

shade. Plots were fertilized with controlled-release fertilizer at time of planting, oak-leaf mulch was applied and is re-applied as needed, soil moisture is monitored by in-ground tensiometers so each plot can be watered as needed and weeding is done at least once a month. Plant growth is rated, recorded and entered into the computer by the volunteers monthly. The experiment will be continued for a year to allow for plant growth and coverage of an area and to determine seasonal effects on the plants.

Plant survey and evaluation research. This long-term project is oriented toward finding somewhat elusive, preferably low-maintenance, crops which have the potential to be desirable ornamentals. The research team is collecting information about 'old-time' plants included on a preliminary list made during the first meeting of the group. Each team member is trying to locate specimen plants in area landscapes and identify the growing conditions. They are also checking on availability and quality of those plants in local garden centers during the prime planting seasons of spring

and fall, searching the literature for information about the listed plants, identifying persons with knowledge about the plants, and collecting photographs and propagules, whenever possible, of the plants. Plans are to follow up with some growth experiments of candidate plants and finally summarize findings into fact sheets that can be made available for public use.

Conclusions

The first Master Researcher class has proven to be rewarding to both the faculty involved and the "master researchers". A second set of participants received training in October 1993, and a waiting list has been started for the 1994-95 term. Refinements were made to both the concepts taught in the classroom and research projects, as is typical of any teaching/field experience, and time will tell just how beneficial the program is as a research-extension tool.

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EVALUATION OF SEED GERANIUM CULTIVARS FOR THE LANDSCAPE

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Abstract. Seed geranium (*Pelargonium* × *hortorum* L. H. Bailey) cultivars were evaluated based on days to flower, flower and umbel diameter, flower color, plant dimensions, uniformity, appearance, longevity and floriferousness during the spring and fall of 1992 and spring 1993. **Spring 1992:** Days from sowing to flower for 60 cultivars ranged from 96 to 115 days. 'Tetra Scarlet' was significantly later to flower than all other cultivars except 'Orange Appeal', which flowered at 112 days. Plant height ranged from 9.6 to 15.1 inches at the beginning of flowering. 'Pinto White' was taller than all other cultivars except 'Tetra Scarlet', 'Pinto Quicksilver' and 'Pinto Bicolor'. Umbel diameter ranged from 3.7 to 5.6 inches. 'Freckles' had the largest umbel diameter. At 111 days after

sowing, umbel number ranged from 1.0 to 11.5, with 'Multibloom Salmon' and 'Multibloom Pink' producing the greatest number of umbels. **Fall 1992:** Days from sowing to flower for 62 cultivars ranged from 85 to 136 days. 'Orange Appeal' flowered later than any other cultivar, and 'Tetra Scarlet', which flowered at 119 days, was also later than any other cultivar, except 'Orange Appeal'. Mature plant height ranged from 10.0 to 16.6 inches. 'Pinto White' was significantly taller than 38 other cultivars. Umbel diameter ranged from 3.3 to 5.2 inches. **Spring 1993:** The earliest cultivar to flower was 'Avanti White' at 85 days, while the latest was 'Tetra Scarlet' at 118 days. Mature plant height ranged from 10.6 to 14.8 inches with the 'Pinto' series being among the tallest. Umbel diameter ranged from 3.9 to 5.0 inches among the 60 cultivars. During the week 117 days after sowing seed, umbel number ranged from less than 1.0 to 19.3 per plant. All multiflora types had at least 5 umbels at this time.

Florida ranked eighth nationally in the quantity of potted seed geraniums (a.k.a. hybrid geranium) sold in 1992 (USDA, 1993). Since Florida-grown potted seed geraniums were sold at very low wholesale prices (\$0.60 for pots less than five inches and \$1.65 for pots at five inches or larger), Florida ranked only twelfth in wholesale value nationally. Potted seed geranium sales in Florida during 1992 were valued at \$1.22 million. Figures for flats of geranium produced in Florida are not reported separately.

Potted seed geraniums in Florida were produced in 1.3 million sq ft of space in 1992, up dramatically from 0.5 million sq ft in 1991 (USDA, 1993). The most pronounced increase occurred in a specific production niche. During 1992, the number of seed geraniums produced in Florida in pots under 5 inches more than tripled from production

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in 1991. There were 2.6 times more seed geraniums (1.65 million units) than cutting geraniums (0.64 million) used in pots under 5 inches. However, in pots at 5 inches or larger, seed geraniums accounted for 0.14 million units, while cutting geraniums accounted for 1.93 million units. Clearly there is a preference for the use of seed geraniums in smaller container sizes.

Problems long associated with seed geraniums since their initial release in the 1960's, such as smaller plants at time of sale, smaller flowers than cutting geraniums, and petal shattering have become almost a thing of the past (Armitage, 1986). Seed geraniums have persisted and their place in the greenhouse has expanded due to the ease of growing, fewer production costs, healthier plants, good garden performance and increasing color selection (Armitage, 1986). Dr. Richard Craig projected ten years ago that the geranium, both seed and cutting, would prosper and improve through the 1980's and 90's (Craig, 1983). His predictions included a doubling in the color range by 1990, shorter seed to flower interval approaching 70 days, and more compact plants which would eliminate the use of growth retardants. All these goals have not been met, but are being approached by plant breeders.

