

RESULTS OF THE NATIONAL CRABAPPLE EVALUATION PROGRAM

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ABSTRACT -- The National Crabapple Evaluation Program began in 1984 and distributed 49 crabapple taxa to 25 locations. The purpose of this evaluation program was to select some of the good-quality crabapple cultivars that were readily available and test them at different locations throughout the United States. Previous crabapple evaluations were conducted in established collections. Disease resistance and other differences within a given cultivar were observed at various locations. The National Crabapple Evaluation Program was designed to reduce variables in scion source and understock which could be the cause of some of the evaluation variation. By 1990 most trees that had been distributed were large enough to evaluate for disease resistance and autumn aesthetic appeal. After four years of evaluation it was determined that there were a few cultivars that performed well at most of the test sites. However, many of the cultivars are affected by regional diseases and environmental factors. Crabapples recommended for use in a given area should be based upon the performance of the crabapples located in the closest NCEP test plot rather than from a generic list.

BACKGROUND

Professor Les Nichols spent much of his Extension Plant Pathology career at Penn State University evaluating crabapples at botanic gardens, arboreta, parks, private estates and nurseries throughout the 1960'S until his death in 1985. This included the Morton Arboretum in Lisle, Illinois. I accompanied Les on his evaluation during my first summer at the Arboretum in 1981. By 1983 I was helping him at other sites in the midwest, including Boerner Botanic Garden, Hales Corners, Wisconsin and The University of Wisconsin Arboretum in Madison. There Edward R. Hasselkus, Extension Horticulturist, assisted in the evaluations.

Cultivar 'Profusion' was of particular interest because Les had found it to be severely susceptible to scab in Ohio, slightly susceptible in Wisconsin, and without scab infection in Illinois. It is known that a small percentage of plants at Botanic Gardens and Arboreta are incorrectly labeled. This could be one possible explanation for the differences observed. Maybe the scion sources were too far removed from the original 'Profusion'. Perhaps some of the trees were infected with viruses. Could understock affect disease resistance or symptom expression? There was no way to know the identity of the understock. There

was also a possibility of differences in disease races.

The only way to reduce some of the variables was to obtain trees (scions) from a single known source all grown on the same understock. Some materials used in the study were virus indexed, but not all.

MATERIALS AND METHODS

Ed Hasselkus and Les Nichols helped generate a list of quality crabapples (Table 1). Quality crabapples have a combination of some disease resistance and good ornamental characteristics. Included in good ornamental characteristics were attractive, small and persistent fruit. Fruit display lasts longer than the flower display, and the number one complaint directed at crabapples is messy fruit. It was decided that there should be three replicates of each cultivar and there should be disease-susceptible cultivars for controls and to help supply inoculum to the rest of the collection. When several nursery representatives were approached about supplying cooperating stations with crabapples, they were unwilling to ship three trees of each cultivar to each of the cooperating stations. They wanted to ship all the trees to one location where they could be distributed to cooperating stations. The Morton Arboretum was selected as the distribution center.

Les and Ed had numerous contacts and developed a list of cooperating stations. There were 15 original cooperators, but word of the program spread and others requested to be included. The final number of cooperating stations for the program was 25 (Table 2), but only 23 were able to submit evaluation reports.

Several nurseries were contacted in the fall and winter of 1983 and were willing to provide trees, free of charge, for testing (Table 1). Trees were shipped to the Morton Arboretum in the spring of 1984. Trees that died were replaced. New cooperating stations added after 1984 received a full set of trees. Trees were large enough to evaluate in 1990.

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EVALUATIONS

DISEASE

Trees were evaluated for scab, fire blight, powdery mildew, cedar-apple rust, and frog eye leaf spot. All evaluations were on a five-point scale that Les Nichols had used in his previous evaluations:

- 0 = no disease observed
- 1 = slight
- 2 = moderate
- 3 = severe
- 4 = very severe

AESTHETICS

It was observed that some cultivars that rated severely susceptible to scab in July were very different in September. For example, 'Radiant' had totally defoliated and 'Winter Gold', although heavily infected with scab, still had most of its leaves. 'Winter Gold' was expressing tolerance. Most homeowners do not care if their crabapple is heavily infected with scab, but they do care if the tree defoliates prematurely.

