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Evaluation and Scheduling of Snapdragon Cultivars



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*Information contained herein is available to all persons
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EVALUATION AND SCHEDULING OF SNAPDRAGON CULTIVARS

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MARKET DEMANDS, low energy costs of production (13), and recent advances in breeding and culture have made the snapdragon, *Antirrhinum majus* L., a promising florist crop for Alabama. A summer-flowering perennial native to the Mediterranean, the snapdragon was developed into a successful cool temperature greenhouse crop in the early 1900's; however, few available cultivars grew satisfactorily under Alabama's high light intensity and temperature conditions. In the early 1950's breeders recognized that the growth of snapdragon cultivars was genetically dependent on temperature, light intensity, and photoperiod. High temperature, high light intensity, and long photoperiod cultivars were developed, and snapdragons were classified into four response groups based on their optimum flowering period for commercial production under conditions in the Northern United States (1).

Group I cultivars produce quality stems and spikes at 50°F minimum temperatures under low-light intensity and short days of mid-winter.

Group II cultivars are best adapted to light and temperature conditions occurring between February 15 and May 10.

Group III cultivars produce quality stems and spikes during the late spring and fall.

Group IV cultivars do best under high temperature, high light intensity, and long days normally experienced during the summer months.

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By using appropriate cultivars, year-round production of snapdragons has been achieved in most of the major producing areas: Colorado (5), Florida (7,8), Michigan (4), Missouri (9,10,11), Oklahoma (6), and Pennsylvania (14). Most of the information on cultural practices, cultivars, and scheduling is for year-round production in greenhouses in the Northern United States or cloth houses in Florida. Cultural information and schedules are lacking for Southern culture.

This report considers 17 years of research on the performance of various cultivars from the four groups grown under greenhouse conditions at the Alabama Agricultural Experiment Station of Auburn University.

All four groups of cultivars were tested. Group III cultivars were also evaluated for year-round culture; all other groups, with some exceptions, were usually scheduled to flower during their optimum flowering period as outlined by Ball (3).

Group I cultivars were evaluated in an experiment conducted in a low temperature (thermostat at 45°F) plastic greenhouse in 1969 and in a glass greenhouse at a minimum night temperature of 62°F in 1976 and 1980. All other cultivar groups were grown in a glasshouse at a minimum night temperature of 62°F when possible. The glasshouse was air-cooled by a fan and pad system with a thermostat set at 72°F from May to October. Plants were grown in full sun from October to May and shaded lightly (approximately 10 percent) from May to October. Monthly mean temperature, solar radiation, and daylength for Auburn, Alabama, latitude 32°34' N, longitude 85°31' W, taken from Auburn University micro-meteorological data (2), are shown in table 1.

Seeds of the various cultivars were sown in peat-lite medium (Jiffy Mix from Jiffy Products of America, West Chicago, Illinois) and mist propagated at 70°F approximately 3 to 4 weeks prior to transplanting into a steam pasteurized 1:1:1 ratio (by volume) of soil, peat, perlite medium. Plants were spaced 16 square inches per plant and grown single stem. The seedlings were treated at transplanting with Terrachlor™ at the rate of 8 ounces per 100 gallons to prevent disease. All crops received borax at the rate of ½ ounce per 100 square feet to prevent boron deficiency. Fertilization generally consisted of 2 pounds of either 25-10-10 or 20-20-20 per 100 gallons every 2 weeks.

TABLE 1. MONTHLY MEAN TEMPERATURE, SOLAR RADIATION, AND DAYLENGTH, AUBURN, ALABAMA, LATITUDE 32°34' N, LONGITUDE 85°31' W

Month	Temperature ¹		Solar ² radiation 1972	Daylength ³ sunrise to sunset
	Average daily maximum	Average daily minimum		
	<i>Deg. F</i>	<i>Deg. F</i>	<i>Langleys</i>	<i>Hr.:min.</i>
January	57.1	34.9	5898	10:17
February	60.3	36.7	6823	11:00
March	66.6	42.4	10427	12:00
April	76.4	51.0	11696	13:03
May	84.3	58.5	15911	13:52
June	89.8	65.6	15607	14:13
July	90.9	68.3	14262	14:02
August	90.9	67.7	13650	13:21
September	86.5	63.2	11656	12:21
October	78.0	52.3	10009	11:17
November	66.9	41.3	6635	10:27
December	58.5	35.5	5187	10:04

¹ Means for 1941-1970.

² Mean for 1982.

³ Mean calculated from monthly range. Sunrise and sunset are considered to occur when the upper edge of the disk of the sun appears to be exactly on the horizon, with normal atmospheric conditions, at zero elevation above the earth's surface in a level region.

A randomized block design with two replications of a minimum of 100 plants of each cultivar per replication was used in most experiments. Growth data were taken on 20 plants at harvest, that is when one-third to one-half of the florets were open. Plants were harvested by cutting stems at the soil line. Data included date of harvest, plant height and fresh weight, spike length, and stem strength. Stem strength was determined by stripping five plants of all leaves, cutting 20 inches of stem from directly below the last floret, weighing the stripped stem sections, and calculating an index of grams per centimeter. Sanderson and Link (12) found that top grade snapdragons (averaging a 3.2 quality grade out of a possible 4.0) had grams per centimeter ratios ranging from 0.17 to 0.22. Rogers (9) used a different sampling method to assert that 0.4 gram per centimeter is the lowest grams per centimeter ratio for usable stems.

GROUP I CULTIVARS FLOWERED AT 45°F IN THE WINTER

Group I (winter-flowering in the North) snapdragons are not recommended for culture in the South because they usually produce short, poor quality, flower spikes. Some Alabama growers grow them because they offer a large selection of cultivars and a wide range of colors. Most of these growers have used flexible plastic greenhouses for their culture. Such greenhouses provide low temperatures; soil temperatures are especially low since the plants are often grown on the ground.

In one Auburn test, a flexible plastic greenhouse equipped with ground benches was used to test four Group I cultivars. Ground beds containing a 1:1:1 ratio (by volume) of soil, perlite, and sphagnum peat moss medium treated with Vapam at the rate of 1 quart per 100 square feet were used. The house was not covered with plastic at the time of Vapam application. Seedlings of the cultivars Vulcan, Yosemite, Rio Grande, and Zion were planted in benches approximately 18 feet long. Fertilization consisted of a preplant application of 2 pounds of Osmocote 14-14-14 fertilizer per 100 square feet. During the unusually cold winter, plant level temperatures inside ranged from 35° to 50°F with the thermostat set at 45°F at night.

Flowering occurred in 103 days for Zion and 110 days for Vulcan. Vulcan produced plants with the greatest fresh weight, height, and strongest stem (grams per centimeter of stem), table 2. Rio Grande weighed less than the other cultivars tested. Mean height and flower spike length of Zion were the shortest in the experiment. Rio Grande had the lowest grams per centimeter of stem determinations in the experiment, but this ratio was higher than ratios found acceptable by Sanderson and Link (12).