A survey of seed geraniums available nationally, which contained a listing of those recommended for use in Florida, was last published thirteen years ago (Black and Tjia, 1980) and reprinted later without revision (Black and Tjia, 1988). Few, if any, of the 26 hybrid geraniums on their list are still procurable today, and nearly all currently available cultivars, which number in the hundreds, are absent from this publication. This is evidence of the progressive activity in breeding hybrid geraniums in the last 15 years.

The last extensive field evaluations of seed geranium cultivars were conducted in west-central Florida in 1985 (Howe and Waters, 1986). These evaluations included 45 standard seed geranium entries. In view of the development and release of many new cultivars in various seed geranium classes since 1985, another set of field trials was undertaken at the University of Florida, Gulf Coast Research & Education Center in Bradenton, FL over three seasons during 1992 and 1993. At least 60 cultivars were examined each season and included standard, multiflora and tetraploid types.

Materials and Methods

Seeds of geranium cultivars were sown in flats filled with peat:vermiculite medium (1:1, v:v, amended with dolomite, superphosphate and hydrated lime). Seedlings were transplanted into 1.5 × 1.5 × 2.5-inch containerized cells filled with the previously mentioned medium. Transplants received soluble fertilizer as needed during production. No plant growth regulators were used in this study.

Beds of EauGallie fine sand were formed to a width of 32 inches, 8 inches high on 5 ft centers. Slow release fertilizer at 41.5 lb (1992) or 39.3 lb (1993) per 1000 sq ft of Osmocote® 18-2.6-11.2 (N-P-K) was incorporated over the full bed width to a depth of three to four inches. Beds were fumigated with 67% methyl bromide:33% chloropicrin and covered with white on black polyethylene. The area was irrigated by subsurface seepage via two ditches spaced 41 ft apart and parallel to the beds. These ditches also drained the field after rainfall.

Plants were set into beds on 12-inch centers with three staggered rows per bed on 27 Feb. 1992, 10 Oct. 1992 and 1 Mar. 1993. Four replications of six plants per cultivar were arranged in a randomized complete block design.

Insect pests were not problematic during the three seasons. Lepidopterous larvae were the pests that management practices focussed upon since population increases were potentially destructive to floral buds.

Plants were treated with fungicides preventatively, primarily to control foliar diseases and *Botrytis*. Plants were drenched with metalaxyl to control damping off. However, fatalities from plants rotting at the soil line and wilting were severe in the fall of 1992 and slight in the spring of 1993. In all cases the decline of plant vigor began as flowering started. Isolates predominately composed of *Fusarium* were identified from effected tissue, however pathologists were not convinced that the causal agent was in fact *Fusarium*. Other circumstances which may have contributed to damaged tissue at the soil line included the occurrence of high salt levels early in the fall of 1992 and a severe storm with winds gusting to 70 mph early in the spring of 1993. Plants in each instance may have survived until the stress of flowering overtaxed plant vigor.

Cultivars were evaluated for earliness of flowering, flower size and color, mature plant dimensions, umbel proliferation and other horticultural characteristics. Additionally, subjective ratings were given at least once a season where scores ranged from 0 for all plants being dead to 10 for excellent. Overall ratings were based on vigor, floriferousness, trueness to type, uniformity and mortality.

Results and Discussion

Weather conditions for the 1992 and 1993 seasons are found in Table 1. The only unusual circumstance, as mentioned previously, involved a severe storm in March of 1993.

Growth and performance parameters of seed geranium cultivars during the spring of 1992 appear in Table 2. The range of days to flowering among all entries was 96 to 115 days. Of the 60 cultivars in trial, only three were similar to 'Avanti White' in earliness to flower: 'Avanti Rose', 'Satellite Salmon Pink' and 'Avanti Lilac Rose'. 'Tetra Scarlet' was significantly later to flower than all other cultivars except 'Orange Appeal'.

Umbel diameter ranged from 3.7 to 5.6 inches. 'Freckles' had the largest umbel diameter, but often the umbels were

Table 1. Temperature and rainfall at the Gulf Coast Research and Education Center, Bradenton, FL during 1992-93 geranium trials (Stanley, 1993).

Month	Year	Daily average temperature (°F)		Rainfall (inches)
		Maximum	Minimum	
Mar	92	78	56	4.05
Apr	92	81	61	2.93
May	92	86	62	0.15
Oct	92	84	63	3.19
Nov	92	80	63	1.81
Dec	92	77	55	1.59
Mar	93	75	55	2.16
Apr	93	80	57	3.73
May	93	87	64	1.53

Table 2. Growth and performance of seed geranium cultivars in field beds during spring 1992.

