

EVALUATION OF CHRYSANTHEMUM CULTIVARS AS SINGLE-PLANT POTS FOR MASS MARKET OUTLETS

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tion unit adapted for mass market sales is a single pinched plant in a 4 in pot which could be produced at a cost acceptable to the consumer for spontaneous buying at the market. This size plant could be used either for special occasions or for general home display.

The purpose of this research was to evaluate a selection of the available chrysanthemum cultivars for their use as small potted plants for mass market sales and to determine their shelf life under simulated household conditions.

Materials and Methods

Abstract. Forty-two chrysanthemum cultivars were grown as single plants in 4 in diameter pots and evaluated for their potential use as a mass-market product. Rooted cuttings were planted on February 18, 1972, pinched on February 23, and treated with B-9 (0.5%) on March 3. Plants were grown in the greenhouse under prevailing day lengths and light intensities. Data recorded at flowering were on plant height and width, number of shoots, flower size and number, general foliage and stem characteristics. Thirty of the cultivars were evaluated under simulated household conditions consisting of constant temperature (76°F), 12 hours of light (150 ft-c), and periodic soil drying. Cultivars which were adapted to cultivation for mass-market included 'BGA Always Pink', 'Discovery', 'Wildfire', and 'Distinctive'.

Production of potted chrysanthemums is a \$3 million industry in Florida (1), with most of the units sold containing 4 or 5 plants in 6 in diam. pots. These plants are sold in florists shops, chain stores or are exported to northern markets. Most of the sales, retailing from \$2.00 to \$5.00 per pot, are for special occasions, such as birthdays, anniversaries or holidays. Cost of these plants generally inhibits consumers from spontaneously purchasing them for home decorations. To make potted mums more appealing to the consumer, cost of the unit must be lowered, either by reducing production costs or unit size. The simplest produc-

tion unit adapted for mass market sales is a single pinched plant in a 4 in pot which could be produced at a cost acceptable to the consumer for spontaneous buying at the market. This size plant could be used either for special occasions or for general home display.

Forty-two chrysanthemum cultivars (Table 1) were grown in a glass greenhouse during the spring 1972 season at Bradenton, Florida. Single cuttings were planted in 4 in diam. plastic pots containing a 2:2:1 (by volume) soil mix of Peace River peat, Leon fine sand, and perlite, respectively, supplemented with 8 lbs/cu yd of 14-14-14 Osmocote^(R) fertilizer. Plants were soft-pinched 5 days after planting and were sprayed with 0.5% B-9 10 days later. Each cultivar was replicated 5 times. Plants were grown in a greenhouse using the Chapin^(R) watering system and standard disease and insect control practices (2). Plants were evaluated and measured when all the terminal flowers in an individual pot were open.

Thirty of the cultivars, using 3 replications (Table 2), were evaluated for their shelf life under simulated household conditions. Plants were held at a temperature of 76°F with approximately 150 ft-c light for 12 hours. All cultivars were watered as follows: 5 days of daily water; 2 days no water; 1 day watered; and 2 days no water. Plants were evaluated after 10 days. Flowers were rated on a scale of 1 to 5, with 1 indicating complete desiccation and 5 indicating turgid and well-developed flowers: 1 = completely desiccated, 2 = severe wilting, 3 = moderate wilting, 4 = incipient wilting and/or slight deterioration, 5 = turgid and fully developed. Foliage was rated from 1 to 5 on degree of chlorosis, with 1 being severe with necrotic leaf margins and 5 showing no chlorosis: 1 = severe chlorosis with necrotic margins, 2 = severe chlorosis, 3 = moderate chlorosis, 4 = incipient chlorosis, 5 = no visible chlorosis. A foliage wilting index was also determined, based on the angle of the leaves to the stems. A value of 1 in-

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Table 1. Flower and foliage characteristics of 40 chrysanthemum cultivars grown as single plants in 4 in. pots.