GROUP I CULTIVARS FLOWERED AT 62°F IN THE WINTER

Flowering time for Group I cultivars at 62°F minimum night temperature, during January 1 to March 30, averaged 61 days, table 3. Minneapolis flowered earliest (56 days) and Moscow flowered latest (66 days) of the Group I cultivars. All cultivars flowered within a week of the mean flowering time.

TABLE 2. EVALUATION OF GROUP I CULTIVARS OF SNAPDRAGONS GROWN IN A POLYETHYLENE PLASTIC GREENHOUSE AT 45° F (MINIMUM NIGHT TEMPERATURE WHEN CONTROLLED)

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Rio Grande.....	1	69-70	Dec. 18	Apr. 6	109	48.9	3.2	10.4	0.296	Pan Amer.	Lemon yellow
Vulcan	1	69-70	Dec. 18	Apr. 7	110	51.3	4.3	10.4	.412	Pan Amer.	Wine red
Yosemite	1	69-70	Dec. 18	Apr. 6	109	48.8	3.9	11.3	.336	Pan Amer.	Medium pink
Zion	1	69-70	Dec. 18	Mar. 31	103	47.8	3.8	9.6	.332	Pan Amer.	Lemon yellow
Mean	—	—	—	—	108	49.2	3.8	10.4	.344	—	—

TABLE 3. EVALUATION OF GROUP I CULTIVARS OF SNAPDRAGONS FLOWERED JANUARY 1 TO MARCH 30 AT MINIMUM NIGHT TEMPERATURE OF 62° F

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Cheyenne	1	80	Jan. 25	Mar. 27	63	39.6	2.1	6.9	0.154	Yoder	Yellow
Michigan	1	80	Jan. 25	Mar. 24	60	38.0	1.5	9.0	.114	Yoder	Bronze
Minneapolis.....	1	80	Jan. 25	Mar. 24	56	37.2	1.5	8.8	.161	Yoder	Pink
Moscow	1	80	Jan. 25	Mar. 30	66	38.1	1.9	7.8	.146	Yoder	Red
Oakland	2	76,80	Jan. 31 ¹	Mar. 27 ¹	57	37.3	1.6	9.2	.138	Yoder	White
Oregon	1	80	Jan. 25	Mar. 23	59	39.4	2.0	6.9	.198	Yoder	Orchid
Washington	1	80	Jan. 25	Mar. 29	65	43.7	1.8	8.5	.111	Yoder	Rose Pink
Group I mean	—	—	—	—	61	39.0	1.8	8.2	.146	—	—

¹ Averages of more than one trial.

Average plant height of Group I cultivars was 39.0 inches. Washington (43.7 inches) and Minneapolis (37.2 inches) produced the tallest and shortest plants, respectively. Cheyenne, Oregon, and Washington were equal to or taller than the cultivar mean.

Group I plants averaged 1.8 ounces and ranged from 1.5 ounces (Michigan and Minneapolis) to 2.1 ounces (Cheyenne). Mean cultivar weight was equalled or exceeded by Cheyenne, Moscow, Oregon, and Washington plants.

Oakland plants produced the largest (9.2 inches) flower spikes, whereas Cheyenne and Oregon had the shortest (6.9 inches) flower spikes. The average flower spike length of 8.2 inches was exceeded by Michigan, Minneapolis, Oakland, and Washington plants.

The mean grams per centimeter ratio for Group I cultivars flowered at 62°F was 0.146. The lowest and highest ratios were produced by Washington (0.111) and Oregon (0.198), respectively. Equalling or exceeding the cultivar grams per centimeter ratio were Cheyenne, Minneapolis, Moscow, and Oregon plants.

None of the Group I cultivars tested equalled or exceeded the mean for all four growth parameters measured. Cheyenne, Oregon, and Washington plants equalled or exceeded the mean for three growth parameters. Minneapolis and Moscow plants equalled or exceeded the cultivar mean for two growth parameters.

GROUP II CULTIVARS FLOWERED IN THE WINTER

Group II cultivars averaged 69 days from benching to flowering, table 4. Oakland plants averaged 52 days, whereas Phoenix plants flowered in 80 days. Butterfly White II and McKinley plants flowered over a week later than the Group II average flowering time and Madison and Oakland plants flowered over a week earlier than the average.

Plant height ranged from 20.5 inches for White No. 133 to 47.0 inches for Christina. The mean height of 32.5 inches was equalled or exceeded by Baltimore, Butterfly White II, California, Christina, Debutante, Hercules, Kodiak, Lavender

Lady, Lavender No. 54, McKinley, Montezuma, Phoenix, Rainer, Rocky Mountain, Madison, Oakland, Treasure Chest, and Tennessee.

Group II plant weight averaged 1.9 ounces and ranged from 1.4 ounces for Madison to 2.4 ounces for Crimson No. 101 plants. Cultivars that generally equalled or exceeded the mean plant weight were Baltimore, Bronze Scarlet No. 147, Bronze Yellow No. 163, Butterfly White II, California, Crimson No. 101, Hercules, Indiana, Lavender Lady, Lavender No. 54, Kodiak, McKinley, Montezuma, Phoenix, Pink No. 149, Rainer, Red No. 148, Rocky Mountain, Swaps, Tennessee, and Yellow No. 117.

Phoenix and Butterfly White II had the largest flower spikes (8.9 inches), and Crimson No. 101 produced the smallest flower spikes (4.4 inches). Group II cultivars averaged flower spikes of 7.2 inches. Baltimore, Butterfly White II, Bronze Scarlet No. 147, Bronze Yellow No. 163, California, Christina, Indiana, McKinley, Montezuma, Phoenix, Red No. 148, Rocky Mountain, Oakland, Tennessee, Twenty Grand, White No. 133, and Yellow No. 150 generally produced flower spikes equalling or exceeding the mean spike length.

Stem strength of Group II cultivars averaged 0.172 gram per centimeter and ranged from 0.128 gram (Oakland and Lavender Lady) to 0.233 gram per centimeter (Rocky Mountain). Baltimore, Bronze Yellow No. 163, California, Crimson No. 101, Jackpot, Kodiak, Lavender No. 54, McKinley, Phoenix, Pink No. 149, Rocky Mountain, Swaps, Yellow No. 117, and Yellow No. 150 plants had grams per centimeter values equalling or exceeding the cultivar mean for stem strength.

Considering all four of the parameters measured, Baltimore, McKinley, Phoenix, Rocky Mountain, and California plants equalled or exceeded the cultivar mean; therefore, these cultivars should be considered excellent Group II cultivars. Butterfly White II, Bronze Yellow No. 163, Lavender No. 54, Montezuma, Kodiak, and Tennessee plants generally equalled or exceeded the cultivar mean in three parameters. Bronze Scarlet No. 147, Crimson No. 101, Indiana, Pink No. 149, Red No. 148, Swaps, Lavender Lady, Christina, Hercules, Oakland, and Yellow No. 117 plants generally scored average or better in two parameters.