Cultivar	Type ^z	Days to ^y flower	Divergence ^x of flowering	Flower ^w diameter (in.)	Umbel ^w diameter (in.)	Umbel ^w number	Plant ^w height (in.)	Plant ^w width (in.)	Overall ^v rating	
									1	2
Avanti White	M	96 ^u	13	1.6	4.5	8.2	11.5	12.5	7.3	4.0
Avanti Rose	M	97	9	1.8	4.3	6.5	11.2	14.3	8.5	4.8
Satellite Salmon Pink	S	98	12	1.5	4.0	7.2	10.3	11.9	5.3	3.8
Avanti Lilac Rose	M	101	10	1.8	4.7	4.1	11.4	14.1	8.8	6.3
Multibloom Pink	M	102	5	1.6	4.2	11.5	10.7	13.4	9.8	4.5
White Elite	S	103	5	1.5	4.2	1.6	11.5	13.4	8.8	5.3
Multibloom Salmon	M	103	12	1.7	3.9	11.5	10.7	12.6	9.8	5.5
Multibloom Scarlet	M	103	3	1.7	4.3	7.4	11.0	13.7	9.5	2.3
Multibloom Lavender	M	103	6	1.5	4.4	7.0	11.9	13.8	9.0	4.8
Avanti Salmon	M	104	8	1.6	3.8	4.5	10.0	10.3	4.3	3.3
Multibloom White	M	104	7	1.7	4.0	3.6	11.4	13.4	6.3	3.5
Avanti Scarlet	M	104	7	1.7	3.8	5.7	10.6	11.9	5.3	3.0
Multibloom Scarlet Eye	M	104	4	1.7	4.2	6.8	11.3	13.3	6.0	3.8
Salmon Orbit	S	104	3	1.8	4.1	2.1	11.1	12.9	9.5	8.3
Multibloom Red	M	104	4	1.6	4.2	5.0	10.7	11.2	9.5	4.5
Red Elite	S	104	4	1.9	4.3	2.1	11.1	11.9	8.8	6.3
Avanti Light Salmon	M	105	5	1.6	3.9	5.5	10.9	11.6	3.5	1.5
Satellite Salmon Orange	S	105	4	1.8	4.1	1.9	12.4	13.7	7.3	3.5
Avanti Red	M	105	6	1.9	4.3	6.8	10.7	12.0	6.3	2.8
Hot Pink Orbit	S	105	3	1.7	4.7	1.8	11.9	13.6	10.0	8.3
Pinto Blush	S	105	3	1.6	4.2	2.1	12.7	14.4	9.8	7.3
Violet Orbit	S	105	3	1.6	4.3	1.6	11.1	13.1	9.3	6.0
Light Salmon Orbit	S	105	4	1.5	4.1	2.0	12.0	14.0	9.3	7.3
Geronimo	S	105	3	1.7	4.2	2.1	11.4	12.6	9.0	4.8
Neon Rose Improved	S	105	3	1.8	4.5	2.0	12.6	13.7	8.5	6.0
Pinto Scarlet	S	105	2	1.7	4.0	2.0	11.3	12.6	7.3	4.0
Salmon Elite	S	105	3	1.8	3.9	1.8	10.9	13.6	8.5	5.8
Ringo Deep Scarlet	S	105	2	1.7	3.8	1.5	11.0	12.9	8.3	4.3
Satellite Carmine	S	105	3	1.7	4.0	1.8	12.3	13.7	5.5	3.8
Signal Orange	S	105	3	1.6	3.8	1.9	10.6	12.2	4.3	0.3
Pinto Bicolor	S	105	7	1.9	4.2	2.0	12.9	14.4	8.5	6.3
Rose Orbit	S	105	4	1.6	4.5	1.8	12.0	14.5	8.3	6.0
Glow Orbit	S	105	2	1.7	4.2	1.8	11.0	13.0	9.0	3.0
Ringo Rose	S	105	2	1.6	4.5	1.9	11.5	13.7	8.5	5.8
Pinto Red	S	106	4	1.7	4.4	2.0	12.3	14.1	8.5	4.5
Pink Orbit	S	106	3	1.5	4.1	1.8	12.1	13.2	9.0	5.8
Deep Salmon Orbit	S	106	2	1.5	4.0	1.4	11.3	13.5	9.0	8.0
Ringo Salmon	S	106	4	1.5	4.1	1.8	10.1	12.2	9.0	5.0
Pinto Salmon	S	106	6	1.6	4.3	2.0	11.1	14.0	9.0	6.0
Pinto Violet	S	106	3	1.9	4.5	1.7	11.3	13.1	8.0	2.8
Pinto Quicksilver	S	106	5	1.7	4.1	1.9	13.5	16.5	8.3	5.8
Scarlet Orbit	S	106	4	1.8	4.3	1.6	10.8	11.7	6.5	3.3
Appleblossom Orbit	S	106	4	1.5	4.1	1.7	11.7	13.2	8.8	4.8
Satellite Scarlet	S	106	4	1.8	3.7	1.7	11.3	13.3	8.0	3.0
Pinto White	S	106	3	1.5	4.2	1.9	15.1	15.1	8.0	6.5
Scarlet Elite	S	106	4	1.7	4.4	1.5	10.8	12.8	8.0	2.5
Multibloom Bright Rose	M	106	6	1.8	4.4	1.9	11.6	13.4	9.0	3.0
Saturn Flare	S	106	5	1.8	4.5	1.2	11.0	12.2	7.0	6.3
Cherry Elite	S	106	4	1.8	4.4	1.7	10.6	11.8	7.8	2.0
Cardinal Orbit	S	106	2	1.8	4.2	1.3	10.7	11.6	6.5	5.3
Satellite Red & White	S	106	5	1.8	4.2	1.5	12.0	13.3	7.3	4.0
Pink Elite	S	107	5	1.6	4.2	1.7	10.1	12.9	8.3	5.8
Freckles	4N	107	13	1.6	5.6	1.8	9.6	12.1	8.8	5.3
Orchid Orbit	S	108	4	1.6	4.1	1.3	11.4	12.7	8.0	5.5
Red Orbit	S	108	6	1.8	4.3	1.1	10.7	13.1	8.0	5.8
Coral Orbit	S	108	2	1.6	4.2	1.1	11.2	13.1	9.3	8.0
Scarlet Eye Orbit	S	108	4	1.6	4.2	1.1	11.3	12.7	8.8	6.8
Saturn Bright Eyes	S	108	5	1.8	4.3	1.1	12.5	14.0	9.0	8.0
Orange Appeal	S	112	17	1.7	3.9	1.0	12.6	15.0	7.0	4.3
Tetra Scarlet	4N	115	15	1.9	4.8	1.0	14.0	15.3	8.3	8.3
HSD (5%)		5	11	0.3	0.6	2.6	2.2	3.2	3.9	4.7

