

Table of Contents

Introduction.....	2
Acknowledgements.....	2
Cultural Data.....	5
Data Collection Methods	8
Soil Analysis	10
Monthly Temperature and Precipitation	11
2006 “Best of” Winners and “Plants Rated as Superior”	12
Plants Grown in Beds	
Visual Evaluations and Comments on 8/7/06.....	16
Height, Width and Coordinator Comments	54
Plants Grown in Containers	
Visual Evaluations and Comments on 8/7/06.....	78
Height, Width and Coordinator Comments	105
Multi-year Trials on Perennial Varieties	
Height, Width and Coordinator Comments	122

Colorado State University

2006 Annual Trial Garden Report

Dr. James E. Klett, Chris Copenhefer and David Staats*

Introduction

The W. D. Holley Plant Environmental Research Center (PERC) on the Colorado State University campus is celebrating its 35th year of operation. This year also marked the sixth year for the new annual trial garden site located at 1401 Remington Street, which is across the street from the new Center for the Arts at Colorado State University.

The annual trials at Colorado State University have no operating dollars directly allocated from state funds. Financial assistance, plant material and other miscellaneous material for trial operations have been donated by a number of sources. These sources include: various state horticulture industry associations, foundations, flower seed and vegetative producer companies, nurseries and greenhouse growers from across the nation. Some operational and staff dollars have come from the Colorado State Agricultural Experiment Station, Cooperative Extension, the College of Agricultural Sciences and the Department of Horticulture and Landscape Architecture.

The outdoor display and test areas were established to allow students, researchers, industry representatives, homeowners and extension personnel to learn, teach and evaluate horticultural research and demonstration projects in the Rocky Mountain/High Plains region. The annual flower trial garden and All American Selections (AAS) display and trial gardens are open to students, industry personnel and the public for viewing, gathering ideas about new varieties, studying the different growth habits, tolerances and visual characteristics of many annual flowering varieties.

The trial gardens at Colorado State University are an unique evaluation site because of our environmental conditions. The Rocky Mountain/High Plains region is known for its high altitude (approximately 5,200 feet), intense solar radiation, drying winds, potential for severe hailstorms, large fluctuations between day and night temperatures, season-long need for irrigation, and heavy clay soils.

Acknowledgements

The Department of Horticulture and Landscape Architecture and Colorado State University appreciate the support and donations given by the many seed/plant companies who participated in the 2006 Trials. Without their cooperation, the research reported here would not have been possible.

Both seed companies and vegetative growers participated in the 2006 trials by submitting seed varieties and vegetative materials for testing. The following are the flower companies and

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growers that participated in this year's trials: Ball Seed Co., Ball FloraPlant, Danziger Flower Farm - Israel, Ernst Benary of America, Inc., Bodger Seeds, Bodger Botanicals, Inc., Dummen, EuroAmerican Propagators, Fides North American, Fischer USA, Goldsmith Seeds, Jackson & Perkins Wholesale, Jelitto Perennial Seeds, Keift Seed Co., Oglevee Ltd., Pan American Seed Co., Plant Source International, Proven Winners Co., Sakata Seed Co., Cohen c/o Agrexco, Selecta First Class, Inc., Sygenta Seed and Cuttings, Inc., The Flower Fields – Paul Ecke Ranch, Welby Gardens Co. and Yoder Brothers, Inc.

Very special thanks go out to Welby Gardens Co. in Denver, Colorado. Welby Gardens germinated and grew all the seed propagated varieties at a very reduced cost for these trials. Welby Gardens also donated the slow release fertilizer used in the containers.

Thanks are also extended to Green Care Fertilizers, Inc. and Blackmore Company for the liquid fertilizer used in both outdoor trials and the greenhouse. We would like to thank Sun Gro Horticulture Inc. for providing the potting media for all the vegetatively propagated plants grown in the Colorado State University greenhouse. Scotts Inc. donated Osmocote 14-14-14 slow release fertilizer used in beds. Organix Supply, Inc., donated Pro Rich Fertilizer (14-5-5) that was used in the beds and surrounding turf areas just prior to planting.

Thanks also go to all the personnel who worked tirelessly on the day-to-day preparation and maintenance of the Annual Trial Garden. Special thanks go to undergraduate student Chris Copenhefer for his long hours of work and dedication as the 2006 Annual Trial Garden Coordinator. Also a special thanks goes to Heidi Moss as the assistant coordinator for the Annual Trial Garden. Much thanks also is given to summer-time employees Ashleigh Dewey, Willow Steen, Ryan Brown, Matt Reeder and Nicole Paul. Research Associate John Ray helped with pest control inside the greenhouses.