TABLE 4. EVALUATION OF GROUP II CULTIVARS OF SNAPDRAGONS FLOWERED DECEMBER 1 TO APRIL 30 AT A MINIMUM NIGHT TEMPERATURE OF 62° F

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Baltimore	1	83	Feb. 8	Apr. 21	74	46.6	2.3	8.2	0.188	Yoder	Deep pink
Bronze Scarlet No. 147	1	68	Jan. 12	Mar. 26	73	25.3	1.8	7.2	.160	Sakata	Unusual blend-bronze scarlet
Bronze Yellow No. 163	1	68	Jan. 12	Mar. 19	66	24.0	1.8	7.8	.174	Sakata	Unusual blend-bronze yellow
Butterfly White II	3	82,82,82	Jan. 16	Apr. 3	78	41.0	2.1	8.9	.168	Goldsmith	White
California	3	82,82,82	Jan. 16 ¹	Mar. 28 ¹	72	38.9	1.9	8.0	.196	Yoder	Paper white
Christina	3	82,82,82	Jan. 16 ¹	Mar. 27 ¹	71	47.0	1.6	7.3	.145	Pan Amer.	Light pink
Crimson No. 101	1	68	Jan. 12	Mar. 29	76	30.3	2.4	4.4	.198	Sakata	Crimson
Debutante	3	82,82,82	Jan. 31 ¹	Apr. 1 ¹	61	35.6	1.5	6.9	.140	Pan Amer.	Medium pink
Hercules	3	82,82,82	Jan. 16 ¹	Mar. 28 ¹	72	41.8	1.9	6.5	.144	Pan Amer.	Strong light pink
Indiana	2	68	Jan. 15 ¹	Apr. 1 ¹	76	26.2	1.9	7.6	.151	Yoder	Light rose pink
Jackpot	3	67,68,69	Jan. 9 ¹	Mar. 17 ¹	68	24.9	1.7	6.7	.181	Pan Amer.	Rose pink
Kodiak	2	69	Oct. 28 ¹	Jan. 5 ¹	69	34.6	1.9	6.6	.175	Pan Amer.	White
Lavender Lady	3	82,82,82	Jan. 16 ¹	Mar. 25 ¹	71	37.3	1.9	6.9	.128	Pan Amer.	Deep rosy lavender
Lavender No. 54... ..	1	68	Jan. 12	Mar. 29	76	33.4	1.8	6.9	.204	Sakata	Muted lavender
Madison	1	76	Feb. 6	Apr. 6	59	34.3	1.4	5.7	.160	Yoder	Dark pink

Continued

TABLE 4 (Continued). EVALUATION OF GROUP II CULTIVARS OF SNAPDRAGONS FLOWERED DECEMBER 1 TO APRIL 30 AT A MINIMUM NIGHT TEMPERATURE OF 62° F

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
McKinley	2	69	Jan. 4 ¹	Mar. 24 ¹	79	32.7	2.1	7.5	0.224	Pan Amer.	Ivory white
Montezuma	6	69,80,82,82,82	Jan. 14 ¹	Mar. 21 ¹	67	36.9	1.8	8.5	.166	Pan Amer.	Deep yellow
Phoenix	1	69	Dec. 27	Mar. 17	80	42.6	1.9	8.9	.196	Pan Amer.	Light yellow
Pink No. 149	2	68	Jan. 15 ¹	Mar. 20 ¹	64	25.7	2.0	7.0	.178	Sakata	Light rose pink
Rainer	4	82,82,82,83	Jan. 16 ¹	Mar. 24 ¹	68	37.5	1.8	7.0	.163	Pan Amer.	White
Red No. 148	2	68	Jan. 15 ¹	Mar. 20 ¹	64	24.1	1.9	7.3	.167	Sakata	Red
Rocky Mountain ..	5	68,69,80	Feb. 28 ¹	May 9 ¹	72	36.1	2.1	7.3	.233	Pan Amer.	Medium to salmon pink
Oakland	1	76	Feb. 6	Mar. 30	52	34.0	1.5	8.7	.128	Yoder	Paper white
Swaps	1	67-68	Jan. 12	Mar. 26	73	26.3	2.0	7.0	.192	Yoder	Yellow
Treasure Chest	3	82,82,82	Jan. 31 ¹	Apr. 9 ¹	69	36.8	1.6	6.7	.157	Pan Amer.	Medium rose
Tennessee	1	83	Feb. 8	Apr. 22	75	43.8	2.0	8.3	.148	Yoder	Red
Twenty Grand	2	68	Jan. 15 ¹	Mar. 20 ¹	64	23.3	1.6	8.2	.165	Yoder	Ivory white
White No. 102	1	67-68	Jan. 12	Mar. 19	66	20.6	1.5	6.3	.156	Sakata	Pure white
White No. 133	1	67-68	Jan. 12	Mar. 19	66	20.5	1.5	7.9	.152	Sakata	Pure white
Yellow No. 117	1	67-68	Jan. 12	Mar. 19	66	23.7	1.8	5.1	.200	Sakata	Medium yellow
Yellow No. 150	1	67-68	Jan. 12	Mar. 19	66	22.0	1.7	7.1	.184	Sakata	Deep yellow
Group II mean	—	—	—	—	69	32.5	1.9	7.2	.172	—	—

¹ Dates given are averages of more than one trial.

GROUP III CULTIVARS FLOWERED IN THE SPRING

Three Group IV cultivars (Veracruz, Dark Star, and June Bride) were tested in the spring flowering period. All three cultivars flowered earlier than most Group III cultivars; however, their growth and quality generally were below that of the Group III mean, table 5.

Time from benching to flowering averaged 69 days for spring-grown Group III cultivars, with a range from 48 days (Panama) to 80 days (Laurel, Potomac Ivory, and Winchester), table 5. Cultivars that flowered approximately 1 week or more earlier than the Group III mean were Hawaii, Nevada, Panama, Dark Star (IV), June Bride (IV), Pan American Summer Pink, Potomac White, and Veracruz (IV). Atlanta, Double Azalea White, Laurel, Potomac Ivory, New Mexico, Winchester, and Virginia plants flowered a week or more later than the Group III mean.

Plant height ranged from 32.2 inches (Nevada) to 54.6 inches (St. Louis), with a mean of 43.8 inches. Plants of Atlanta, Butterfly Pink III, Columbia, Laurel, Missouri, New Mexico, Potomac Ivory, Potomac Pink, Potomac Yellow, Roanoke, San Francisco, St. Louis, and Winchester were taller than the group mean. Kansas and Virginia plants came close to equalling or exceeding the height for this cultivar group.

Fresh weight of Potomac Ivory (3.8 ounces) was the highest of any Group III cultivars and was more than three times that of the lightest cultivar, Roanoke (1.1 ounces). The plant fresh weight of the cultivars averaged 2.4 ounces. Butterfly Light Pink III, Butterfly Pink III, Butterfly White, Double Azalea White, Laurel, Missouri, New Mexico, Potomac Ivory, Potomac Pink, Potomac Yellow, San Francisco, Tucson, Winchester, and Virginia plants generally equalled or exceeded the group mean plant fresh weight.

