Variety Trials

Evaluation of Dwarf Ornamental Chile Pepper Cultivars for Commercial Greenhouse Production

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ADDITIONAL INDEX WORDS. *Capsicum*, compact, compact plant, dwarf, semidwarf

SUMMARY. In the past, many ornamental chile pepper (*Capsicum annuum*) cultivars had to be pinched or sprayed with a uniconazole foliar application to achieve a dwarf, semidwarf, or compact plant habit. This study compares 12 currently available commercial ornamental pepper cultivars considered to be compact, and introduces 13 new ornamental pepper cultivars that do not require pinching or a uniconazole foliar spray to accomplish the desired dwarf or semidwarf plant habit. All 25 cultivars evaluated in this study were given either a dwarf or semidwarf classification based on industry standards. Of the 25 cultivars evaluated, 12 originate from and are commercially available and bred by various breeding programs, whereas 13 are new cultivars bred by the New Mexico State University Chile Pepper Breeding Program with the goal of having dwarf or semidwarf growth habits. Data indicate that the 13 new ornamental chile pepper cultivars did not require pinching or a chemical foliar spray to develop a dwarf or semidwarf plant habit and have the potential for commercial container production in the greenhouse and nursery industries.

Chile peppers have been highly regarded as ornamental plants since being introduced to Europe in the 15th century (Armitage and Hamilton, 1987). Chile peppers considered by the horticulture industry to be “ornamental,” are compact plants with colorful or showy fruit that grow well in containers (Stommel and Bosland, 2006). From the 1800s to the 1920s, chile pepper plants were given as Christmas gifts because they had pods with red and green fruit colors associated with the Christmas holiday. Today, the typical

Christmas plant is a poinsettia (*Euphorbia pulcherrima*), and ornamental chile peppers have lost their association with this holiday (Hammer, 1980). However, in addition to spring and summer sales for outside plantings, ornamental chile peppers are commonly marketed for sale as house plants in the late fall and early winter months (Stommel and Bosland, 2006).

Standard chile pepper cultivars have a dichotomous growth pattern,

whereas ornamental chile pepper cultivars have polychotomous branching of the basal stems giving plants a shorter and more compact growth habit. This makes them ideal as container plants with commercial value for the greenhouse and landscape industry (Bosland et al., 1994). Many of the commercial ornamental pepper cultivars currently available need to be pinched or sprayed with a uniconazole foliar application to achieve a dwarf or semidwarf plant habit (Starman, 1993). Dwarf and semidwarf plants are generally recognized as being smaller than normal size plants, whereas compact plants are defined by a dichotomous growth pattern (Bosland et al., 1994). Conversely, Corley and Dempsey (1971) described a compact ornamental chile pepper plant as a plant reaching 48 cm or less in height, which is too tall for most container production and required pinching or spraying to reach the desired dwarf and compact plant habit. This study compared 12 currently available commercial ornamental pepper cultivars considered to be compact and introduces 13 new ornamental pepper cultivars that do not require pinching or a uniconazole foliar spray to develop a dwarf or semidwarf plant habit. The 12 currently available ornamental pepper cultivars were chosen based on their popularity as nursery-potted plants, whereas the 13 new and commercially available ornamental pepper cultivars are being evaluated for the dwarf and semidwarf characteristics. In this study, dwarf is considered to be 15 cm or shorter in height, whereas semidwarf is considered to be 16 to 25 cm.

Materials and methods

Seeds of each cultivar were sown in 12-celled plastic trays (T.O. Plastics, Clearwater, MN). Trays were filled with a commercial peatmoss-vermiculite soil mixture (RediEarth Plug & Seedling Mix; Sun Gro Horticulture, Bellevue, WA). Trays were placed on propagation pads to maintain root zone temperature at 28 °C

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doi: 10.21273/HORTTECH03452-16

Units

To convert U.S. to SI, multiply by	U.S. unit	SI unit	To convert SI to U.S., multiply by
0.3048	ft	m	3.2808
2.54	inch(es)	cm	0.3937
(°F – 32) ÷ 1.8	°F	°C	(°C × 1.8) + 32

Table 1. Plant heights and widths of 25 ornamental chile pepper cultivars grown in 4- and 6-inch containers in 2015. Measurements were taken about 128 d after planting.