Also, fruit abundance, color and persistence were considered in the aesthetic evaluation. Evaluating the aesthetics of crabapples in the fall was considered to be more important than spring flower evaluations. Flower periods are relatively short, making it difficult to get evaluations from all cooperating stations. Besides, most of the crabapples that were chosen for the study were known to have nice flower displays. Aesthetic evaluation criteria:

- 0 = perfect tree; abundant fruit; fruit colorful; no disease. (This is the tree that attracts your attention from the rest in the collection and is used to compare the rest).
- 1 = highly ornamental; fruit may not be heavy, but with good color; little or no disease.
- 2 = ornamental; may be devoid of fruit; but with good leaf quality; may have heavy scab, but fruit highly ornamental.
- 3 = green tree; not considered to be very ornamental.
- 4 = not ornamental; large fruit dropping and making a mess; or defoliating due to disease.
- 5 = recommended removal; serious disease problems AND fruit mess.

RESULTS

I was personally able to evaluate only up to 12 of the cooperating stations each fall. Therefore, I relied on the cooperators to conduct fall evaluations. Not all of the cooperating stations submitted fall evaluations each year. Not all 3 trees of each cultivar survived in each cooperating station during the entire study. Trees at the North Dakota and Oklahoma cooperating stations suffered so severely during the drought of 1988 that these two cooperating stations were lost to the program. All this resulted in an unequal total (Sum).

Table 4 provides a Composite for years 1990, 1991, 1992 and 1993.

DISCUSSION

One of the original cultivars, *M. halliana* var. *Parkmanii*, was not true to name. It is believed to be *M. floribunda*. The results of this study show which trees have the least disease and the best display in the fall. Evaluators gave higher ratings to trees with bright red or orangish-red fruit over dark red and yellow fruit. The top 11 cultivars have bright red or orangish-

red fruit. Bright red and orangish-red fruit almost always correlates to white flowers. Therefore, pink and red flowering cultivars are somewhat penalized because they usually have dark red fruit. Indian Magic is an exception. One of the very best crabapples *M. floribunda*, the Japanese Flowering Crabapple, actually ranks 34th because of its poor fall display. When evaluating its disease resistance, form, and spring flower display this crabapple would rank near the top. However, in the fall its fruits turn from amber to brown, soften and drop. It provides a great source of food for wildlife, especially migrating robins and cedar waxwings.

Disease Resistance

Overall, trees that rank below 3.00 should be considered for use as highly ornamental trees. But when planting crabapples, disease resistance should be considered first. Scab can cause problems for many of these cultivars in the Pacific Northwest (west of the Cascades) and northeastern Ohio. Fire Blight is a big problem in Colorado and worth considering in Michigan, Ohio, and Washington D.C. It is of absolutely no consequence in the Pacific Northwest, yet. Some crabapples in South Carolina and Georgia had an unidentified leaf spot that caused defoliation similar to scab in some cultivars.

Form

There isn't one crabapple cultivar that works for every landscape. Crabapples come in different sizes and shapes. When choosing a crabapple for a given landscape, consider the ultimate size and form.

Fall Display

Table 4 provides a good list of trees that evaluate highly in late summer and fall. Since the fall display can last for weeks and months, it should be given a higher importance in the selection process than flower display. Harvest Gold® and 'Winter Gold' are yellow-fruited crabapples with delayed displays. They ranked lower because at the time of the fall aesthetic evaluations their peak color had not occurred. They would have ranked a little higher if evaluated two to three weeks later.

Flower Display

Most crabapples have a nice flower display. Placement in full sun will increase flower and fruit display. Some crabapples bear flowers every other year. *M. sargentii* and 'Mary Potter' exhibit this characteristic. Some crabapples, such as *M. X zumi* 'Calocarpa', 'Snowdrift', 'Adams' Profusion' and *M. floribunda*, bear abundant flowers every year. The flower display will last for approximately one week. Hot and windy weather can shorten the display time. Most crabapples have red or pink buds. Many open white; some stay pinkish or maintain a red petal fringe and are called pink & white. Some open pink and usually fade to nearly white when in full bloom. Others open dark red and fade to pink at full bloom. There are a few which open dark red. Some crabapples have double flowers (11 - 45 or more petals). None of

the double-flowering crabapples was included in this study. Double flowering crabapples last longer but petals often turn brown rather than drop off. Double flowering crabapples also tend to produce less fruit, resulting in less aesthetic fall displays. Flower color should be considered last, not first, when choosing a crabapple.