With a Group III cultivar mean of 8.6 inches, spike length ranged from 6.2 inches (Double Azalea White and Hawaii) to 10.7 inches (Potomac Ivory). Spike length for Columbia, Kansas, Laurel, Missouri, New Orleans, New Mexico, Panama, Pan American Summer Pink, Potomac Ivory, Potomac Pink, Potomac White, Roanoke, San Francisco, St. Louis, Tampico, Tucson, Winchester, Virginia, and June Bride essentially equalled or exceeded the mean.

TABLE 5. EVALUATION OF GROUP III CULTIVARS OF SNAPDRAGONS FLOWERED IN THE SPRING, MAY 1-JUNE 30

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Atlanta	1	81	Feb. 18	May 6	76	48.4	1.6	7.8	0.180	Yoder	Pink
Butterfly Light											
Pink III	2	73	Feb. 17 ¹	May 2 ¹	74	41.2	2.8	6.6	.181	Goldsmith	Light pink
Butterfly Pink III	2	69,73	Jan. 20 ¹	Apr. 26 ¹	72	43.9	3.1	8.1	.189	Goldsmith	Pink
Butterfly White	2	73	Feb. 7 ¹	May 2 ¹	73	40.8	2.3	7.3	.180	Goldsmith	White
Columbia	2	76,81	Feb. 12 ¹	Apr. 17 ¹	65	48.8	2.0	8.9	.252	Yoder	Rose pink
Double Azalea											
White	2	73	Feb. 17 ¹	May 5 ¹	77	38.8	2.6	6.2	.213	Pan Amer.	White
Hawaii	1	68	Apr. 5	June 3	59	36.9	1.9	6.2	missing	Yoder	Ivory
Kansas	1	83	Feb. 8	Apr. 19	74	43.6	2.1	8.5	.192	Yoder	Orange bronze
											Apple blossom pink
Kentucky	2	77,83	Feb. 26 ¹	May 6 ¹	69	38.9	1.9	7.6	.182	Yoder	pink
Laurel	1	83	Feb. 8	Apr. 25	80	49.2	2.8	8.7	.224	Yoder	Deep pink
Missouri	1	81	Feb. 18	Apr. 27	69	48.7	3.0	8.7	.268	Yoder	Dark yellow
Nevada	1	67	Mar. 28	May 22	55	32.2	1.3	7.0	missing	Yoder	Yellow
New Orleans	1	81	Feb. 18	Apr. 27	68	42.5	1.9	9.3	.220	Yoder	White
New Mexico	2	81,83	Feb. 13 ¹	Apr. 28 ¹	76	48.2	2.7	9.8	.184	Yoder	Deep bronze
Panama	1	70	May 12	June 29	48	37.1	1.7	8.6	.167	Pan Amer.	White
											Medium light pink
Pan American Pink	1	68	Apr. 5	May 30	55	37.4	1.5	8.6	missing	Pan Amer.	pink
Potomac Ivory	2	73	Feb. 17 ¹	May 7 ¹	80	50.8	3.8	10.7	.409	Winkler	ivory
Potomac Pink	5	66,68,73,79	Mar. 15 ¹	May 21 ¹	69	47.8	2.7	8.8	.255	Winkler	Medium pink
Potomac White	2	66,68	Mar. 19 ¹	May 16 ¹	59	41.1	2.2	9.7	.295	Winkler	White
Potomac Yellow ...	4	67,68,71,83	Feb. 28 ¹	May 10 ¹	72	44.9	2.6	8.1	.266	Winkler	Medium yellow
Roanoke	1	81	Feb. 18	Apr. 25	67	45.0	1.1	10.3	.136	Yoder	White
San Francisco	3	71,79,81	Mar. 7 ¹	May 7 ¹	62	46.7	2.7	10.3	.235	Yoder	Paper white
St. Louis	1	76	Feb. 6	Apr. 19	73	54.6	2.2	8.6	.338	Yoder	Deep yellow
Tampico	2	67,68,83	Mar. 4 ¹	May 12 ¹	69	41.3	2.1	8.5	.221	Pan Amer.	Medium yellow

Continued

TABLE 5 (Continued). EVALUATION OF GROUP III CULTIVARS OF SNAPDRAGONS FLOWERED IN THE SPRING, MAY 1-JUNE 30

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Tucson	1	71	Feb. 11	Apr. 17	65	39.2	2.8	8.8	0.327	Pan Amer.	Medium lavender
Winchester	2	71,83	Feb. 7 ¹	Apr. 28 ¹	80	50.4	3.6	10.4	.305	Yoder	Light rose pink
Veracruz ²	1	67	Mar. 28	May 22	55	35.6	1.8	7.8	.244	Pan Amer.	Deep yellow
Virginia	3	77,81,83	Feb. 20 ¹	May 10 ¹	79	43.6	2.4	9.7	.166	Yoder	Paper white
Dark Star ²	1	67	Mar. 28	May 22	55	32.4	1.6	6.3	.269	Yoder	Medium yellow
June Bride ²	1	69	Apr. 2	June 17	45	39.0	2.0	9.6	.159	Pan Amer.	Pure white
Overall mean	—	—	—	—	67	43.0	2.3	8.5	.232	—	—
Group III mean ...	—	—	—	—	69	43.8	2.4	8.6	.233	—	—

¹ Average dates for trials.

² Normally a Group IV cultivar, tested as a Group III, not included in Group III mean.

Grams per centimeter ratios for Group III cultivars flowered in the spring ranged from 0.136 (Roanoke) to 0.409 (Potomac Ivory). Columbia, Missouri, Potomac Ivory, Potomac Pink, Potomac White, Potomac Yellow, San Francisco, St. Louis, Tucson, Winchester, Vera Cruz (IV), and Dark Star (IV) plants had grams per centimeter ratios which exceeded the mean of 0.233 for this cultivar group.

In summarizing Group III cultivars flowered in the spring, Missouri, Potomac Ivory, Potomac Pink, San Francisco, and Winchester plants scored high in all the growth parameters measured. Columbia, Laurel, New Mexico, Potomac Yellow, St. Louis, and Tucson plants generally met or exceeded all but one of the mean Group III growth parameters. Generally meeting just two of the growth parameters measured were Butterfly Pink III, Butterfly White, Potomac White, Roanoke, and Virginia.

GROUP III CULTIVARS FLOWERED IN THE FALL

Several Group II and IV cultivars were tested along with the Group III cultivars for fall flowering. When the spike length and grams per centimeter data for these cultivars were compared with similar Group III data, the means exceeded those of the Group III cultivars alone, table 6.

Group III cultivars flowered in approximately 58 days in the fall. Flowering time ranged from 48 days for Panama plants to 75 days for Light Pink Butterfly plants. Varying from the Group III mean by more than 7 days were the earlier-flowering North Carolina and Panama plants and the late-flowering Kentucky, Light Pink Butterfly, New Mexico, and Virginia plants.