The Department of Horticulture and Landscape Architecture would also like to thank the Trial Garden Advisory Committee including: Ron Brum (Ball Seed Co.), Galen Doktor (Syngenta/S&G Flowers), Gary Douglas (Denver City Park Greenhouse), Al Gerace (Welby Gardens), Tracier Gray (Denver Botanic Gardens), David Hartley (CSU Department of Horticulture and L.A.), Harvey J. Lang (Fischer USA), Merle Moore (retired, Denver Zoological Gardens), Garth Penrod (High Plains Greenhouses), Wayne Pianta (PanAmerican Seed), Gene Pielin (Gulley Greenhouse), Diana Reavis (Eason Horticultural Resources); Mark Seguin (Fischer USA), Don Shelanskey (Michell's), Duane Sinning (Benary Seed), Celia Tannehill (Fort Collins Nursery), Mel Tessene (Hardy Starts Seed), Karl Trellinger (Fischer USA), John Williams (Tagawa Greenhouses), and Frank Yantorno (Center Greenhouse) for their advice and direction on the project throughout the year. Also special thanks goes to Celia Tannehill, Gary Douglas, and Mel Tessene for proofreading the 2006 final report.

Recognition must also be given to the Larimer County Master Gardeners who helped with the greenhouse planting and the outside bed planting. The department would also like to thank Research Associate David Staats for his substantial time, assistance and experience in the organization of the trials.

For further information on the Annual Trial Gardens at Colorado State University, feel free to write, call or e-mail:

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Cultural Data for the 2006 Annual Flower Trial Gardens

Dates of Plug Arrival

March	22 nd	Plant Source International: Geraniums
	24 th	Flower Fields by Ecke Ranch: Argyranthemum, Calibrachoa, Coleus, Impatiens (New Guinea, Double, SunImpatiens), Osteospermum, Pentas, Petunia, Verbena, & miscellaneous varieties
	29 th	Ball Flora Plant: Geranium (Ivy & Zonal), Impatiens (New Guinea, Exotic, Trailing) Selecta First Class: Geranium (Ivy & Zonal), Impatiens (New Guinea), Osteospermum
	31 st	Fischer USA: Argyranthemum, Calibrachoa, Diascia, Geranium (Exotic, Ivy, Zonal), Impatiens (Double, Mini, New Guinea, Trailing), Lobelia, Osteospermum, Penstemon, Petunia (Mini, Double, Spreading), Snapdragon, Verbena, Vinca, & miscellaneous varieties
April	5 th	Dummen: Geranium (Ivy, Zonal), Impatiens (New Guinea), Osteospermum
	7 th	Oglevee: Begonia, Geranium (Zonal) S & G Flowers: Diascia, Geranium (Ivy), Impatiens (New Guinea)
	10 th	Dummen: Begonia
	11 th	Ball Flora Plant: Argyranthemum, Calibrachoa, Lantana, Petunia (Spreading), Verbena, & miscellaneous varieties
	12 th	Selecta First Class: Angelonia, Argyranthemum, Bracteantha, Calibrachoa, Diascia, Nemesia, Petunia (Spreading, Mini, Double), Verbena, & miscellaneous varieties Jackson & Perkins: Calibrachoa, Fuschia, Petunia (Spreading), Torenia, Verbena & miscellaneous varieties.
	13 th	Yoder Brothers: Achillea & Coreopsis
	18 th	Ball Flora Plant: Ageratum, Diascia, Heuchera, Impatiens (Double), Purslane, Verbena & miscellaneous varieties Fides North America: Calibrachoa, Dianthus, Geranium (Zonal), Impatiens (New Guinea), Nemesia, Osteospermum, Petunia (Double, Spreading), Snapdragon & miscellaneous varieties
	20 th	Oglevee: Geranium (Exotic, Ivy, Zonal)
	21 st	S & G Flowers: Anagallis, Argyranthemum, Diascia, Geranium (Ivy, Zonal), Impatiens (Trailing), Osteospermum, Petunia (Spreading), Salvia & miscellaneous varieties Proven Winners: Argyranthemum, Browallia, Calibrachoa, Cleome, Coleus, Euphorbia, Lobelia, Nemesia, Phlox, Scaevola, Verbena, & miscellaneous varieties Cohen Nursery c/o Agrexco: Calibrachoa, Diascia, Lobelia, Verbena, & miscellaneous varieties Fischer USA: Impatiens (New Guinea)
May	3 rd	Danziger: Argyranthemum, Bacopa, Calibrachoa, Impatiens (Double, New Guinea), Jamesbrittiana, Petunia (Mini, Spreading), Torenia & Miscellaneous varieties