^zM = multiflora, S = standard, 4N = tetraploid.^yFrom sowing 10 January 1992.^xNumber of days between when the first plant in the plot flowered until the last.^wMeasured 29 and 30 April, 1992.^vRating 1 on 4 May 1992, Rating 2 on 2 June 1992. Rating scale: 0 = all plants dead, 1 = very poor, 5 = poor enough for landscape removal, 8 = good, 9 = very good, 10 = excellent.^uMean separation by Tukey's procedure, HSD 5% level.

Table 3. Growth and performance of seed geranium cultivars in field beds during fall 1992.

Cultivar	Type ²	Days to ³ flower	Divergence ⁴ of flowering	Number of plants	Flower ^w diameter (in.)	Umbel ^w diameter (in.)	Plant ^w height (in.)	Overall ^v rating
Avanti White	M	85 ^u	19 ^u	8	1.5 ± 0.0 ^t	4.0 ± 0.4 ^t	11.3 ± 1.5 ^t	2.6 ^u
Multibloom Lavender	M	88	18	12	1.5 ± 0.1	4.4 ± 0.3	11.8 ± 1.2	5.4
Multibloom Pink	M	90	22	17	1.4 ± 0.1	3.8 ± 0.3	11.6 ± 1.2	6.8
Multibloom Salmon	M	93	14	13	1.6 ± 0.1	3.5 ± 0.4	10.0 ± 1.2	5.1
Avanti Lilac Rose	M	93	24	6	1.7 ± 0.1	4.6 ± 0.5	13.9 ± 1.8	2.3
Avanti Rose	M	96	14	7	1.6 ± 0.2	4.1 ± 0.5	11.7 ± 1.2	2.9
Multibloom Red	M	97	11	14	1.4 ± 0.1	3.6 ± 0.4	10.9 ± 0.9	5.5
Multibloom Scarlet Eye	M	97	6	14	1.5 ± 0.1	3.9 ± 0.4	12.6 ± 0.9	5.4
Avanti Light Salmon	M	97	5	3	1.5 ± 0.0	3.8 ± 0.4	11.3 ± 0.6	0.6
Satellite Salmon Pink	S	97	8	2	1.3 ± 0.0	3.3 ± 0.4	11.0 ± 1.4	0.5
Glow Orbit	S	97	2	15	1.7 ± 0.2	4.5 ± 0.4	12.8 ± 1.1	5.9
Multibloom Scarlet	M	98	3	6	1.4 ± 0.1	4.0 ± 0.6	11.1 ± 0.9	2.8
Avanti Salmon	M	98	3	6	1.5 ± 0.1	3.7 ± 0.5	12.0 ± 1.1	2.6
Signal Orange	S	99	4	5	1.6 ± 0.2	4.3 ± 0.6	12.7 ± 1.9	2.1
Pinto Red	S	99	4	4	1.4 ± 0.1	4.2 ± 0.7	13.8 ± 2.5	2.1
Ringo Deep Scarlet	S	99	4	6	1.5 ± 0.2	4.5 ± 0.8	12.8 ± 1.3	2.4
Avanti Scarlet	M	99	6	9	1.5 ± 0.1	3.6 ± 0.4	12.5 ± 0.7	3.5
Pinto Salmon Orange	S	99	9	15	1.5 ± 0.1	4.6 ± 0.4	16.0 ± 1.6	6.6
Scarlet Elite	S	99	7	18	1.7 ± 0.2	4.5 ± 0.4	12.7 ± 1.4	7.1
Pinto Bicolor	S	99	5	8	1.8 ± 0.1	4.6 ± 0.2	15.1 ± 1.8	3.8
Rose Orbit	S	99	5	15	1.6 ± 0.1	5.2 ± 0.3	14.9 ± 1.3	6.8
Avanti Red	M	99	4	7	1.5 ± 0.3	4.4 ± 1.1	12.6 ± 1.2	2.8
Saturn Flare	S	99	5	4	1.6 ± 0.2	4.2 ± 1.0	12.8 ± 2.2	1.3
Salmon Orbit	S	100	12	9	1.5 ± 0.2	4.3 ± 0.6	12.1 ± 0.6	4.1
Red Elite	S	100	8	11	1.8 ± 0.1	4.7 ± 0.5	12.5 ± 1.2	5.0
Pinto Quicksilver	S	100	7	8	1.6 ± 0.1	4.7 ± 0.3	14.8 ± 1.2	4.0
