample.
- ④ ☞ Mail the sample within 24 hours. Try to collect the sample at the beginning of the week so delivery will not be delayed over the weekend.

NCCFGA NEWS

Greetings!!! I hope all of you have recovered from the '97 poinsettia season and that it was a successful one for you. Are you rested and ready to tackle another busy spring? The rainy days of winter are a good time to reflect on the past business year; to evaluate what worked and didn't work; and to make resolutions for what you will do different this year.

The following is a list of resolutions I made several years ago to guide me in operating my business. It has served me well and I hope it will be beneficial to you:

- ① Have a desire to be the best. If you as the owner, have a desire to excel, your employees see it and your customers see it. This creates a pride in your work and a pride that those who work with you can share in.
- ② Satisfy the customer. A satisfied customer will come back and an unhappy one will tell others of their bad experience. ***Good service + a quality product + a fair price = A satisfied customer.***
- ③ Know your limitations and your company's. Don't promise the customer the world if you can't deliver on it.
- ④ Hire good people. Treat them well and with respect. Treating people right and telling them you appreciate them is worth more than any sum of money.
- ⑤ Keep informed of changes in the industry and the latest trends. There are numerous good trade magazines to read and many trade shows and seminars to attend. Also, visit other people's businesses -- we are in an industry where most people are more than willing to share and talk about their successes and failures.
- ⑥ Know how to handle money -- not only how to make it, but how to spend it wisely. Don't place too much emphasis on how much money you "make." The bottom line is what you're left with at the end of the year. Also, making more money will not solve all your problems. It only increases your responsibility.
- ⑦ Know your market. You must know who you're trying to sell to, how to sell that product, and how to set yourself apart from your competition. Who is your customer?
- ⑧ Be able to view your business from your customer's point of view. Do they understand what you're about? If you can't be objective, get someone who can (a friend, business associate, consultant, customer, etc.). Be willing to respond to changes they suggest.
- ⑨ Work hard. It takes resolve, determination, and hard work to stay in *and* be successful in our industry.
- ⑩ Recognize the rewards! We in the horticulture industry are in an enviable position because we grow and sell a product that people love and enjoy; one that beautifies the world around us.

Enough said and enough to do... As always, feel free to call me with questions or comments and let me know how our associations can serve you better.

Best Regards,



Joe Stoffregen, NCCFGA President

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ADDRESS CORRECTION REQUESTED

TO:

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