	5 th	Selecta First Class: Calibrachoa & miscellaneous varieties
	18 th	Proven Winners: Gerbera
		Welby Gardens: Geranium seed varieties are delivered
June	1 st	Yoder Brothers: Hibiscus
		Dummen: Verbena
	8 th	Miscellaneous seed varieties grown by Welby Gardens

Planting

Seeds from companies began arriving in January and vegetative material began arriving in late-March with the last vegetative shipment in early June. All seeds were sent to Welby Gardens for germination and transplanting into jumbo 6 packs. All vegetative varieties were potted into 4.5” pots as soon as they arrived. The seed varieties were delivered from Welby Gardens on June 8th and held in the greenhouse until the appropriate planting day. If enough plants were supplied, 24 of each cultivar were planted in two rows of 12 each. Five plants of each cultivar were planted in the containers.

Soil Amendments and Preparation[†]

All beds at the 1401 Remington Street site were raked clean of old mulch, planting material and weeds. Where necessary, Roundup[®] was sprayed on weeds. All beds were roto-tilled to a depth of 8”. After soil preparation the beds were crowned for better drainage and raked smooth, and top-dressed with Pro Rich Fertilizer (14-5-5). The fertilizer was supplied by Organix Supply, Inc., and applied at the rate of 1 pound N per 1000 square feet for all plantings. The top 5” of media were removed from each 20” container and replaced prior to fertilizing and planting. The 20” containers received 24.7g of Hardy Start Fertilizer (7-2-6) each. Osmocote[®] (14-14-14) was applied to all sun beds, including the All American Display Bed, and the “Best-Of” Bed at the rate of 9.5 grams/sq. ft. (suggested medium rate on label).

Bed Spacing

At the Annual Flower Trial Garden the Ivy, Seed and Zonal Geraniums were spaced at 15” within the variety and 20” spacing between the varieties; petunias were spaced at 20” within the variety and 28” between the varieties; calibrachoa were spaced at 15” within the variety and 15” between the varieties; verbenas were spaced at 16” within the variety and 20” between the varieties. All other varieties were spaced at 12” within the variety and 12” between varieties. Since all the beds at the Annual Flower Trial Garden site are curved some larger spacing occurred at the outside edges.

Planting Dates

May 25	All Zonal, Ivy, Exotics and Seed Geraniums planted.
May 31	Planting of vegetative Petunias, Calibrachoa, Osteospermum and Verbenas.
June 2	Planting of New Guinea Impatiens other vegetative Impatiens, and miscellaneous plants including: Coleus, Penstemon and Crossandra.

[†] No endorsement of products named is intended nor is criticism of products not mentioned.

- June 7 Planting of vegetative miscellaneous plants including: Argyranthemum, Diascia, Dianthus, Lobelia, Nemesis, Vinca, Pentas, Salvia, Angelonia, Snapdragons, Lantana, SunPatiens, and Cleome.
- June 9 Planting of seed varieties in shade and sun locations and shade containers.
- June 12-15 Planting of sun containers and other miscellaneous seed varieties.

Dates of Severe Weather

June 2nd through June 14th temperatures were at an extreme with highs in the upper 80's to the upper 90's with the hottest day on June 14th, 101.4°F. Unseasonably cool temperatures were observed on July 8th, 74.2 and July 9th, 62.0°F. More unseasonable hot weather was observed from July 11th through July 17th with highs in the mid to upper 90's with the hottest day on July 15th, 101.6°F. All summer temperatures were unseasonably warm. The dates listed were the longest periods of severely warm weather. There were several other days observed when temperatures were in the mid to upper 90's. The first killing frost was October 17th.

Fertilizer Applications (Indoors)

Greenhouse plant material was watered on an "as needed" basis. Greencare 14-4-14-3Ca-1Mg (100ppm), was applied to the New Guinea Impatiens. Other vegetative plant material received Greencare 14-4-14-3Ca-1Mg (200ppm). Fertilizer was injected into the irrigation water on a continuous basis.