Neon Rose Improved	S	100	4	12	1.7 ± 0.1	4.8 ± 0.4	15.4 ± 1.4	4.9
Pinto Rose	S	100	5	7	1.6 ± 0.1	4.8 ± 0.6	14.4 ± 1.1	3.4
Pink Orbit	S	100	6	10	1.5 ± 0.2	5.2 ± 0.4	14.9 ± 1.5	4.4
Hot Pink Orbit	S	100	3	16	1.6 ± 0.2	4.5 ± 0.5	14.4 ± 1.2	6.4
Deep Salmon Orbit	S	100	8	13	1.4 ± 0.1	4.4 ± 0.6	13.3 ± 1.8	5.5
Satellite Scarlet	S	101	6	12	1.5 ± 0.1	3.7 ± 0.8	14.3 ± 2.2	4.5
Appleblossom Orbit	S	101	6	16	1.5 ± 0.1	4.8 ± 0.6	13.4 ± 1.6	6.5
White Elite	S	101	6	9	1.6 ± 0.3	4.1 ± 0.7	13.8 ± 1.3	4.5
Light Salmon Orbit	S	101	10	11	1.5 ± 0.1	4.2 ± 0.6	14.5 ± 1.4	5.3
Pinto Violet	S	101	5	16	1.8 ± 0.1	5.0 ± 0.4	15.1 ± 1.6	7.0
White Orbit	S	101	5	11	1.5 ± 0.1	4.5 ± 0.4	14.8 ± 1.6	4.1
Satellite Carmine	S	101	11	9	1.6 ± 0.1	4.7 ± 0.7	15.3 ± 1.8	3.8
Pinto Scarlet	S	101	5	18	1.4 ± 0.1	4.4 ± 0.4	14.8 ± 1.8	7.3
Orchid Orbit	S	101	9	4	1.6 ± 0.1	4.5 ± 0.7	12.9 ± 3.1	1.6
Pinto Salmon	S	101	8	8	1.8 ± 0.0	4.5 ± 0.2	15.4 ± 1.7	3.5
Pink Elite	S	101	6	13	1.5 ± 0.2	4.1 ± 0.6	12.4 ± 1.8	5.9
Ringo Rose	S	102	11	9	1.5 ± 0.2	4.5 ± 0.4	12.7 ± 1.0	3.8
Ringo Salmon	S	102	10	2	1.3 ± 0.4	4.1 ± 1.2	10.5 ± 3.5	0.6
Satellite Salmon Orange	S	102	15	10	1.8 ± 0.2	4.8 ± 1.0	13.6 ± 1.5	4.6
Multibloom White	M	102	6	5	1.7 ± 0.1	4.2 ± 0.4	13.3 ± 1.8	1.9
Satellite Red & White	S	102	8	11	1.7 ± 0.2	4.5 ± 0.6	15.1 ± 1.5	4.6
Multibloom Bright Rose	M	103	7	9	1.5 ± 0.1	4.4 ± 0.3	13.9 ± 0.9	3.8
Pinto White	S	103	5	17	1.6 ± 0.2	4.5 ± 0.4	16.6 ± 1.2	7.1
Saturn Bright Eyes	S	103	7	20	1.6 ± 0.2	4.8 ± 0.5	15.1 ± 1.5	7.5
Geronimo	S	103	7	9	1.6 ± 0.1	4.4 ± 0.6	12.9 ± 1.2	4.0
Scarlet Eye Orbit	S	103	7	10	1.5 ± 0.2	4.3 ± 0.8	12.3 ± 2.1	3.6
Salmon Elite	S	103	14	7	1.6 ± 0.3	4.1 ± 0.8	13.1 ± 2.7	2.4
Violet Orbit	S	103	16	13	1.6 ± 0.1	4.5 ± 0.4	12.4 ± 1.3	4.9
Red Orbit	S	103	12	15	1.7 ± 0.2	4.6 ± 0.4	13.4 ± 1.3	6.4
Pinto Blush	S	105	15	10	1.5 ± 0.1	4.7 ± 0.6	15.5 ± 1.9	4.6
Coral Orbit	S	105	12	14	1.5 ± 0.2	4.1 ± 0.5	12.5 ± 1.5	5.6
Scarlet Orbit	S	105	13	9	1.7 ± 0.2	4.8 ± 0.7	14.6 ± 1.3	4.0
Cardinal Orbit	S	106	14	4	1.8 ± 0.0	4.8 ± 0.3	14.0 ± 0.8	2.3
Freckles	4N	108	13	7	1.5 ± 0.2	4.8 ± 1.2	11.1 ± 1.2	3.0
Tetra Scarlet	4N	119	22	11	1.9 ± 0.3	4.6 ± 0.8	13.0 ± 2.5	4.3
Orange Appeal	S	136	15	8	1.6 ± 0.1	4.1 ± 0.1	13.4 ± 1.9	3.0
HSD (5%)		7	17					6.4