Mean plant height for fall-flowering Group III cultivars was 40.2 inches. Plant heights ranged from 30.7 inches (Bronze Butterfly) to 51.8 inches (New Mexico). Georgia (IV), Idaho, Kentucky, New Mexico, North Carolina, Oklahoma (IV), Potomac Ivory, Potomac Orange, Potomac Pink, Potomac Yellow, Roanoke, San Francisco, Tampico, Tennessee, Virginia, West Virginia (II), and Winchester equalled or exceeded the Group III mean.

TABLE 6. EVALUATION OF GROUP III CULTIVARS OF SNAPDRAGONS FLOWERED IN THE FALL, OCTOBER 1-NOVEMBER 30

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Baltimore	1	68	Aug. 29	Oct. 29	61	39.7	1.7	6.6	0.218	Yoder	Deep pink
Bronze Butterfly ..	1	74	Sept. 16	Nov. 7	52	30.7	1.6	7.1	.132	Goldsmith	Light bronze
Dark Star ³	1	68	Aug. 29	Oct. 21	53	36.4	2.1	7.6	.276	Yoder	Medium yellow
Double Azalea Bronze	1	74	Sept. 16	Nov. 17	61	38.0	1.6	5.8	.216	Goldsmith	Med. bronze double
Double Azalea Pink.....	1	74	Sept. 16	Nov. 20	64	35.4	1.9	5.8	.208	Goldsmith	Med. pink double
Double Azalea Yel- low	1	74	Sept. 16	Nov. 11	55	32.2	1.6	6.0	.152	Goldsmith	Med. yellow double
Double Azalea White	1	74	Sept. 16	Nov. 17	61	38.8	2.3	6.4	.152	Goldsmith	White double
Georgia ³	1	68	Aug. 24	Oct. 20	57	41.2	2.5	9.5	.247	Yoder	Light pink
Houston ³	2	74	Aug. 10	Oct. 2	53	35.0	1.2	7.5	.115	Yoder	Paper white
Idaho	1	68	Aug. 29	Oct. 24	56	43.1	2.2	7.6	.208	Yoder	Light pink
Illinois ²	1	68	Aug. 29	Oct. 24	56	34.0	1.7	8.7	.227	Yoder	Medium pink
June Bride ³	1	68	Aug. 29	Oct. 19	51	38.3	2.8	9.6	.285	Pan Amer.	Pure white
Kentucky	3	74,82	Sept. 5 ¹	Nov. 11 ¹	68	44.9	2.5	6.7	.235	Yoder	Light pink
Kodiak	1	68	Aug. 29	Oct. 21	53	32.3	1.5	7.7	.175	Pan Amer.	White
Light Pink Butter- fly	1	74	Sept. 16	Nov. 30	75	35.3	1.6	3.7	.120	Goldsmith	Light pink Light rose flecked with white
Maryland Apple- blossom ²	1	68	Aug. 29	Oct. 23	55	33.9	1.7	8.4	.204	Winkler	Red
Maryland Rouge ² ..	1	68	Aug. 29	Oct. 24	56	32.2	1.9	6.2	.218	Winkler	Red
Missouri	1	68	Aug. 29	Oct. 30	62	36.3	1.6	7.2	missing	Yoder	Intense yellow
Monterey ³	1	68	Aug. 29	Oct. 20	52	37.4	2.2	10.0	.274	Pan Amer.	Pure white
New Mexico	1	82	Aug. 25	Nov. 1	68	51.8	2.6	10.0	.168	Yoder	Deep bronze
North Carolina	1	68	Aug. 29	Oct. 17	49	43.3	2.2	9.1	.199	Yoder	Light rose pink

Continued

TABLE 6 (Continued). EVALUATION OF GROUP III CULTIVARS OF SNAPDRAGONS FLOWERED IN THE FALL, OCTOBER 1-NOVEMBER 30

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Oklahoma ³	3	68,73	Aug. 27	Oct. 30	64	53.0	2.9	9.0	0.309	Yoder	Deep yellow
Panama	1	68	Aug. 29	Oct. 18	48	37.7	2.0	8.7	.210	Yoder	White
Pink Butterfly	1	74	Sept. 16	Nov. 7	52	35.9	1.9	5.1	.140	Goldsmith	Medium pink
Potomac Ivory	1	68	Aug. 29	Oct. 21	53	41.8	2.3	9.2	.240	Winkler	Ivory
Potomac Orange ..	1	68	Aug. 29	Oct. 22	54	45.7	2.0	8.8	missing	Winkler	Rose-bronze
Potomac Pink	4	66,68,73	Aug. 19 ¹	Oct. 21 ¹	63	45.7	1.8	8.0	.211	Winkler	Medium pink
Potomac Yellow ...	2	68,82	Aug. 27 ¹	Oct. 16 ¹	51	43.5	1.8	7.8	.169	Winkler	Medium yellow
Roanoke	1	74	Sept. 16	Nov. 11	55	41.7	2.6	9.0	.220	Yoder	Pearl white
Rocky Mountain ..	1	68	Aug. 29	Oct. 24	56	37.8	1.9	6.9	.260	Pan Amer.	Light pink
San Francisco	1	71	Aug. 31	Oct. 23	53	43.1	1.7	9.1	.162	Yoder	Paper white
Tampico	2	68,82	Aug. 27 ¹	Oct. 16 ¹	51	44.5	1.8	8.3	.153	Pan Amer.	Medium yellow
Tennessee	1	82	Aug. 25	Oct. 20	56	47.8	1.5	6.8	.096	Yoder	Red
Veracruz ³	1	69	Aug. 29	Oct. 16	48	39.6	2.4	8.9	.276	Pan Amer.	Deep yellow
Virginia	2	74,82	Sept. 5 ¹	Nov. 13 ¹	70	44.0	2.4	7.6	.179	Yoder	White
West Virginia ²	1	68	Aug. 29	Oct. 21	53	46.6	2.2	9.3	.213	Yoder	Deep yellow
White Butterfly	1	74	Sept. 16	Nov. 7	52	34.8	1.8	5.8	.140	Goldsmith	White
Winchester	5	71,72,73,82	Aug. 19 ¹	Oct. 12 ¹	54	49.8	1.8	6.1	.170	Yoder	Rose pink
Yellow Butterfly ...	1	74	Sept. 16	Nov. 7	52	33.8	2.0	7.8	.284	Goldsmith	Medium yellow
Overall mean	—	—	—	—	57	40.0	2.0	7.7	.204	—	—
Group III mean ...	—	—	—	—	58	40.2	2.0	7.4	.191	—	—

¹ Averages for more than one trial.

² Group II cultivars tested as Group III cultivars but not included in Group III mean.

³ Group IV cultivars tested as Group III cultivars but not included in Group III mean.