Cultivar	Plant ht (cm) ^z	Plant width (cm)	Plant ht (cm)	Plant width (cm)
	4-inch container		6-inch container	
Blanca	15.9 cd ^y	15.0 de	19.4 b	20.0 cdef
Blast	11.6 fgh	13.8 ef	13.6 defg	18.5 efg
Calico	15.5 cd	18.3 bc	20.6 ab	25.9 a
Conga	12.3 efg	11.0 g	11.0 fgh	16.9 fghij
Explosive Ember	17.1 bc	22.5 a	20.4 ab	23.6 ab
Favorit Yellow	8.6 hi	15.6 de	9.8 gh	20.7 bcde
Masquerade	21.5 a	13.8 ef	23.9 a	18.5 efg
Medusa	13.8 def	12.2 fg	14.6 cdef	12.8 kl
NuMex April Fool's Day	19.2 ab	17.5 bcd	24.4 a	18.3 efg
NuMex Chinese New Year	17.2 bc	13.8 ef	18.1 bc	19.6 def
NuMex Christmas	10.7 fghi	9.8 gh	12.5 efg	15.1 hijkl
NuMex Cinco de Mayo	16.9 bcd	16.0 cde	18.8 bc	22.4 bcd
NuMex Earth Day	10.3 ghi	10.0 gh	11.7 fgh	12.2 l
NuMex Easter	15.1 cde	14.4 ef	16.8 bcde	18.1 efg
NuMex Halloween	10.3 ghi	17.1 bcd	10.5 fgh	20.2 bcde
NuMex Memorial Day	10.4 ghi	9.7 gh	13.2 defgh	14.3 jkl
NuMex St. Patrick's Day	10.0 ghi	15.4 de	10.7 fgh	20.0 cdef
NuMex Summer Solstice	8.4 hi	15.2 de	10.1 gh	15.8 ghijk
NuMex Thanksgiving	7.6 i	7.9 h	9.0 h	13.7 jkl
NuMex Valentine's Day	10.4 ghi	10.0 gh	11.6 fgh	18.5 efg
NuMex Veterans Day	10.8 fghi	7.9 h	10.7 fgh	14.9 ijkl
Purple Flash	15.1 cde	18.9 b	17.1 bcd	23.4 ab
Red Missile	15.5 cd	15.3 de	19.5 b	18.1 efg
Sangria	15.7 cd	17.5 bcd	20.6 ab	23.0 abc
Treasures Red	17.2 bc	11.0 g	18.2 bc	18.8 efg
	$P \leq 0.0001$	$P \leq 0.0001$	$P \leq 0.0001$	$P \leq 0.0001$

^z1 cm = 0.3937 inch.

^yMeans followed by the same letter within a column are not significantly different at $\alpha = 0.001$, separated by Tukey's honest significant difference test.

Table 2. Plant and fruit characteristics of 25 ornamental chile pepper cultivars.