²M = multiflora, S = standard, 4N = tetraploid.³From sowing 29 July 1992.⁴Number of days between when the first plant in the plot flowered until the last.^wMeasured 3 December 1992.^vRating on 22 December 1992.^uMean separation by Tukey's procedure, HSD 5% level.^tMean comparison by standard deviation.

Table 4. Growth and performance of seed geranium cultivars in field beds during spring 1993.

Cultivar	Type ^z	Days to ^y flower	Divergence ^x of flowering	Flower ^w diameter (in.)	Umbel ^w diameter (in.)	Umbel ^w number	Plant ^w height (in.)	Plant ^w width (in.)	Overall ^v rating	
									1	2
Avanti White	M	85 ^u	8	1.6	4.9	10.4	12.0	15.3	7.0	4.5
Avanti Rose	M	91	12	1.7	4.5	8.9	11.7	16.9	9.4	9.8
Avanti Lilac Rose	M	94	10	1.7	5.0	7.9	12.2	17.8	8.5	7.0
Multibloom Salmon	M	94	14	1.6	4.3	19.3	11.5	16.8	9.6	9.3
Multibloom Lavender	M	97	10	1.7	4.7	8.2	11.8	15.3	8.5	9.5
Multibloom Pink	M	99	10	1.5	4.6	17.1	12.0	16.5	9.9	10.0
Premium Mix	S	100	14	1.7	4.9	15.7	13.1	19.5	6.8	7.8
Avanti Scarlet	M	101	9	1.7	4.7	11.6	11.6	16.7	6.5	6.3
Multibloom Scarlet Eye	M	101	10	1.5	4.6	11.5	11.2	16.5	3.3	1.8
Avanti Light Salmon	M	102	10	1.4	4.3	10.8	11.4	15.1	1.8	1.3
Multibloom Scarlet	M	102	11	1.6	4.6	11.2	12.3	17.9	7.8	8.0
Avanti Salmon	M	103	11	1.7	4.3	6.5	10.9	13.8	1.8	0.5
Avanti Red	M	103	14	1.8	4.7	10.6	11.8	16.7	6.8	4.3
Ringo 2000 White	S	103	7	1.7	4.8	3.2	14.5	16.7	9.0	9.0
Ringo 2000 Salmon	S	103	12	1.6	4.4	10.1	12.7	18.2	9.3	8.5
Multibloom Red	M	104	4	1.6	4.6	11.7	12.3	15.7	6.5	6.3
Multibloom White	M	104	19	1.6	4.2	7.3	12.2	15.6	6.5	6.0
Ringo 2000 Deep Scarlet	S	105	7	1.6	4.5	4.6	13.3	15.9	8.3	7.5
Experimental Red Improved	S	107	4	1.6	5.0	2.2	10.6	12.8	5.5	5.8
White Elite	S	107	4	1.7	4.4	1.9	13.1	15.2	8.8	8.8
Ringo 2000 Light Salmon	S	107	4	1.7	4.8	1.5	12.6	14.5	7.6	6.3
Pinto Red	S	107	3	1.4	4.7	2.7	12.8	13.7	3.5	3.3
Satellite Salmon Orange	S	108	7	1.6	4.5	1.7	12.7	12.8	4.5	5.8
Pinto Quicksilver	S	108	3	1.6	4.5	2.1	14.7	16.7	9.0	9.0
Pinto Bicolor	S	108	6	1.8	4.5	2.3	13.4	15.2	6.8	6.8
Experimental Light Salmon	S	108	6	1.5	4.7	2.1	14.0	16.7	9.8	10.0
Pinto Violet	S	108	4	2.1	4.7	1.7	13.1	16.2	8.9	8.8
Light Salmon Orbit	S	108	5	1.5	3.9	1.8	12.0	14.9	7.8	8.0
Glow Orbit	S	108	5	1.7	4.6	2.0	11.8	14.7	8.4	7.0
Satellite Scarlet	S	109	8	1.7	4.3	2.1	13.3	15.1	7.3	6.8
Ringo 2000 Violet	S	109	4	1.7	4.5	1.4	12.4	12.3	4.9	4.8
Neon Rose Improved	S	109	4	1.7	4.7	2.0	14.1	14.6	7.3	6.3
White Orbit	S	109	6	1.5	4.5	1.9	13.5	16.6	8.0	7.0
Hot Pink Orbit	S	109	5	1.6	4.7	2.2	12.8	14.3	9.3	8.8
Cherry Elite	S	109	4	1.7	4.7	2.3	12.2	12.8	7.9	7.3
Scarlet Elite	S	109	4	1.7	4.4	1.8	11.7	13.8	8.6	9.0
Experimental Rose	S	109	4	1.7	4.7	1.9	12.4	16.0	9.6	9.8
Salmon Orbit	S	109	5	1.8	4.4	1.8	12.0	13.4	8.9	10.0
Red Elite	S	109	6	1.8	4.4	2.3	11.2	12.6	8.0	8.0
Cardinal Orbit	S	109	3	1.8	4.5	1.1	10.8	11.6	5.5	3.8
Salmon Elite	S	109	5	1.7	4.0	1.9	11.5	14.5	7.4	7.3
Pinto Salmon Orange	S	109	5	1.6	4.7	1.9	14.3	15.8	8.3	7.8
Signal Orange	S	109	6	1.6	4.2	1.8	11.7	12.5	5.5	0.8
Scarlet Orbit	S	109	6	1.8	4.6	1.0	11.4	12.2	5.3	3.5
Pink Orbit	S	109	5	1.5	4.4	1.5	12.3	13.1	8.0	7.5
Multibloom Bright Rose	M	110	4	1.7	4.6	5.3	12.4	16.0	8.0	8.3
Rose Orbit	S	110	3	1.6	4.7	1.7	12.5	14.2	8.0	8.8
Violet Orbit	S	110	5	1.6	4.5	1.5	11.5	13.6	8.8	8.8
Appleblossom Orbit	S	110	4	1.6	4.3	1.5	12.0	14.8	8.3	8.8
Pinto Blush	S	110	4	1.5	4.5	2.5	14.8	16.7	9.5	9.3
Deep Salmon Orbit	S	110	6	1.5	4.1	1.4	11.7	14.9	8.9	8.3
Pink Elite	S	111	4	1.6	4.3	1.7	11.2	15.2	9.3	9.5
Cherry Orbit	S	111	4	1.7	4.5	1.2	12.3	13.4	8.3	8.3
Cameo	S	112	7	1.7	4.1	0.9	12.4	14.4	6.0	4.5
Red Orbit	S	112	5	1.7	4.4	1.0	11.5	13.3	9.0	8.8
Coral Orbit	S	112	9	1.7	4.2	1.0	11.8	13.9	8.9	9.8
Orchid Orbit	S	112	7	1.7	4.5	1.1	11.8	13.2	6.6	5.8
Orange Appeal	S	113	7	1.7	4.5	1.5	11.2	14.1	8.6	8.3
Scarlet Eye Orbit	S	113	5	1.8	4.5	1.2	12.3	13.7	8.9	9.5
Tetra Scarlet	4N	118	8	1.8	4.7	0.8	12.5	13.8	6.3	7.8
HSD (5%)		4	10	0.4	0.7	3.6	2.1	3.8	4.4	5.4