This study revealed that 'Indian Magic,, 'Adams,, 'Red Splendor', and 'Robinson, were among the best of the pink flowering crabapples. 'Prairifire, and 'Liset, were considered to be among the best of the red flowering crabapples. *M. X zumi* 'Calocarpa,, 'Professor Sprenger,, 'Donald Wyman,, Molten **Lava®**, Sugar **Tyme®**, and Red Jewel@ are at the top for white flowering, red-fruited crabapples.

Table 1. Crabapple taxa selected for use in the National Crabapple Evaluation Program

'ADAMS'	'PROFUSION'
baccata v. <i>Jackii</i>	'RADIANT' ²
'BEVERLY'	'RALPH SHAY'
'BOB WHITE'	'RED BARRON'
CENTURION@	'RED JADE'
CHRISTMAS HOLLY''	'RED JEWEL'
'DAVID'	'RED SPLENDOR'
'DOLGO'	'ROBINSON'
'DONALD WYMAN'	'ROYALTY''
<i>floribunda</i>	'RUBY LUSTER'
<i>halliana</i> v. <i>Parkmanii</i> '	sargen <i>tii</i>
HARVEST GOLD@	'SELKIRK'
'HENNINGII'	'SENTINEL'
'HOPA' ²	'SILVER MOON'
<i>hupehensis</i>	'SNOWDRIFT'
'INDIAN MAGIC'	'STRAWBERRY PARFAIT'
'INDIAN SUMMER'	SUGAR TYME@
'JEWELBERRY'	<i>tschonoskii</i>
'LISET'	'VELVET PILLAR'
'MARY POTTER'	WEEPING CANDIED APPLE@
MOLTEN LAVA@	'WHITE ANGEL'
'ORMISTON ROY'	WHITE CASCADE@
'PRAIRIFIRE'	'WINTER GOLD'
'PROFESSOR SPRENGER'	<i>yunnanensis</i> v. <i>Veitchii</i>
	x <i>zumi</i> 'Calocarpa'

¹ *halliana* v. *Parkmanii* originally included was incorrectly identified by nursery source.

² Disease susceptible trees used for controls and source of inoculum

Table 2. Cooperating Stations

- 1 Alabama: John den Boer, TVA Dam in Muscle Shoals¹
- 2 Colorado: James E. Klett, Colorado State University, Fort Collins
- 3 Georgia: Rich Ludwig, Gwinette Area Tech, Lawrenceville
- 4 Iowa: Jeff Iles, Iowa State University, Ames
- 5 Illinois: Thomas L. Green, Morton Arboretum, Lisle
- 6 Kentucky: Robert E. McNeil and John R. Hartman, University of KY, Lexington
- 7 Michigan: Tim Boland, Michigan State University, East Lansing
- 8 Michigan: Doug Chapman, Dow Gardens, Midland
- 9 Minnesota: Harold Pellet, University of Minnesota Landscape Arboretum, Chanhassen
- 10 Nebraska: John Watkins & Richard Sutton, University of Nebraska, Lincoln
- 11 New Mexico: Norm Lownds, New Mexico State University, Las Cruces
- 12 North Carolina: D. Mike Benson, North Carolina State University, Raleigh
- 13 North Dakota: Dale Herman, North Dakota State University, Fargo²
- 14 Ohio: Peter Bristol, Holden Arboretum, Mentor
- 15 Ohio: Ken Cochran, Secrest Arboretum, Wooster
- 16 Oklahoma: Carl Whitcomb, Oklahoma State University, Stillwater¹
- 17 Oregon: Keith Warren, J. Frank Schmidt & Son, Co., Boring
- 18 Pennsylvania: Scott Arboretum, Swarthmore
- 19 Rhode Island: Larry Englander, University of Rhode Island, Kingston
- 20 South Carolina: James B. Aitken, Clemson University, Elgin
- 21 South Carolina: Michael Dirr, Milliken Corporate HQ, Spartanburg¹
- 22 Utah: Larry Rupp, Utah State University, Logan
- 23 Washington: Robert Norton, NW Washington Extension Unit, Mount Vernon
- 24 Washington DC: Mark McGuinness, National Arboretum
- 25 Wisconsin: Bill Radler, Boerner Botanic Garden, Hales Corners