Cultivar	Plant height (in)	Plant width (in)	Flower diam. (in)	No. breaks	No. flowers per break	Total no. flowers	Plant support	Foliage Size - Color	Overall rating ^y
<u>White</u>									
BGA Aspen (8) ^z	11.0	10.2	3.5	5.2	5.4	28	Med	Med-Light	3
BGA Cheers (8)	10.2	11.8	3.2	6.2	6.4	40	Poor	Med-Med	3
BGA Commander (9)	9.3	9.4	3.4	6.4	6.8	44	Good	Small-Dark	3
CFPC Marguerita (9)	23.2	14.2	5.3	4.4	11.0	48	Good	Med-Med	1
BGA Mercury (9)	9.1	10.2	3.7	6.2	8.2	51	Good	Small-Med	4
BGA Neptune (9)	10.6	10.2	2.8	7.0	7.4	52	Good	Med-Dark	4
Oregon (10)	9.1	9.4	4.1	5.2	7.8	41	Good	Med-Some chl.	4
Paragon (8)	10.2	10.6	3.5	6.8	9.0	61	Med	Med-Dark	4
BGA Puritan (9)	11.0	9.8	2.8	7.8	9.6	75	Good	Small-Med	4
CFPC White Daisy Pot (9)	10.2	10.6	3.3	4.2	10.8	45	Good	Med-Med	5
CFPC White Pot (9)	9.8	10.2	3.1	5.6	14.0	78	Med	Small-Med	4
White Spider Pot (10)	15.0	10.2	5.4	6.0	9.6	58	Med	Small-Light	3
<u>Red & Bronze</u>									
BGA Cimmaron (9)	12.2	13.0	3.0	5.8	8.2	48	Med	Med-Med	3
Delaware (10)	7.9	9.4	4.3	4.8	8.4	40	Good	Med-Med	4
BGA Festival (10)	10.6	11.4	3.7	4.8	8.2	39	Good	Med-Med	4
BGA Matador (9)	8.3	8.7	3.1	5.2	5.6	29	Med	Large-Dark	4
BGA Red Baron (9)	10.2	9.8	3.7	5.0	5.8	29	Good	Large-Dark	4
BGA Vermillion (9)	8.7	9.1	3.1	5.2	7.4	39	Good	Med-Dark	4
BGA Warhawk (10)	9.4	10.6	3.8	4.6	8.2	38	Good	Med-Dark	3
BGA Wildfire (9)	9.1	9.4	3.4	5.0	7.4	37	Good	Med-Light	5
<u>Pink & Lavender</u>									
BGA Always Pink (8)	9.1	9.8	3.4	7.6	5.4	41	Good	Med-Med	5
BGA Blue Ridge (10)	10.6	11.8	3.5	7.2	10.4	75	Good	Med-Med	4
BGA Bravo (10)	9.8	10.2	3.2	8.6	7.4	64	Good	Med-Med	4
Bridesmaid (9)	10.2	13.8	4.3	7.0	10.4	73	Med	Small-Light	4
Bright Rosamund (10)	15.0	10.2	3.8	3.4	8.6	29	Good	Large-Light	2
BGA Charm (9)	9.8	8.7	2.8	5.0	7.3	36	Good	Med-Med	2
BGA Conquest (9)	14.6	12.6	3.0	5.8	8.0	46	Good	Med-Med	3
BGA Deep Mermaid (9)	9.1	9.4	2.5	6.5	8.8	69	Good	Small-Dark	5
Distinctive (8)	9.1	11.4	3.5	7.8	8.8	69	Good	Med-Dark	5
BGA Frolic (10)	11.0	10.2	1.9	5.6	13.8	77	Med	Med-Med	2
BGA Illini Hot Pink (9)	11.4	11.4	3.6	6.6	6.4	42	Fair	Med-Med	4
BGA In the Pink (8)	10.6	9.1	3.1	5.3	6.3	34	Med	Med-Dark	3
BGA Malabar (9)	10.2	10.6	3.1	7.6	8.2	62	Good	Med-Med	5
BGA Resplendent (8)	8.7	10.2	4.0	5.4	8.6	46	Good	Med-Med	5
<u>Yellow</u>									
BGA Discovery (9)	8.7	9.1	3.5	6.2	6.8	42	Good	Med-Dark	5
Bright Golden Anne (10)	15.0	11.8	3.3	5.0	6.2	31	Poor	Med-Med	2
BGA Goldenrod (10)	9.1	11.0	3.3	5.5	5.5	30	Med	Large-Light	3
CFPC Gold Pot (9)	9.1	10.6	3.3	5.6	17.8	100	Good	Small-Light	4
BGA Mt. Sun (9)	8.3	8.3	2.8	7.0	6.6	46	Good	Med-Med	4
BGA Sunnyside Up (9)	8.7	8.3	3.2	5.2	4.8	25	Poor	Med-Med	2
BGA Treasure Chest (9)	8.7	9.4	3.0	5.0	7.0	35	Fair	Large-Med	3
CFPC Yellow Daisy Pot (9)	10.6	11.8	3.5	5.0	8.6	43	Good	Med-Med	5