Cultivar	Plant and fruit			
	Plant habit	Pod shape	Immature color ^z	Mature color
Blanca	Fasciculated compact	Large bullet	Pale ivory 10YR 8/4	Pale peach 2.5Y 8/6
Blast	Fasciculated semidwarf	Bullet	Yellow 5Y 8/6	Red 7.5 R 4/12
Calico	Compact	Pendulum bullet	Purple 10P 3/4	Red 7.5R 3/10
Conga	Semidwarf	Bullet	Purple 10P 3/4	Red 7.5R 3/10
Explosive Ember	Fasciculated compact	Bullet	Purple 10P 3/4	Red 7.5R 3/10
Favorit Yellow	Compact	Large bullet	Dark green 5GY 4/6	Dark yellow 10YR 7/12
Masquerade	Compact	Long thin	Purple 10P 3/4	Red 7.5R 3/10
Medusa	Dwarf	Long thin	Yellow 5Y 8/6	Red 7.5 R 4/12
NuMex April Fool's Day	Semidwarf	Long thin	Purple 10P 3/4	Red 7.5R 3/10
NuMex Chinese New Year	Fasciculated/dwarf	Bullet	Light green 5GY 6/8	Red 7.5R 4/12
NuMex Christmas	Dwarf	Round blunt	Dark green 5GY 4/6	Red 7.5R 3/12
NuMex Cinco de Mayo	Semidwarf	Long thin	Yellow 5Y 8/6	Red 7.5 R 4/12
NuMex Earth Day	Swarf	Round blunt	Dark green 5GY 4/6	Brown 5R 2/4
NuMex Easter	Fasciculated/semidwarf	Bullet	Lilac 10P 4/6	Orange 2.5YR 5/12
NuMex Halloween	Dwarf	Round tapered	Black 5P 2/2	Orange 2.5YR 5/14
NuMex Memorial Day	Dwarf	Round tapered	Off-white 5Y 7/6	Yellow 5Y 8/10
NuMex St. Patrick's Day	Dwarf	Round blunt	Dark green 5GY 4/6	Orange 2.5YR 6/14
NuMex Summer Solstice	Dwarf	Round blunt	Pale ivory 10YR 8/6	Pale peach 2.5Y 8/4
NuMex Thanksgiving	Dwarf	Round tapered	Off-white 10Y 8/4	Light orange 5YR 6/12
NuMex Valentine's Day	Dwarf	Round tapered	Ivory 7.5Y 8/6	Red 7.5RY 3/4
NuMex Veterans Day	Dwarf	Round tapered	Purple 10P 2/4	Dark orange 10R 4/10
Purple Flash	Compact	Small round	Purple 10P 3/2	Red 7.5R 3/8
Red Missile	Compact	Large bullet	Yellow 5Y 8/5	Red 7.5 R 4/12
Sangria	Compact	Bullet	Purple 10P 3/4	Red 7.5R 3/10
Treasures Red	Semidwarf	Large bullet	Yellow 5Y 8/6	Red 7.5 R 4/12

^zColor codes from the Munsell Book of Color (Xrite Inc., 1980) with page number (e.g., 10YRP), followed by value/chroma.

and hand irrigated twice daily. Plants were grown in a climate-controlled greenhouse maintained at 28 ± 6 °C day/ 18 ± 6 °C night temperatures, with a 12-h natural light photoperiod. The greenhouse is located at the New Mexico State University Fabian Garcia Science Center in Las Cruces (lat. 32.16°N, long. 106.46°W, elevation 1186 m). When the seedlings reached the two true-leaf stage, they were transplanted to 4- and 6-inch plastic azalea containers AZG04000 and AZE06000, respectively (T.O. Plastics) with a professional growing medium (LM-3 Professional Growing Medium; Lambert, Riviere-Ouelle, Québec, Canada), and fertilized with 14N-6.1P-11.6K controlled-release fertilizer (Osmocote; Everris International, Geldermalsen, The Netherlands). Containers were moved from propagation mats and placed on benches 6 inches apart; however, all other greenhouse conditions remained the same. Once the fruits began to change from the immature color to the mature color, which was ≈ 128 d from planting, height and width measurements, immature and mature color data, and pod shape descriptions were taken on each plant for the 4- and 6-inch container sizes. Color was recorded by comparing the color tabs in the Munsell Book of Color (Xrite Inc., 1980) observed in full daylight.

The experimental design was a completely randomized block design with five replications. Five 6-inch potted plants and five 4-inch potted plants of each cultivar were observed and each plant was considered a replication. Data were analyzed by analysis of variance using JMP (version 11.0 Pro; SAS Institute, Cary, NC). Tukey's honest significant difference test was used for means separations ($\alpha = 0.001$). Associations among all dependent variables were determined using multivariate pairwise correlation coefficients of the mean values using JMP.

Results and conclusion

For each cultivar, mean plant height and width are shown for both 4- and 6-inch containers in Table 1. Nine of the new dwarf ornamental chile pepper cultivars did not exceed 15 cm in height when grown in both 4- and 6-inch containers, whereas the four new semidwarf ornamental chile pepper cultivars did not reach greater

than 25 cm in 6-inch containers and 22 cm in 4-inch containers.