¹ Did not receive a full set of trees because of belated start

² Suffered severe losses in drought of 1988 and not included in evaluations

Table 3. Nurseries Supplying Trees For National Crabapple Evaluation Program

Nursery	Cultivars
Simpson Nursery Company, Vincennes, Indiana	18
J. Frank Schmidt & Son, Company, Boring, Oregon	16
Lake County Nursery, Perry, Ohio	4
The Cole Company, Madison, Ohio	3
Bailey Nursery, St. Paul, Minnesota	3
Mount Arbor Nursery, Shenandoah, Iowa	2
Princeton Nursery, Princeton, New Jersey	1
Moller's Nursery, Gresham, Oregon	1
Boyer Nursery, Biglerville, Pennsylvania	

Table 4. Composite Fall Aesthetic Crabapple Evaluation 1990-1993

NAME	0	1	2	3	4	5	SUM	AVG
x zumi 'CALOCARPA'	48	53	29	7	1	1	139	1.01
'PROFESSOR SPRENGER'	44	65	33	9	3	0	154	1.10
'DONALD WYMAN'	44	80	31	2	6	1	168	1.13
MOLTEN LAVA@	48	55	38	4	11	0	156	1.20
SUGAR TYME®	42	54	44	21	2	0	163	1.31
'SNOWDRIFT'	24	63	45	12	0	0	144	1.35
'DAVID'	31	57	35	20	4	0	147	1.38
RED JEWEL@	22	50	28	13	5	0	118	1.40
'INDIAN MAGIC'	23	68	45	18	5	0	159	1.45
'MARY POTTER'	28	64	38	18	7	3	158	1.49
'SENTINEL'	29	59	47	16	7	3	161	1.51
CHRISTMAS HOLLY''	19	48	30	13	4	3	117	1.52
'BOB WHITE'	3	68	60	10	1	0	142	1.56
'ADAMS'	9	83	56	21	1	1	171	1.56
'PRAIRIFIRE'	12	73	43	14	10	0	152	1.58
'INDIAN SUMMER'	21	50	58	23	3	1	156	1.61
'PROFUSION'	11	73	36	18	11	1	150	1.65
'HENNINGI'	10	53	62	17	4	0	146	1.66
'ORMISTON ROY'	13	66	43	20	9	3	154	1.70
'RED SPLENDOR'	7	46	70	19	4	0	146	1.77
baccata 'JACKII'	3	44	61	18	2	0	128	1.78
'RALPH SHAY'	3	71	76	10	13	1	174	1.78
'WHITE ANGEL'	9	43	54	23	5	2	136	1.83
CENTURION@	12	51	50	26	13	0	152	1.84
'JEWELBERRY'	4	45	42	23	5	1	120	1.85
sargentii	17	41	40	19	14	4	135	1.88
'ROBINSON'	0	55	70	24	9	0	158	1.92
'RED JADE'	8	54	40	25	11	6	144	1.96
'SILVER MOON'	8	30	48	19	7	4	116	1.99
'BEVERLY'	10	44	52	29	21	0	156	2.04
halliana v. Parkmanii'	0	24	32	16	7	0	79	2.07
WEEPING CANDIED APPLE@	8	36	53	18	21	1	137	2.08
HARVEST GOLD@	6	27	52	19	17	0	121	2.11
floribunda	3	41	50	30	18	0	142	2.13
hupehensis	0	29	44	26	9	0	108	2.13
'WHITE CASCADE'	2	22	48	19	17	0	108	2.24
'RED BARRON'	2	37	52	33	17	3	144	2.24
'WINTER GOLD'	7	27	49	32	23	0	138	2.26
'LISET'	1	22	60	26	16	0	125	2.27
tschonoskii	6	22	31	37	11	4	111	2.33
'STRAWBERRY PARFAIT'	0	22	46	49	10	0	127	2.36
'VELVET PILLAR'	2	17	45	40	42	3	149	2.75
yunnanensis v. Veitchii	0	14	14	40	25	10	103	3.08
'SELKIRK'	0	6	23	57	46	1	133	3.10
'DOLGO'	1	10	19	59	54	5	148	3.15
'ROYALTY'	0	6	16	56	48	4	130	3.21
'RUBY LUSTER'	1	2	12	42	72	6	135	3.48
'RADIANT'	1	4	12	38	73	23	151	3.63
'HOPA'	2	4	13	20	75	18	132	3.63

¹ *M. halliana v. Parkmanii* is known to be incorrectly named by the originator. It is believed to be *M. floribunda*.