^zNumber of weeks to flower following pinching.^y1 = poor, 5 = excellent.

indicated complete wilting and 5 indicated fully turgid leaves: 1 = foliage completely wilted (leaves 0° to stem); 2 = severe wilting (leaves <50° >0° to stem); 3 = moderate wilting (leaves >50° <75° to stem); 4 = incipient wilting (leaves >75° <90° to stem); 5 = fully turgid (leaves 90° to stem).

In addition, the plants were rated on general overall quality from 1 to 5 with 1 having no aesthetic value and 5 having excellent appearance: 1 = no aesthetic quality, 2 = little aesthetic quality, 3 = moderate deterioration of marginal quality, 4 = slight deterioration but of acceptable quality, 5 = excellent appearance and market

Table 2. Evaluation of flower and foliage characteristics of 30 chrysanthemum cultivars grown as single plants in 4 in. pots after 10 days of simulated home conditions.

Cultivar	Flowers ^z	Foliage ^y		Wilting Coefficient ^x	Overall quality ^w
		Upper	Lower		
<u>White</u>					
BGA Cheers	1.0	4.0	3.0	4.0	1.0
BGA Commander	2.0	4.3	3.7	3.0	1.8
BGA Mercury	4.3	4.7	4.3	4.7	4.0
BGA Neptune	3.7	4.7	4.3	3.0	3.3
Oregon	2.0	3.3	2.3	1.7	1.3
BGA Puritan	2.7	3.7	2.7	1.7	1.7
CFPC White Daisy Pot	3.3	4.3	3.7	3.7	2.2
CFPC White Pot	2.0	3.7	2.3	1.7	1.4
<u>Red & Bronze</u>					
BGA Cunnarib	3.3	5.0	4.0	5.0	3.5
Delaware	4.3	5.0	4.3	5.0	4.4
BGA Festival	3.7	4.0	2.7	3.3	2.6
BGA Red Baron	3.0	5.0	4.3	4.0	2.8
BGA Vermillion	4.0	5.0	3.3	5.0	3.2
BGA Warhawk	4.7	5.0	4.0	5.0	4.7
BGA Wildfire	4.5	4.3	3.7	5.0	3.8
<u>Pink & Lavender</u>					
BGA Always Pink	2.3	3.0	2.3	2.0	1.7
BGA Bravo	2.0	4.0	2.3	3.7	2.2
Bridesmaid	3.0	5.0	3.7	5.0	3.7
Bright Rosamund	2.3	4.0	3.7	3.3	2.7
Conquest	2.7	3.0	1.7	1.7	1.7
BGA Illini Hot Pink	1.3	4.0	3.3	1.7	1.3
BGA In the Pink	2.0	4.0	3.3	2.3	2.0
BGA Malabar	3.7	5.0	4.0	4.7	3.1
<u>Yellow</u>					
BGA Discovery	4.7	4.7	4.3	5.0	3.9
Bright Golden Anne	3.3	4.0	3.0	3.3	2.8
BGA Goldenrod	3.0	4.3	3.7	3.3	3.2
BGA Mt. Sun	3.3	4.3	3.3	2.3	2.9
BGA Sunnyside Up	3.3	3.7	2.7	3.3	2.1
BGA Treasure Chest	5.0	5.0	4.0	5.0	4.5
CFPC Yellow Daisy Pot	4.7	4.7	4.3	5.0	3.6

^z1 = dessicated, 5 = turgid and well developed

^y1 = extremely chlorotic, 5 = no chlorosis

^x1 = completely wilted, 5 = turgid

^w1 = no market value, 5 = excellent market value

quality. Plants were rated by 3 observers and their evaluations were averaged.