Fertilizer Applications (Outdoors)

The beds were top dressed with Pro Rich Fertilizer (14-5-5). The fertilizer was supplied by Organix Supply, Inc., and applied at the rate of 1 pound N per 1000 square feet for all plantings. The 20" containers received 24.7g of Hardy Start Fertilizer (7-2-6) each. Osmocote[®] (14-14-14) was applied to all sun beds, including the All American Display Bed, and their "Best-Of" Bed at the rate of 9.5 grams/sq. ft. (suggested medium rate on label). Greencare 20-10-20 was used on the beds at the rate of 200 ppm twice a week and plain water application approximately once a week. Chelated iron (FeATURE 6-0-0, 10%Fe) at the rate of 3 lbs/100 gallons was applied to all callibrachos planted in beds July 6, 2006 and again on July 25, 2006.

Watering Schedule

Outdoor container trials were thoroughly hand watered after planting and then drip irrigated daily for 45 minutes. All ground beds were hand watered immediately after planting and then watered 2-3 times weekly. All beds in the Annual Gardens are zoned according to x, xx and xxx watering requirements. X rated beds are receiving 1.5" per week. XX rated beds are receiving 1" per week. XXX rated beds are receiving .5" per week. During the extreme heat in June and July watering increased based on the needs of individual beds and containers.

Weed Control

The herbicide Round Up[®] was applied two times prior to bed preparation. Hand weeding was continuous from June 20th. Wood chip mulch was applied to paths in mid-July.

Maintenance of Flowers

Deadheading: zonal and ivy geraniums and snapdragons were deadheaded July 5th. Deadheading was also done on July 12th, July 19th-20th, August 1st-2nd, August 13th-15th, & September 5th-8th. Plants were pinched and deadheaded as needed in the greenhouse prior to outdoor planting.

Pest Control in Greenhouse (prior to outdoor planting):

Banrot[®] was applied to all plugs immediately after arrival and prior to potting up. A drench of 6 oz per gallon was delivered to each plug tray as they arrived.

Other chemical treatments that were applied in the greenhouse as follows:

- May 1st: Cycocel[®] (chlormequat) applied to all geraniums (1 oz/gallon)
May 1st: Applied Medallion[®] to vincas to control pythium
May 1st: Applied Banrot[®] (etriadozole) to all calibrachos
May 2nd: B-Nine[®] WSG (daminozide) was applied to petunias and calibrachos at the rate of (1.1g/gallon)
May 10th: Cycocel[®] (chlormequat) applied to all geraniums (1 oz/gallon)
May 12th: PlantShield[®] HC (*trichoderma harzianum*), Companion (*Bacillus subtilis*) and Subdue[®] IIE (mefenoxam) applied to all plants to control/prevent root rot.
May 4th Imidacloprid (Marathon) and pymetrozine (Endeavor) applied for aphids in House 6 at PERC
May 16th : B-Nine[®] WSG (daminozide) was applied to petunias and calibrachos at the rate of (1.1g/gallon)

Pest Control in Outdoor Beds:

Flea Beetles were a problem on the cleome and mustard varieties but were controlled by using Conserve[®] and Marathon[®] II on June 15th. No other major pest problems were experienced to date (end of July 2006).

Disease Control in Outdoor Beds:

The Annual Flower Trial Garden has its own supplies and tools in order to reduce the potential spread of disease from other sites. In March 2006, the two beds that had xanthomonas problems in 2005 were fumigated with Vapam by Swingle Tree Company. No evidence of xanthomonas was detected in 2006. Petunias planted in the beds were drenched with Banrot[®] on July 12th to control pythium. Confirm[®] 2F, Perraguard[®] 50W and Marathon[®] II were put on Verbena June 14th to control for leafminer and powdery mildew. A few geranium plants were found to have botrytis on July 25th but it did not appear to be widespread but it was monitored in case further action would be needed for control. There were some calibrachos that died soon after planting and were replaced early in the summer but the problem seemed to persist (to a limited degree) through the summer. Some calibrachos and petunia plants were submitted to the CSU pathology lab on August 1st and lab tests indicated a problem with verticillium.

Disease Report on Greenhouse Plants:

Medallion[®] was applied to vinca on May 2nd to control some appearances of root rot. Besides the initial application of Banrot[®] on the arrival of the plugs, another application was applied to calibrachos on May 1st to control root rot. All plants were drenched with Companion[®], PlantShield[®] and Subdue[®] IIE on May 12th to help prevent root rot.