^zM = multiflora, S = standard, 4N = tetraploid.^yFrom sowing 7 January 1993.^xNumber of days between when the first plant in the plot flowered until the last.^wMeasured 3-7 May 1993.^vRating 1 on 5 May 1993, Rating 2 on 25 May 1993. Rating scale: 0 = all plants dead, 1 = very poor, 5 = poor enough for landscape removal, 8 = good, 9 = very good, 10 = excellent.^uMean separation by Tukey's procedure, HSD 5% level.

not round. At 111 days after sowing, umbel number ranged from 1.0 to 11.5, with 'Multibloom Salmon' and 'Multibloom Pink' producing the most. All multiflora types produced more than three umbels at this time except 'Multibloom Rose'. The only standard seed geranium to produce more than three umbels at 111 days was 'Satellite Salmon Pink' which averaged 7.2 umbels per plant.

Mature plant height ranged from 9.6 to 15.1 inches, with the 'Pinto' series being generally tallest. 'Pinto White' was significantly taller than all others except 'Tetra Scarlet', 'Pinto Quicksilver' and 'Pinto Bicolor'.

Subjective ratings were assigned at 116 and 145 days after sowing. On the first date, ratings ranged from 3.5 to 10.0. 'Satellite Carmine', 'Satellite Salmon Pink', 'Avanti Scarlet', 'Signal Orange', 'Avanti Salmon' and 'Avanti Light Salmon' were rated significantly lower than 'Hot Pink Orbit', 'Multibloom Salmon', 'Pinto Blush', 'Multibloom Pink', 'Multibloom Red', 'Salmon Orbit' and 'Multibloom Scarlet'. On the second date, ratings ranged from 0.3 to 8.3 with 'Scarlet Elite', 'Multibloom Scarlet', 'Cherry Elite', 'Avanti Light Salmon' and 'Signal Orange' rated significantly lower than 'Hot Pink Orbit', 'Tetra Scarlet', 'Salmon Orbit', 'Deep Salmon Orbit', 'Saturn Bright Eyes', 'Coral Orbit', 'Light Salmon Orbit' and 'Pinto Blush'.