Results and Discussion

Data on the flower and foliage characteristics of the 42 chrysanthemum cultivars are presented in Table 1. Height of the plants above the rim of the pot ranged from 7.9 to 23.2 in, represented by 'Delaware' and 'CFPC Marguerita', respectively. For pleasing aesthetic value the optimum height of the plants above the rim of the pot, which was 4 in high, should be between 8 and 12 in. All but 7 of the cultivars produced finished plants within this range. Height of most of these cultivars could probably be reduced by additional sprays of B-9 but 'CFPC Marguerita' was much too tall to be used for this type of potted plant.

Plant width ranged from 8.3 to 14.2 in, represented by 'BGA Mt. Sun' and 'CFPC Marguerita', respectively. For a mass market, a pot containing properly proportioned plants would be most desirable. Therefore, a plant with a height of 10 in above the pot should be approximately 10 in wide. Any extreme deviation from these dimensions would produce a disproportionate plant. For example, 'Bridesmaid' had a height of 10.2 in but a width of 13.8 in. This would indicate that the lateral breaks spread to the sides and were not upright in the pot, leaving the center of the pot void of flowers.

Flower diameter, not a critical factor in mass market pots, ranged from 1.9 to 15.4 in, represented by 'BGA Frolic' and 'White Spider Pot', respectively. The number of lateral branches developing following removal of the apical meristem and the number of flowers per lateral is critically important. Number of laterals per plant ranged from 3.4 to 8.6, represented by 'Bright Rosamund' and 'BGA Bravo', respectively. For maximum floral display the plant should have at least 5 lateral shoots developing after pinching. Thirty-four of the cultivars evaluated produced 5 or more lateral branches. Number of potential flowers, obtained by counting the number of floral buds per lateral, ranged from 4.8 to 17.8, represented by 'BGA Sunnyside Up' and 'CFPC White Pot', respectively. The majority of the cultivars produced between 6 and 8 flower buds per lateral.

Total number of potential flowers per plant, obtained by multiplying the number of laterals times the number of floral buds per lateral, ranged from 25 to 100, represented by 'BGA Sunnyside Up' and 'CFPC Gold Pot', respectively. Majority of the cultivars had a flower potential between 40

and 60 per plant. Most of the cultivars had sturdy stems which held the flowers upright. 'BGA Cheers', 'Bright Golden Anne' and 'BGA Sunnyside Up' had very weak stems which made the pots unsaleable.

Based on the characteristics of the plants in the greenhouse, the cultivars most adapted to this type of culture were: 'CFPC White Daisy Pot', 'BGA Wildfire', 'BGA Always Pink', 'BGA Deep Mermaid', 'Distinctive', 'BGA Malabar', 'BGA Resplendent', 'BGA Discovery', and 'CFPC Yellow Daisy Pot'.

Results of the evaluation of the shelf life of 30 of the chrysanthemum cultivars are summarized in Table 2. Flower quality ranged from 1.0 to 5.0, represented by 'BGA Cheers' and 'BGA Treasure Chest', respectively. Flowers of the former were almost completely desiccated at the end of the 10 day period while those of the latter were still turgid and of marketable quality. The yellow cultivars appeared to retain quality flowers better than the other colors with the pinks and lavenders fading and petal margins becoming necrotic.

Chlorosis of the foliage was more pronounced in the lower leaves than in the upper. Several of the cultivars, such as 'Delaware', 'BGA Red Baron', 'BGA Warhawk', and 'BGA Treasure Chest', showed almost no chlorosis in the leaves, even after 10 days of reduced light and extreme water stress. 'BGA Conquest' exhibited the most extreme foliage chlorosis. The foliage wilting coefficient, which measured the angle of the leaves to the stem, ranged from 1.7 to 5.0. Generally this parameter could be directly correlated with flower quality. As the leaves lost their turgidity, the quality of the flowers decreased. As has been shown previously (3), shelf life of the potted mums varied greatly according to the cultivar.