Ranging in plant weight from 1.5 ounces (Kodiak and Tennessee) to 2.6 ounces (Roanoke and New Mexico), Group III plants averaged 2.0 ounces. Generally equalling or exceeding the Group III plant weight mean were Dark Star (IV), Double Azalea White, Double Azalea Pink, Georgia (IV), Idaho, June Bride (IV), Kentucky, Maryland Rouge (II), Monterey (IV), New Mexico, North Carolina, Oklahoma (IV), Panama, Pink Butterfly, Potomac Ivory, Potomac Orange, Roanoke, Rocky Mountain, Veracruz (IV), Virginia, West Virginia (II), and Yellow Butterfly plants.

Flower spikes for Group III cultivars averaged 7.4 inches, with Light Pink Butterfly (3.7 inches) having the shortest spikes and Monterey (IV) and New Mexico (10.0 inches) having the longest spikes. Spikes of the following cultivars equalled or exceeded the Group III mean: Dark Star (IV), Georgia (IV), Houston (IV), Idaho, Illinois (II), June Bride (IV), Kodiak, Maryland Appleblossom (II), Monterey (IV), New Mexico, North Carolina, Oklahoma (IV), Panama, Potomac Ivory, Potomac Orange, Potomac Pink, Potomac Yellow, Roanoke, San Francisco, Tampico, Veracruz (IV), Virginia, West Virginia (II), and Yellow Butterfly plants.

Stem strength for fall-flowering Group III cultivars, as measured by grams per centimeter, averaged 0.191 gram per centimeter. Tennessee stems yielded the lowest (0.096) grams per centimeter ratio and Yellow Butterfly stems yielded the highest (0.284) grams per centimeter ratio for Group III cultivars. Equalling or bettering the Group III mean for grams per centimeter ratios were stems of Baltimore, Dark Star (IV), Double Azalea Bronze, Double Azalea Pink, Georgia (IV), Idaho, Illinois (II), June Bride (IV), Kentucky, Maryland Appleblossom (II), Maryland Rouge (II), Monterey (IV), North Carolina, Oklahoma (IV), Panama, Potomac Ivory, Potomac Pink, Roanoke, Rocky Mountain, Veracruz (IV), West Virginia (II), and Yellow Butterfly plants.

Based on the growth parameters measured, Georgia (IV), Idaho, North Carolina, Oklahoma (IV), Potomac Ivory, Roanoke, and West Virginia (II) were the best cultivars tested for fall flowering. Ranking second best were Dark Star (IV), Kentucky, June Bride (IV), Monterey (IV), New Mexico, Panama, Potomac Orange, Potomac Pink, Veracruz (IV), Virginia,

and Yellow Butterfly plants. Stem strength data were not available on Potomac Orange, therefore this cultivar had to be ranked a second best cultivar. Illinois (II), Maryland Appleblossom (II), Potomac Yellow, Rocky Mountain, San Francisco, and Tampico plants generally equalled or exceeded the Group III cultivar means for two of the four growth parameters measured for fall flowering.

GROUP III CULTIVARS FLOWERED OUT OF SEASON IN THE WINTER

Flowering time for Group III cultivars flowered out of season averaged 98 days, table 7. Potomac Pink plants required the longest time (115 days) and San Francisco plants required the shortest time (81 days). San Francisco and Virginia plants flowered more than a week earlier than the group mean, whereas Potomac Pink, Potomac White, and Potomac Yellow plants flowered more than a week later than the Group III mean.

Missouri plants were the tallest (56.2 inches) and Tucson plants were the shortest (43.1 inches) of all the Group III cultivars flowered out of season. Equalling or exceeding the mean height for Group III cultivars flowered out of season were Baltimore, Kansas, Laurel, Missouri, Potomac Yellow, Potomac Pink, Potomac White, Roanoke, and Winchester.

Out of season Group III cultivars had a mean plant fresh weight of 2.9 ounces. Plant weights ranged from 1.9 ounces (Potomac Yellow, Rainer, and Tucson plants) to 4.2 ounces (Pan American Summer Pink plants). The fresh weight of Kansas, Kentucky, Laurel, New Mexico, Pan American Summer Pink, Potomac Pink, Potomac White, Tampico, Tennessee, and Winchester plants equalled or exceeded the mean fresh weight for all cultivars tested.

Kansas plants produced the largest (10.0 inches) flower spikes, whereas Tucson plants had the shortest (6.1 inches) flower spikes. Spikes of Kansas, Kentucky, New Mexico, Pan American Summer Pink, Potomac Pink, Potomac White, Tennessee, Virginia, and Winchester equalled or exceeded the mean spike length of 7.6 inches.

TABLE 7. EVALUATION OF GROUP III CULTIVARS OF SNAPDRAGONS FLOWERED OUT OF SEASON IN THE WINTER AT A MINIMUM NIGHT TEMPERATURE OF 62° F

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						<i>In.</i>	<i>Oz.</i>	<i>In.</i>	<i>g/cm</i>		
Baltimore	1	83	Nov. 17	Feb. 18	94	54.7	2.7	7.3	0.192	Yoder	Deep pink
Kansas	3	69,70,83	Dec. 3 ¹	Mar. 7 ¹	96	51.4	3.3	10.0	.260	Yoder	Red
Kentucky	1	83	Nov. 17	Feb. 22	98	49.6	4.0	8.2	.304	Yoder	Light pink
Laurel	1	83	Nov. 17	Feb. 21	97	54.1	3.1	7.2	.208	Yoder	Dark pink
Missouri	1	79	Oct. 24	Feb. 6	96	56.2	2.7	6.3	.281	Yoder	Dark yellow
New Mexico	2	79,83	Nov. 5 ¹	Feb. 14 ¹	101	48.2	3.6	7.6	.262	Yoder	Deep bronze
Pan American											
Summer Pink ...	1	69	Dec. 16	Mar. 20	94	46.3	4.2	8.4	.503	Pan Amer.	Pink
Potomac Yellow	1	83	Nov. 17	Feb. 25	106	56.0	1.9	6.6	.320	Winkler	Medium yellow
Potomac Pink	2	66,67	Nov. 16 ¹	Mar. 11 ¹	115	51.9	3.8	8.7	.275	Winkler	Medium pink
Potomac White ..	1	67	Nov. 14	Mar. 3	109	51.1	3.2	8.4	.264	Winkler	White
Rainer	1	83	Nov. 17	Feb. 18	94	47.9	1.9	6.4	.144	Pan Amer.	White
Roanoke	1	79	Oct. 24	Jan. 30	98	52.2	2.3	6.8	.184	Yoder	White
San Francisco	1	79	Oct. 24	Jan. 13	81	48.7	2.0	7.4	.197	Yoder	White
Tampico	2	70,83	Oct. 8 ¹	Jan. 15 ¹	100	49.7	3.0	7.4	.239	Pan Amer.	Medium yellow
Tennessee	1	83	Nov. 17	Feb. 22	98	45.3	3.1	7.7	.232	Yoder	Red
Treasure Chest ..	1	83	Nov. 17	Feb. 21	97	47.5	2.7	7.4	.168	Yoder	Rose
Tucson	1	70	Aug. 28	Dec. 11	105	43.1	1.9	6.1	.203	Pan Amer.	Medium lavender
Virginia	2	79,83	Nov. 5 ¹	Feb. 4 ¹	91	47.3	2.4	7.7	.171	Yoder	White
Winchester	1	83	Nov. 17	Feb. 23	99	53.4	3.8	9.0	.272	Yoder	Rose Pink
Mean	—	—	—	—	98	50.2	2.9	7.6	.246	—	—

¹ Average for more than one trial.

