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Multidisciplinary Evaluation of New Apple Cultivars: the NE-183 Regional Project 1999 Planting

D. Greene, R. Crassweller, C. Hampson, R. McNew, S. Miller, A. Azarenko, B. Barritt, L. Berkett, S. Brown, J. Clements, W. Cowgill, J. Cline, C. Embree, E. Fallahi, B. Fallahi, E. Garcia, G. Greene, T. Lindstrom, I. Merwin, J.D. Obermiller, D. Rosenberger and M. Stasiak

Abstract

The NE-183 regional project was established in 1994 with its primary objective to evaluate horticultural characteristics and pest susceptibility of new apple (*Malus* × *domestica* Borkh.) cultivars and advanced selections at numerous locations throughout the United States and Canada to determine both limitations and positive attributes of these cultivars. The project was established because many new apple cultivars were available but there was no established mechanism to provide unbiased evaluation to aid orchardists in making informed decisions about what apple cultivars have the greatest likelihood of being successful. There were two types of plantings: horticulture and pest susceptibility. Pest susceptibility plantings were intended to assess natural susceptibility of cultivars to insects and diseases. The horticulture plantings were intended to evaluate horticultural characteristics, fruit quality and sensory characteristics of the cultivars. The first NE-183 cultivar planting was established in 1995 at 28 locations in 18 states or Canadian provinces. A second group of 23 cultivars was planted in 1999. This article summarizes the rationale for initiating the NE-183 project, and lists the cultivars, locations and overall project design for the 1999 planting.

Apple production has been rising modestly in the United States (U.S.) in the decades since World War II (24). Initially production was dominated by cultivars such as 'Delicious', 'Golden Delicious' and 'McIntosh' and these accounted for over 75% of the total apple production (19). During the past 25 years, there has been a gradual metamorphosis of novel cultivar types being planted, starting first with the successful introduction of 'Granny Smith' from Australia in the early 1980s. The popularity of this apple showed that nontraditional apples could become commercially successful in the U.S. Significant planting of 'Gala', 'Fuji' and 'Braeburn' soon followed. In the 1980s and early 1990s many new apples became available. Some promising cultivars were discovered as chance seedlings, others were identified by nurseries or fruit growers as mutations, while another large group were released or became available from active breeding programs (27).

Increasingly, U. S. apple growers are competing with other apple producers in a worldwide market. Apple production levels in China, Chile, Brazil, South Africa, New Zealand, the European Union and Eastern Europe impact apple prices and sales in the U.S. Trade barriers that have existed for years are either being reduced or eliminated, further facilitating trade between countries (24). Most of the apples imported into the U.S. for fresh-market sales are relatively new cultivars with distinctive color, taste, or quality characteristics. Retail sellers are looking for "new cultivar" designations which they hope will stimulate a renewed interest and lead to increased sales of apples, since per capita consumption in the U.S. has remained unchanged for many years (24). Diversity, quality, and taste are important attributes that lead to apple purchases (2,25). A recent survey reported that customers would patronize roadside stands specifically to purchase new, different and better tasting apples (12). The survey indicated that customers would purchase these new apples in preference to apples they normally buy, even though the apples they normally buy were considered new generation apples, such

as 'Gala', 'Fuji', or 'Braeburn'. These same customers indicated a willingness to pay a higher price to purchase these new cultivars.

There is a trend in all of agriculture to reduce the amount of pesticide applied in crop production through the implementation of integrated pest management strategies (IPM). Nevertheless, pesticide requirements for apple production remain relatively high. A substantial portion of the pesticides used on apples, especially in humid growing regions, is to control apple scab. Pressure to reduce pesticide use is likely to continue for the foreseeable future, thus apple cultivars that have both good eating quality and genetic resistance to disease may become an increasingly attractive option when making a decision about what cultivars to plant. However, no disease-resistant apple cultivar has become economically important or extensively planted. Growers are reluctant to plant disease-resistant cultivars because of uncertainty related to whether customers will accept these new apples (29). Apple breeding programs from the PRI program (18), Cornell University's New York State Agricultural Experiment Station, Geneva (7) and the Agriculture and Agri-Food Canada's programs at Kentville, NS, Smithfield, ON, and St. Jean-sur-Richelieu, QC (9,28) have emphasized development of cultivars that are resistant to apple scab.

Growers are showing increasing interest in planting new apple varieties for several reasons (19). Prominent among these reasons are heightened interest by consumers in buying new different and better-tasting cultivars and the higher prices growers receive for new cultivars, relative to other more traditional cultivars.

Cultivar evaluation in the past has revealed clear differences among cultivars in production, quality, insect and disease susceptibility and development of storage disorders (1,11,23,27). The cost of establishing and caring for a block of apples until it starts to come into production frequently exceeds $10,000 per acre ($25,000 per ha). Planting of cultivars that are seriously flawed, due in large part to incomplete testing, has the potential to cost a grower thousands of dollars, particularly if the cultivar turns out to be so seriously flawed that the trees must be removed.