Cultivars which displayed the highest overall quality, based on both flower and foliage characteristics, following 10 days shelf life were: 'BGA Mercury' (4.0), 'Delaware' (4.4), 'BGA Warhawk' (4.7), and 'BGA Treasure Chest' (4.5). Generally plants with the decorative-type flowers had better shelf life than the daisy or incurve type flowers.

Based on the information presented herein, it is evident that many of the cultivars presently grown in Florida as multi-plant pots are adapted to a mass-market unit of one pinched plant per 4 in pot. The "disposable" plant could be sold either in large chain stores or grocery stores on a year-round basis at about one third the cost of the large potted chrysanthemums. Being readily avail-

able and at a reasonable cost would entice consumers to purchase the plants for general home decorations and not just for special occasions.

Literature Cited

1. USDA. 1973. Flowers and foliage plants. Production and Sales 1971, 1972, and intentions for 1973. USDA Statistical Reporting Service Sp Cr 6-1 (73). 19 pp.

2. Waters, W. E. and C. A. Conover. 1969. Chrysanthemum production in Florida. *Fla. Agr. Exp. Sta. Bull.* 730. 64 pp.

3. Wesenberg, B. A. and G. E. Beck. 1964. Influence of production environment and other factors on the longevity of potted chrysanthemum flowers (*Chrysanthemum morifolium* Ramat.). *Proc. Amer. Soc. Hort. Sci.* 85:584-590.

DEVELOPMENT OF DWARF ORNAMENTAL TOMATO VARIETIES AND EVALUATION OF SOIL MEDIA AND FERTILIZER REQUIREMENTS

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Abstract. Forty-three University of Florida ornamental dwarf tomato breeding lines were developed by crossing selected dwarf plants from various sources which were deficient in either horticultural type or disease resistance with standard varieties and lines and then selecting desirable recombinant progeny. Production performance of three of the dwarf ornamental tomato lines possessing characteristics desirable for potted plant production was evaluated when grown in different soil media and at different fertility levels. All new dwarf lines evaluated produced high quality potted plants when grown in a 1:1:1 volume mixture of native peat:builders sand:pine bark or 1:1 native peat:builders sand and fertilized with 10 grams of 14-14-14 "Osmocote" per 6-inch azalea pot.

Sales of tomato cultivars eg. 'Tiny Tim', 'Patio', 'Spring Giant' and 'Small Fry' by plant producers to consumers with limited garden areas have increased greatly in the past five years. These "window-box" and "patio" type tomato plants are especially attractive to mobile-home and apartment dwellers who are interested in growing plants

which are edible as well as esthetically pleasing. Increasing food costs probably have contributed to the popularity of such plant types.

Nurserymen have expressed interest in marketing of tomatoes as potted plants. Such plants are currently marketed on a small scale and are retailed after fruit set but before they ripen. A cursory investigation of the economics of production and sales of tomatoes as potted plants indicates such an operation would be feasible if suitable plant types were available. Cultivars currently available for this type of production are either not well adapted from a horticultural standpoint or have inadequate disease resistance. Therefore, studies were initiated in 1969, first to develop highly improved inbred lines of dwarf types for use by commercial seedmen to produce F_1 hybrid potted tomatoes and, secondly to evaluate production systems for these new dwarf types. Numerous preliminary studies were conducted with different plant types, field and greenhouse production schemes, fertilizer methods and soil media (1,2). This paper presents summary data on comparison of 43 dwarf tomato breeding lines developed at AREC-Bradenton and two experiments with three selected breeding lines which are being considered for release as genetic stocks with fertilizer rates and soil media as variables.

Materials and Methods

Breeding. In preliminary studies, several dwarf tomato breeding lines were acquired and evaluated in 1969 for concentrated fruit set, fruit size, earliness and foliage and bush characteristics. Seed sources were USDA Plant Introductions (P.I.'s), various seed companies and nursery plants pur-