A high grams per centimeter ratio of 0.246 was averaged by all cultivars ranging from 0.144 (Rainer) to 0.503 (Pan American Summer Pink). Equalling or exceeding the mean grams per centimeter readings of all cultivars were Kansas, Kentucky, Missouri, New Mexico, Pan American Summer Pink, Potomac Yellow, Potomac Pink, Potomac White, and Winchester plants.

Kansas, Potomac Pink, Potomac White, and Winchester were the only Group III cultivars which exceeded all growth means for Group III cultivars grown out of season. Kentucky, New Mexico, and Pan American Summer Pink equalled or exceeded the Group III means for three growth parameters. Meeting only two of the growth parameters were Laurel, Potomac Yellow, Tennessee, and Missouri.

GROUP IV CULTIVARS FLOWERED IN THE SUMMER

Summer flowering of Group IV cultivars averaged 53 days and ranged from 42 days for plants of Houston to 69 days for plants of White Skies, table 8. With the exception of Florida (45 days), Houston (42 days), Potomac Pink (65 days), Summer Jewel (62 days), and White Skies (69 days), most of the cultivars flowered within a week of the mean flowering time.

Group IV cultivars averaged a plant height of 37.6 inches when flowered in the summer. The tallest and shortest plants were produced by Potomac Pink (43.3 inches) and Tampa (31.8 inches), respectively. Plant heights of Alabama, Georgia, Houston, June Bride, Miami, Oklahoma, Potomac Pink, Potomac Red, White Skies, and Winchester plants exceeded the cultivar mean height. Arizona, Potomac White, and Potomac Yellow almost equalled the cultivar mean height.

The mean fresh weight of the Group IV cultivars was 1.5 ounces. Arizona, June Bride, and Potomac Pink were the heaviest (2.0 ounces), whereas Tampa weighed the least (0.8 ounce). Plant fresh weight of Arizona, Dark Star, Georgia, June Bride, Miami, Monterey, Oklahoma, Potomac Pink, Potomac Red, Potomac Rose, Potomac White, Summer Jewel, Veracruz, and White Skies generally equalled or exceeded the mean plant fresh weight for Group IV cultivars flowered in the summer.

TABLE 8. EVALUATION OF GROUP IV CULTIVARS OF SNAPDRAGONS FLOWERED IN THE SUMMER, JUNE 10-SEPTEMBER 10

Cultivar	Number of times tested	Year tested	Bench date	Flowering date	Number of days from bench to flowering	Plant height	Plant weight	Spike length	Stem strength	Source (originator)	Color
						In.	Oz.	In.	g/cm		
Alabama	2	71,80	June 30 ¹	Sept. 4 ¹	52	38.1	1.3	7.7	0.135	Yoder	Deep rose pink
Arizona	1	72	July 24	Sept. 21	59	37.1	2.0	8.4	.180	Yoder	Lavender
Dark Star	2	67,68	June 3 ¹	Aug. 6 ¹	54	34.4	1.9	7.0	.276	Yoder	Clear yellow
Florida	4	70,80,82	June 14 ¹	July 29 ¹	45	34.9	1.3	7.7	.117	Yoder	Rose pink
Georgia	2	68,71	July 24 ¹	Sept. 15 ¹	53	41.4	1.6	9.0	.137	Yoder	Light pink
Houston	4	79,80,82	June 21 ¹	Aug. 1 ¹	42	41.1	1.0	8.1	.103	Yoder	White
June Bride	1	69	May 21	June 17	57	39.0	2.0	9.6	.159	Pan Amer.	Pure white
Miami	4	72,80,82	July 2 ¹	Aug. 23 ¹	52	39.9	1.8	8.6	.146	Pan Amer.	Medium pink
Mobile	1	80	July 1	Aug. 16	47	35.2	1.0	6.9	.108	Yoder	Dark pink
Monterey	1	68	July 24	Sept. 21	59	34.2	1.7	8.9	.144	Pan Amer.	Pure white
Oklahoma	4	79,80,82	June 14 ¹	Aug. 1 ¹	48	41.7	1.8	8.9	.162	Yoder	Deep yellow
Potomac Pink	8	71,72	June 19 ¹	Aug. 10 ¹	65	43.3	2.0	8.2	.210	Winkler	Medium pink
Potomac Red	2	82	June 22 ¹	Aug. 14 ¹	53	40.9	1.9	9.2	.136	Winkler	Dark red
Potomac Rose	1	68	July 19	Sept. 14	57	36.0	1.4	7.5	.219	Winkler	Rose pink
Potomac White ..	7	66,68,69,71	July 1 ¹	Aug. 5 ¹	56	37.2	1.5	8.0	.189	Winkler	White
Potomac Yellow ...	4	68,69,82	July 6 ¹	Aug. 25 ¹	50	37.1	1.3	8.5	.163	Winkler	Medium yellow
Summer Jewel	1	68	July 19	Sept. 19	62	35.7	1.4	8.7	.213	Yoder	Deep pink
Tampa	1	80	July 1	Aug. 15	46	31.8	.8	6.6	.068	Yoder	White
Texas	3	80,82	June 23 ¹	Aug. 11 ¹	49	35.4	1.2	7.7	.129	Yoder	White
Veracruz	3	68,69,70	July 16 ¹	Aug. 6 ¹	47	35.9	1.4	8.2	.175	Pan Amer.	Deep yellow
White Skies	1	68	July 19	Sept. 27	69	41.9	1.4	6.5	.215	Yoder	Paper white
Winchester	1	80	July 1	Aug. 17	48	39.4	1.3	7.5	.108	Yoder	Rose pink
Overall mean	—	—	—	—	53	38.0	1.5	8.1	.161	—	—
Group IV mean	—	—	—	—	53	37.6	1.5	8.1	.151	—	—

¹ Average for more than one trial.

The mean flower spike length for summer-flowering Group IV cultivars was 8.1 inches. The longest flower spikes were produced by June Bride (9.6 inches) and the shortest by White Skies (6.5 inches). Arizona, Georgia, Houston, June Bride, Miami, Monterey, Oklahoma, Potomac Pink, Potomac Red, Potomac Yellow, Potomac White, Summer Jewel, and Veracruz generally equalled or exceeded the cultivar flower spike average.