Cultivar testing in the past has been a somewhat haphazard activity. Often testing has been limited to performance in a limited geographical area (11,23,27). Lack of uniform rootstocks, cultural conditions and testing protocols made it difficult to objectively compare and evaluate cultivars grown in different geographical locations. Frequently horticultural, taste and quality evaluations were made in the complete absence of considerations for insect and disease susceptibility.

In the early 1990s a large number of incompletely evaluated apple cultivars was available, and a rapidly increasing number of orchardists wanted to know which were the best cultivars to plant. This led to the realization by many scientists that there was an urgent need to put in place a structured and comprehensive evaluation of new apple cultivars. Communication among horticulturists, plant breeders, plant pathologists and entomologists resulted in a meeting taking place in Syracuse, New York in the fall of 1992 to develop and formalize in a scientifically sound way comprehensive evaluation and testing of new apple cultivars. As a result of this meeting, a regional project proposal was drafted that ultimately resulted in approval by the Northeast Experiment Station directors in 1994 of the NE-183 Regional Project "Multidisciplinary Evaluation of New Apple Cultivars". The primary objective of this project was to evaluate horticultural characteristics and pest susceptibility of new apple cultivars and advanced selections at numerous locations throughout the United States to determine both limitations and positive attributes of these cultivars.

The first NE-183 trial was planted in the spring of 1995 at 28 locations in 18 states or provinces. The results of the evaluation of fruit from the horticultural sites in the

NE-183 planting of 1995 have been summarized and these collective data were published (8,13,14,20,21,22). Results from NE-183 plantings have also been published from individual locations. These reports included susceptibility to insects (15), diseases (3,4,5,6) and leaf and flower characteristics (10). Preliminary reports on disease susceptibility from several locations have also been published (16,17,26,30).

A second NE-183 planting was organized for 1999. Members of the Cultivar Selection Committee identified leading nurseries, apple breeders and knowledgeable pomologists to aid in identifying and then soliciting nominations for the most promising new apple cultivars, including many promising disease resistant apples. A total of 23 cultivars were selected for the planting (Table 1). 'Golden Delicious' (Gibson strain) was included in all plantings as an industry standard control. Additionally, 'McIntosh' was included as a control in all pest susceptibility plantings since it is known to be extremely susceptible to apple scab. All trees for the project were propagated by Wafler Nursery, Wolcott, NY. Reliable sources of bud wood were identified and these are listed in Table 2. The bud wood was shipped to Wafler Nursery so that it would arrive between August 18 and August 22, 1997 so that the budding process could take place in an orderly manner at the same time. All trees were propagated on Malling 9 (M.9) T337 rootstock.

Plantings were designated to collect either horticultural or pest susceptibility data, but not both. Horticultural data were collected only from plantings designated as horticul-

Table 1. Apple cultivars and selections evaluated in the 1999 NE-183 "Multidisciplinary Evaluation of New Apple Cultivars" Regional Project, and their parentage[z].

Cultivar	Parentage	Trademark Name(s)
Ambrosia	Chance seedling	
Autumn Gold	Chance seedling	
BC 8S-26-50	Splendour x Gala	
Chinook	Splendour x Gala	
Co-op 29	Golden Delicious x PRI 1050-201	Sundance
Co-op 39	PCFW2-134 x PRI 669-205	Crimson Crisp
CQR10T17	DIR102T198 x PWR37T133	
CQR12T50	NJ 75 x DIR101T117	
Cripp's Pink	Golden Delicious x Lady Williams	Pink Lady
Delblush	Golden Delicious x Blushing Golden	Tentation
Golden Delicious (Gibson)	Chance seedling	
Hampshire	Chance seedling	
Jubilee Fuji	Full-tree mutation of Fuji	September Wonder
Minnewashta	State Fair x MN 1691	Zestar!
McIntosh	Chance seedling	
NJ 90	136055 x Spartan	
NJ 109	Golden Delicious x NJ 88	
NY 65707-19	Spartan x NY 55140-9	
NY 79507-49	Empire x Redfree	
NY 79507-72	Empire x Redfree	
Pinova	[Duchess of Oldenburg x Cox's Orange Pippin] x Golden Delicious	Corail, Sonata, Piñata
Runkel	Chance seedling	
Silken	Honeygold x Sunrise	

[z]Photographs of these apples are available on the NE-183 website: www.ne183.org

Table 2. Sources of bud wood for the apple cultivars in the NE-183 1999 planting.