When planted in the 4-inch containers, each of the heights of cultivars NuMex Thanksgiving, NuMex Summer Solstice, NuMex St. Patrick's Day, NuMex Halloween, NuMex Veterans Day, NuMex Valentine's Day, NuMex Earth Day, NuMex Christmas, and NuMex Memorial Day were statistically significantly shorter than all other cultivars except Favorit Yellow, Conga, and Blast. The commercial cultivars Favorit Yellow, Conga, and Blast could be classified as dwarf ornamental pepper cultivars (Table 1). When planted in

either the 4- or 6-inch containers, the semidwarf cultivars NuMex April Fool's Day and Masquerade heights were not statistically significantly different from each other ($P \leq 0.0001$).

When planted in 6-inch containers, the heights of dwarf cultivars NuMex Thanksgiving, NuMex Summer Solstice, NuMex St. Patrick's Day, NuMex Halloween, NuMex Veterans Day, NuMex Valentine's Day, NuMex Earth Day, NuMex Christmas, NuMex Memorial Day, Favorit Yellow, Conga, and Blast were statistically significantly shorter than the semidwarf cultivars Medusa, NuMex Easter, Purple Flash, Red

Fig. 1. Twelve commercially available and 13 new ornamental chile pepper cultivars: (top row, left to right) NuMex St. Patrick's Day, NuMex Valentine's Day, NuMex Veterans Day, and Favorit Yellow*; (second row) Sangria*, Calico*, Treasures Red*, and NuMex Thanksgiving; (third row) NuMex April Fool's Day, NuMex Chinese New Year, NuMex Christmas, and NuMex Cinco de Mayo; (fourth row) NuMex Earth Day, NuMex Easter, NuMex Halloween, and NuMex Memorial Day; (fifth row) Masquerade*, Purple Flash*, Medusa*, and Explosive Ember*; (bottom row) NuMex Summer Solstice, Red Missile*, Blanca*, and Blast* (photo courtesy of Ball Horticultural Co., West Chicago, IL).

Missile, NuMex Chinese New Year, Blanca, Treasures Red, NuMex Cinco de Mayo, Calico, Sangria, Explosive Ember, NuMex April Fool's Day, and Masquerade (Table 1); but NuMex April Fool's Day and Masquerade were statistically significantly taller than all other semidwarf cultivars but still under 25 cm height and can be classified as semidwarf. Interestingly, the cultivar Conga's width was strongly influenced by container size and falls into different categories when grown in the two different container sizes.

The cultivars NuMex St. Patrick's Day, NuMex Halloween, NuMex Valentine's Day, NuMex Earth Day, NuMex Christmas, NuMex Memorial Day, NuMex Thanksgiving, NuMex Summer Solstice, and NuMex Veterans Day were classified as dwarf plants, because they were shorter and more compact and were 50% to 70% shorter than the size of normal (48 cm or more) ornamental pepper plants. The cultivars NuMex Easter, NuMex Cinco de Mayo, NuMex Chinese New Year, and NuMex April Fool's Day were classified as semidwarf, and were 30% to 50% shorter than normal size ornamental pepper cultivars, such as NuMex Twilight and NuMex Centennial (Bosland et al., 1994). All heights for the dwarf NuMex ornamental pepper cultivars were significantly different from the semidwarf NuMex

ornamental pepper cultivars and the semidwarf commercial cultivars within the 4- and 6-inch container sizes.

We found that the 4-inch potted plant height was significantly correlated with 6-inch potted plant height ($r = 0.89$), illustrating the low influence of container size on plant height. Although not a characteristic categorized in the industry, plant width plays an important role in the ease of shipment for the greenhouse industry. Interestingly, plant height and plant width were not correlated for the 4- or the 6-inch grown ornamental chile pepper cultivars. This is a novel and noteworthy finding as it provides important insight for commercial growers for cultivar selection. All of the 12 currently available commercial ornamental chile pepper cultivars and the 13 new NuMex commercially available ornamental chile pepper cultivars were classified as dwarf or semidwarf classification based on industry standards. These results mean that none of the cultivars require pinching or a uniconazole, foliar spray to accomplish the desired, dwarf and compact plant habit when grown for greenhouse container production.

All of the ornamental chile peppers evaluated in this study have unique color transitions, fruit shapes, and plant habits (Table 2; Fig. 1). Each of the evaluated cultivars was

also observed by nursery and container plant industry representatives and is considered to be acceptable ornamentals for the commercial market (J. Anderson, unpublished data; T. Knoop, unpublished data).

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