A grams per centimeter ratio of 0.151 was averaged by the Group IV cultivars. Dark Star stems averaged 0.276, the highest grams per centimeter ratio, whereas Tampa averaged 0.068, the lowest grams per centimeter ratio. Stems of Arizona, Dark Star, June Bride, Oklahoma, Potomac Pink, Potomac Rose, Potomac Yellow, Potomac White, Summer Jewel, Veracruz, and White Skies plants equalled or exceeded the cultivar mean for grams per centimeter.

June Bride, Oklahoma, and Potomac Pink were the only cultivars which equalled or exceeded the Group IV means for the plant parameters considered in this study. Arizona, Georgia, Miami, Summer Jewel, Veracruz, White Skies, and Potomac Red failed to meet the Group IV mean in just one growth parameter. Houston, Monterey, Potomac Pink, Potomac Yellow, and Potomac White equalled or exceeded the Group IV means in two of the four growth parameters.

SCHEDULING

A schedule and list of cultivars for central Alabama has been developed from the current investigation and is presented in table 9. Full sunlight (light shade, 10 percent in the late spring and summer), a minimum night temperature of 62°F (when possible, air-cooled greenhouse), and unchecked growth are needed during culture to successfully use the schedule. Cultivar groups should be flowered in the proper flowering period; for example, Group II flowered from December 1 to April 30. Having selected a flowering date and cultivar group, one can use the average flowering time to determine the date of benching or transplanting. A 2-week or more variation in flowering time may exist within a flowering group. This variation is important because a grower would generally want a bench of snapdragons to flower at the same time to facilitate year-round, precision production. For a Group II cultivar, Rocky Mountain flowers in approximately 72 days, which is close to the mean flowering time of 70 days for Group II cultivars. Cultivars such as Oakland (52 days) and Phoenix (80 days) will flower approximately 17 days earlier and 11 days later than Rocky Mountain. Failure to respect this variation could tie up bench space for 11 to 28 days longer than anticipated. Variations in cultivar timing (7 to 14 days) do not apply to Group III flowered out of season in winter, which demonstrated greater variations in Auburn tests.

An average propagation time of 30 days should be added to the average flowering time to determine the date to sow seeds; for example, Rocky Mountain would flower 102 days from the date of sowing seed. Propagation time is based on mist propagation at 70°F, 10-20 percent shade, and transplanting seedlings when 1½ inches in height (unchecked growth). High light intensities according to cultivar group are desirable after germination. Supplemental lighting (constant or a 4-hour light break in the middle of the night with fluorescent lamps at 86 to 108 lamp watts per square meter with tubes 8 to 10 inches above the plants) can be used to hasten the growth of seedlings to transplanting size and decrease overall production time. A 1- to 2-week speedup in timing may result; however, the effect of this supplemental lighting on quality is not known under central Alabama conditions.

TABLE 9. SCHEDULE AND LIST OF CULTIVARS FOR CENTRAL ALABAMA BASED ON AUBURN TESTS, 1966-83

Flowering period and mean flowering time from benching	Timing ¹	Flower color, cultivar , and rating ²			
		White	Pink	Yellow	Others
<i>Group II</i> December 1 to April 30, 69 days	Early	*Oakland			**Bronze Yellow No. 163
	Average	**Kodiak **Rainer	***Baltimore ***Rocky Mountain	***California **Yellow No. 117	**Bronze Scarlet No. 147 **Tennessee
	Late	**McKinley **Butterfly White II		**Montezuma ***Phoenix	***Lavender No. 54
<i>Group III—spring</i> May 1 to June 30, 69 days	Early	*Potomac White			
	Average	***San Francisco *Roanoke *Butterfly White	***Potomac Pink **Columbia *Butterfly Pink II	***Missouri **Potomac Yellow **St. Louis	**Tucson *Kansas
	Late	***Potomac Ivory **Virginia	***Winchester **Laurel		**New Mexico
<i>Group IV—summer</i> June 30 to Sept. 30, 53 days	Early	*Houston			
	Average	***June Bride **Monterey *Potomac White	**Georgia **Miami	***Oklahoma **Potomac Yellow **Veracruz	**Potomac Red **Arizona
	Late	**White Skies	***Potomac Pink **Summer Jewel		

Continued

TABLE 9 (Continued). SCHEDULE AND LIST OF CULTIVARS FOR CENTRAL ALABAMA BASED ON AUBURN TESTS, 1966-83

Flowering period and mean flowering time from benching	Timing ¹	Flower color, cultivar, and rating ²			
		White	Pink	Yellow	Others
<i>Group III—fall</i> Oct. 1 to Nov. 30, 58 days	Early	*Panama	***North Carolina		
	Average	***Roanoke ***Potomac Ivory *San Francisco	***Idaho **Potomac Pink *Rocky Mountain	**Yellow Butterfly *Potomac Yellow *Tampico	***Potomac Orange
	Late	**Virginia	**Kentucky		**New Mexico
<i>Group III—year-round</i> 98 days	Early		**Pan American Summer Pink		
	Average		***Winchester **Kentucky *Laurel	*Missouri	***Kansas **New Mexico *Tennessee
	Late	***Potomac White	***Potomac Pink	*Potomac Yellow	

¹ With the exception of Group III cultivars flowered year-round, early and late indicates approximately 7 days earlier or later, respectively, than the mean flowering time from benching. Approximately 30 days should be added to the figure to determine date of sowing seed.

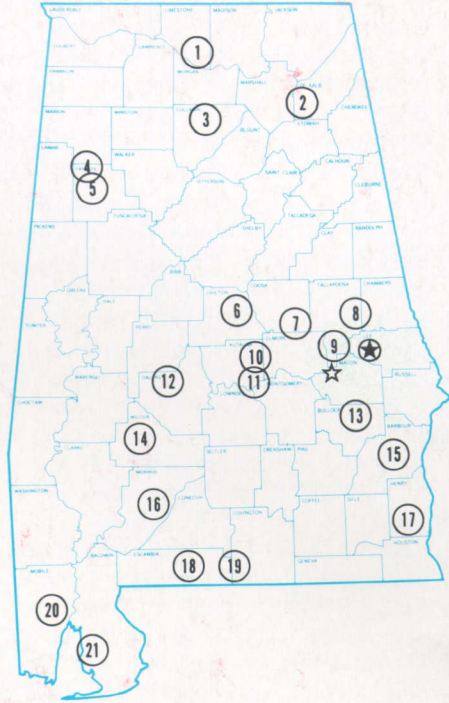
² Cultivars rated on equalling or exceeding cultivar group means for plant height and weight, flower, spike length, and stem strength; *** = perfect score, excellent cultivars; ** = scored in 3 out of 4 measurements, outstanding cultivars; * = scored 2 out of the 4 measurements, good cultivars.

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Alabama's Agricultural Experiment Station System AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

- ★ Main Agricultural Experiment Station, Auburn.
- ☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center, Covington and Escambia counties.
20. Ornamental Horticulture Substation, Spring Hill.
21. Gulf Coast Substation, Fairhope.