Cultivar	Bud Wood Source	Location
Ambrosia	Ken Haddrell, PICO	Summerland, BC, Canada
Autumn Gold	Dena Perleberg Ybarra, Columbia Basin Nursery	Quincy, WA 98848
BC 8S-26-50	Ken Haddrell, PICO	Summerland, BC, Canada
Chinook	Ken Haddrell, PICO	Summerland, BC, Canada
Co-op 29	Ed Fackler, Rocky Meadow Nursery	New Salisbury, IN 47161
Co-op 39	Jules Janick, Purdue University	W. Lafayette, IN 47907
CQR10T17	Jules Janick, Purdue Univesity	W. Lafayette, IN 47907
CQR12T50	Jules Janick, Purdue University	W. Lafayette, IN 47907
Cripp's Pink	Phil Baugher, Adams County Nursery	Aspers, PA 17304
Delblush	Clay Logan, Stark Bros. Nursery	Louisiana, MO 63353
Golden Delicious (Gibson)	Wafler Nursery	Wolcott, NY 14590
Hampshire	Eric Leadbeater, Gould Hill Orchard	Coutoocook, NH 03229
Jubilee Fuji	Gary Snyder, C & O Nursery	Wenatchee, WA 98807
Minnewashta	David Bedford, Univ. of Minnesota	Excelsior, MN 55331
McIntosh	Wafler Nursery	Wolcott, NY 14590
NJ 90	Joe Goffreda, Rutgers University	New Brunswick, NJ 08903
NJ 109	Joe Goffreda, Rutgers University	New Brunswick, NJ 08903
NY 65707-19	Susan Brown, NYSAES	Geneva, NY 14456
NY 79507-49	Susan Brown, NYSAES	Geneva, NY 14456
NY 79507-72	Susan Brown, NYSAES	Geneva, NY 14456
Pinova	Gary Snyder, C & O Nursery	Wenatchee, WA 98807
Runkel	Joan Runkel	Webberville, MI
Silken	Ken Haddrell, PICO	Summerland, BC, Canada

Table 3. Locations and co-operators who submitted data from the 1999 NE-183 planting.

Location	Co-operator(s)	Planting Location
(BC) British Columbia	Cheryl Hampson	Summerland
(ID) Idaho	Esmaeil Fallahi, Bahar Fallahi	Parma
(MA) Massachusetts	Duane W. Greene, Jon Clements	Belchertown
(NC) North Carolina	J. D. Obermiller	Hendersonville
(NJ) New Jersey	Win Cowgill	Pittstown
(NS) Nova Scotia	Charlie Embree	Kentville
(NYG) New York	Susan K. Brown	Geneva
(NYH) New York	Dave Rosenberger	Highland
(NYI) New York	Ian Merwin	Lansing
(ONT) Ontario	John A. Cline	Simco
(OR) Oregon	Anita Azarenko	Corvallis
(PAB) Pennsylvania	George M. Greene	Biglerville
(PAR) Pennsylvania	Rob Crassweller	Rock Springs
(UT) Utah	Thor Lindstrom	Kaysville
(VT) Vermont	M. Elena Garcia, Lorraine Berkett	Burlington
(VA) Virginia	Keith Yoder	Winchester
(WA) Washington	Bruce Barritt	Orondo
(WI) Wisconsin	Matt Stasiak	Sturgeon Bay
(WV) West Virginia	Steve Miller	Kearneysville

tural, to avoid the potential of having severe insect or disease damage confound a cultivar's productivity and fruit quality data. Pest susceptibility data were taken only from plantings designated for evaluation of pest susceptibility.

All pest susceptibility plantings received a full set of 5 replicates per cultivar. Because of poor bud take with some cultivars, there were insufficient numbers of trees to provide 5 replicates for each cultivar at all horticultural planting locations. The decision was made to only plant a full set of 5 replicates at any given location, so some locations did not receive any trees of certain cultivars. Horticulture plantings received either 20 or 21 cultivars. An attempt was made to ensure that all cultivars would be represented in each perceived geographical region.

Trees were dug in the fall of 1998, placed in cold storage, graded and then shipped in late winter or early spring of 1999 to locations in 20 states and 3 provinces in Canada. Location and individuals submitting data for the 1999 planting are listed in Table 3. Dr. Ron McNew from the Agricultural Statistics Laboratory at the University of Arkansas oversaw data management and conducted all statistical analysis for the project.

In subsequent articles in this issue, we report on the growth and yield characteristics, fruit sensory characteristics, and the fruit quality characteristics of the cultivars in the 1999 horticultural plantings.

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Berries by Roger Yepsen – A Review

Elsa Sánchez, Department of Horticulture, Penn State University

Berries by Roger Yepsen. 2006. W.W. Norton & Company, 500 Fifth Avenue, New York, NY 10110. 160 pp., watercolor illustrations, almost 100 recipes. $24.95.

Berries is part cook book, part historical reference and part gardening book. Common berries, including strawberries, raspberries and blueberries, are discussed, as well as less common berries, such as juniper berries, gooseberries and snowberries. Each chapter begins with an historical perspective on a berry crop, followed by gardening information and several recipes. The recipes vary from the simple pink raspberry lemonade to the more complex cranberry orange flan. It is delightfully written and very descriptive. I enjoyed sharing the following description of black currants to students enrolled in the Small Fruit Culture course I teach, "The flavor has been described as "off-putting," "foxy," "repulsive," "flamboyant," "peculiar," "disagreeable," "mawkish," and perhaps putting too fine a point on it, "redolent of cat urine." This description is perfect. Berries also contains accurate watercolor illustrations of botanical characteristics of each small fruit crop as well as some of the completed recipes. Berries is a good read and offers ideas for turning harvested berries into delicious desserts.