Table 3 contains information from fall 1992. Of the 62 cultivars, 'Orange Appeal' flowered later than any other at 136 days from sowing and 'Tetra Scarlet' which flowered at 119 days was also later to flower than any other cultivar, except 'Orange Appeal'. The range among all cultivars was 85 to 136 days. Only two cultivars were similar to 'Avanti White' in earliness to flower: 'Multibloom Lavender' and 'Multibloom Pink'.

Due to plant losses from wilt, data collected on the flower and plant dimensions were analyzed based on the number of surviving plants in the test area. Umbel diameter ranged from 3.3 to 5.2 inches with 38 cultivars not significantly different than 'Rose Orbit'. 'Pinto White' was taller than 38 other cultivars at 16.6 inches. Overall ratings assigned 147 days after sowing ranged from 0.5 to 7.5 with 'Ringo 2000 Salmon', 'Avanti Light Salmon' and 'Satellite Salmon Pink' rated significantly lower than 'Satellite Bright Eyes', 'Pinto Scarlet', 'Pinto White' and 'Scarlet Elite'.

Growth and performance data for spring 1993 are found in Table 4. The earliest cultivar to flower was 'Avanti White' at 85 days from sowing, while the latest was 'Tetra Scarlet' at 118 days. Greatest divergence of flowering was pronounced among the multiflora types. Umbel diameter ranged from 3.9 to 5.0 inches among the 60 cultivars. All but 14 cultivars were similar to 'Avanti Lilac Rose' in large umbel size. At 117 to 121 days after sowing, umbel number ranged from less than one to 19.3 per plant. All multiflora types had at least five umbels at this time. 'Premium Mix' and 'Ringo 2000 Salmon' demonstrated multiflora traits by producing 15.7 and 10.1 umbels per plant, respectively.

Mature plant height ranged from 10.6 to 14.8 inches, with the 'Pinto' series being among the tallest, as in 1992. Overall ratings were given at 120 and 139 days after sowing. At 120 days, ratings ranged from 1.8 to 9.9 with 'Multibloom Scarlet Eye', 'Avanti Light Salmon' and 'Avanti Sal-

mon' being rated significantly lower than 36 other cultivars. At 139 days, ratings ranged from 0.5 to 10.0 with 'Avanti Salmon', 'Signal Orange', 'Avanti Light Salmon' and 'Multibloom Scarlet Eye' rated significantly lower than 36 other cultivars.

A combined analysis of the 47 cultivars common to both spring seasons showed highly significant differences among cultivars and between years for all measured parameters. Also significant interactions between years and cultivars were found for all parameters. Thus single season analyses were necessary.

Summary

Multiflora and standard seed geraniums were different in the number of umbels produced per plant in the spring seasons. At a time shortly after flowering began, standard seed geranium generally had one to two umbels, while multiflora types had umbel numbers in the teens. The exceptions to this difference in geranium types were some of the colors of the 'Ringo 2000' series and 'Premium Mix', both evaluated only during the spring of 1993, and 'Satellite Salmon Pink' evaluated in the spring of 1992. The 'Ringo 2000' series is a newly improved version of the 'Ringo' series of standard seed geranium. 'Premium Mix' geranium has a unique plant growth habit (more sprawling) and flower form (open umbels, petals separated on individual flowers) different from anything else in the trials and might reasonably be classified as a separate type.

'Tetra Scarlet' tetraploid seed geranium was the latest to flower of all types of seed geranium evaluated, except 'Orange Appeal'. Multiflora seed geranium had a tendency to bloom earlier than standard seed geranium in the spring, but this was not the case in the fall.

Individual cultivars within each series should be considered separately since not all colors in a series performed similarly. Selections of cultivars for landscape use need to be made based on preference for floral color, the number of umbels displayed, plant habit and size, and flower form. Overall ratings for performance should then be considered to assess the level of satisfaction the cultivar might be expected to provide in the landscape. Earliness to flower may be more of a concern to the commercial producer since earlier flowering means less time in the greenhouse before shipment.

Literature Cited

- Armitage, A. M. 1986. Seed propagated geraniums. Timber Press Growers Handbook Series. Vol. 1. Portland, OR.
- Black, R. J. and B. Tjia. 1980. Geraniums for Florida. Fla. Coop. Ext. Serv. Circ. 472.
- Black, R. J. and B. Tjia. 1988. Geraniums for Florida. Fla. Coop. Ext. Serv. Circ. 472.
- Craig, R. M. 1983. Geraniums for the 80's. Florists' Rev. 173:21-24.
- Howe, T. K. and W. E. Waters. 1986. Evaluation of seed propagated geranium: Spring and Fall, 1985. Proc. Fla. State Hort. Soc. 99:164-171.
- Stanley, C. D. 1993. Weather report for 1992. Bradenton GCRC Res. Rept. BRA1993-1.
- United States Dept. Agric. 1993. Floriculture Crops 1992 Summary. Nat'l. Agric. Statistics Serv., USDA, Washington, DC.