

Evaluation of Safflower Germplasm for Ornamental Use

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Safflower (*Carthamus tinctorius* L., Asteraceae), is an annual or winter annual herbaceous plant that is adapted for growth in hot and dry environments. Plants often have many spines on leaves and bracts, although plants with few spines exist. Young plants form rosettes that tolerate temperatures as low as -7°C , but are unable to compete well with weeds. Stem elongation in spring-planted safflower begins approximately one month after emergence. After stem elongation the plants are very susceptible to frost injury (Helm et al. 1991). Florets form a capitulum at the end of each stem, usually displaying hues of yellow, orange, red, and rarely white, which darken when dry (Li and Mündel 1996). Safflower is mostly self-pollinating in the absence of pollinators (Knowles 1969).

The Western Regional Plant Introduction Station (WRPIS) is a part of the United States National Plant Germplasm System (NPGS) and maintains the US safflower collection which includes more than 2,300 accessions collected from over 50 countries. Descriptors for the crop include branching pattern, flower color, spininess, head size, plant height, date of flowering, growth habit, iodine number, lysine content, and oil content. Many of the accessions have been evaluated for one or more descriptors and the data have been entered in the Germplasm Resources Information Network (GRIN) along with "passport" data such as taxonomy, improvement status, country of origin, and other collection information. Accessions from the collection are available at no charge to scientists worldwide.

Historically, safflower has been used for many purposes such as, a dye, food coloring, a medicinal, a vegetable side dish, hay and forage, birdseed, and most commonly for edible food oil (Li and Mündel 1996). Presently, safflower is grown primarily for oil in the United States. In Europe, however, safflower is used for both fresh-cut and dried flowers (Uher 1997). Although dried safflower may be found in craft stores in the United States, it is often imported from Holland. It is possible that a market for safflower as an ornamental plant could be developed in the US and would depend on the availability of safflower of ornamental quality. The WRPIS safflower collection most likely includes material that could be used for ornamental purposes with little or no selection.

METHODOLOGY

Safflower accessions for observation were chosen from the WRPIS collection based on information listed in GRIN. All safflower accession data were reviewed for presence or absence of narrative descriptions. Of the almost 800 accessions that had such information, 80 were selected because the narrative description indicated they were used for flowers, were relatively spineless, or displayed a characteristic of interest.

The evaluation nursery was planted on March 30, 1998 at the WRPIS Central Ferry Research Farm, Washington, located in the Snake River Canyon at 46.7°N latitude, 200 m above sea level. Prior to planting approximately 67.2 kg/ha of nitrogen and 10 kg/ha of sulfur were applied and incorporated into the soil as was a pre-emergence herbicide. Seeds were treated with a fungicide prior to being planted in 3 m long single rows, on 1.5 m centers. Rosette-stage plants were thinned to 10 cm apart within a row, and irrigated at a rate of approximately 20 mm per week.

Field evaluation data were recorded and samples of 13 of the most promising were collected for fresh-flower arrangements and for drying (Table 1). Safflower stems were cut and placed in water and kept cool while transported to the WRPIS main facilities at Pullman, Washington. They were submerged up to the heads in water overnight. The following day, the stems were trimmed, lower foliage was removed, and stems were placed in a preservative solution commonly used in the floral industry. These stems were then

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Table 1. Data collected on 13 safflower accessions selected for potential ornamental use.

Accession number	Country	Improvement status	Days to 50% bloom	Flower color ^z		Head size (cm)	Plant height (cm)	Variation ^y	Spines ^y
				wet	dry				
PI 304439	Iran	wild	107	O	R	3.0	100	1	2
PI 304441	Iran	wild	108	O	R	3.0	100	2	1
PI 304442	Iran	wild	107	O	R	3.5	100	1	2
PI 314650	Kazakhstan	wild	100	DO	R	3.0	77	1	1
PI 406012	Iran	cultivated	99	Y	O	3.0	84	2	2
PI 406014	Iran	cultivated	107	Y	O	3.0	84	3	2 or 4
PI 406016	Iran	cultivated	107	Y	O	3.0	84	1	2
PI 406018	Iran	cultivated	100	Y	O	2.5	80	1	2
PI 537618	US	breeding material	98	O	R	3.0	100	1	1
PI 537619	US	breeding material	109	O	R	3.0	90	2	2
PI 544058	China	cultivated	107	O	R	2.5	86	1	1
PI 544059	China	cultivated	101	O	O or G	2.5	80	3	1 or 5
PI 560197	US	breeding material	102	Y or O	O or R	3.5	80	2	2

^zO = orange, DO = dark orange, Y = yellow, G = gold, R = red.

^yRated from 1 (low) to 5 (high).

placed in several fresh arrangements, and photographed. Other stems were hung upside down until dry and then sprayed with a sealant/protectant to prevent breakage and preserve color.

RESULTS

The most important plant characteristics indicating ornamental value in safflower are a combination of appealing flower color and few spines and these descriptors were used as the major evaluation criteria. Thirteen of the 80 accessions observed showed promise for ornamental use as fresh-cut, and/or dried flowers (Table 1).

The majority of selected accessions in Table 1 had few spines except PI 544059 and PI 406014, both of which had equal numbers of plants with many and with few spines. Plants with desired characteristics could easily be selected from these two accessions.

Many flower colors and shades were observed in the eighty accessions evaluated, but accessions with few spines had either orange, red, or yellow fresh flowers. One of the 13 selected accessions, PI 560197, had plants with either yellow or orange fresh flowers, while another, PI 544059, had yellow flowers that dried to either orange or gold. None of the selected accessions had white or pink flowers.

Overall variation within each accession row was evaluated and accessions with high variation scores (4 or 5) were not considered to have ornamental value. Although several of these accessions had individual plants of interest, there are other accessions in the WRPIS safflower collection that could be grown for floral use with little selection.

CONCLUSIONS

A small percentage of the safflower collection at the WRPIS was screened for ornamental value and all 13 of the selected accessions had flowers in shades of orange, red, or yellow. Screening of the collection will continue with the major objective of finding accessions or individual plants with white, pink, or other unique flower colors and few spines. Images of each accession evaluated will be downloaded into GRIN. Other plans include working with horticulturists to evaluate potential use of safflower in home gardens and landscapes, growing safflower in the greenhouse for cut flowers, and consulting with floral industry personnel regarding the market for fresh-cut safflower in the US.

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