Data Collection Methods:

The performance data were collected by various methods. The same methods were utilized to evaluate all aspects of a variety's performance.

The trial evaluation day was held on August 1st. Approximately 60 judges consisting of industry representatives, master gardeners, university employees and trial garden advisory committee members evaluated the plant varieties for performance using a combination of these criteria:

Plant Quality:

- Uniformity of plant habit
- Bushy, well-branched shape versus open and leggy
- Healthy foliage (deep green versus chlorotic, yellow leaves)
- Foliage texture
- Disease resistance

Flower Quality:

- Flower power (number of flowers per plant, substance and holding power)
- Flower presentation (i.e. not hidden by the foliage)
- Color uniformity
- Stable color (resistance to fading) and stable pattern (for bicolor)
- Flower size and uniformity of flower
- Balance of color in a mixture

Overall Presentation:

- Overall "clean" look, versus visible spent blooms
- Fragrant flowers and/or foliage
- Good vigorous growth
- Resistance to climatic stress
- Novelty value of unique features
- Overall consumer appeal

Plant varieties were rated on a scale of 1 to 10 (1=very poor performance; 10=excellent performance). These numerical evaluations were used to calculate the average ratings for each variety in the trials. Participants were also encouraged to make comments and observations concerning each variety on the evaluation form.

Plant height and width measurements were taken during the growing season to chart relative growth performance. The first set of height and width measurements were taken in mid July and then again in August and the final occurred in mid-September.

Selection of "Best of..." and "Other Outstanding Plants" Winners

Ratings from all evaluators on August 7th were averaged and the top three in each category were placed on a preliminary list. A sub-committee of university and industry representatives reviewed the list and walked through the gardens again in early September to verify that they were superior over a period of time and not on just one day and then the final selections were made.

The “Best of...” award was given to a plant if there were at least ten cultivars in the same category and one was superior. “Plants Rated as Superior” was an award created to recognize other select plants that did not have ten cultivars in the same category but obviously had superior qualities and deserved to be recognized. Some plants were also “Rated as Superior” even if there was already a “Best of ...” winner in that category because it deserved special recognition.

Soil Analysis for Annual Flower Trials at Colorado State University for 2006

Bed	pH	E.C. Mmhos/cm	Lime Estimate	% OM	NO3 -N	P	K	Zn	Fe	Mn	Cu	Texture
Old Sun Beds 6/5/06	6.5	1.6	Low	16.5	16.2	250	883	33.8	181	19.2	7.1	Loam
Old Sun Beds 7/10/06	6.6	0.9	Low	22.0	38.5	254	765	37.0	206	19.9	6.0	Loam
Old Sun Beds 8/15/06	6.3	2.0	Low	23.5	155	237	667	26.7	148	7.7	6.5	Loam
Old Sun Beds 9/11/06	6.4	1.3	Low	31.8	114	259	699	29.3	162	11.5	5.2	Loam
New Sun Beds 7/10/06	6.9	0.9	Low	19.7	22.4	244	108 2	31.8	202	30.4	8.5	Loam
New Sun Beds 9/11/06	6.8	0.7	Low	25.8	11.1	240	808	21.5	185	15.0	9.4	Loam
Shade Beds 6/5/06	6.3	1.8	Low	19.7	28.6	220	626	29.8	194	23.3	6.0	Loam
Shade Beds 7/10/06	6.7	0.6	Low	20.2	17.0	220	460	28.4	238	32.4	3.0	Loam
Shade Beds 9/11/06	6.7	0.4	Low	31.8	7.7	190	363	22.9	236	16.1	22.1	Loam
Containers 9/11/06	6.5	0.7	Low	28.0	128	51.3	341	5.8	55.1	10.8	4.9	Loam

Monthly Temperature and Precipitation for 2006

Month	Avg. Maximum Temperature (F)	Avg. Minimum Temperature (F)	Precipitation (Inches)
May (20 th -31 st)	81.4 °F	51.1 °F	0.27
June	87.5 °F	55.7 °F	0.13
July	88.9 °F	61.5 °F	0.84
August	85.0 °F	58.2 °F	0.68
September	72.0 °F	44.7 °F	0.66

*Weather information for the Fort Collins area provided by the Colorado State University at:
http://ccc.atmos.colostate.edu/~coagmet/monsum_form.php