

ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECT

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Hatch Act, as Amended August 11, 1955

January 1 to December 31, 2002

Project: NE-183 Multi disciplinary Evaluation of New Apple Cultivars

COOPERATING AGENCIES AND REPRESENTATIVES:

State/Province	Cooperators ²				Plantings ¹	
					1995	1999
AL					-	H
AR	Curt Rom*	Donn Johnson	Ron McNew	Pat Fenn	-	-
CT-NH	Victoria L. Smith*				P	P
GA	Dan Horton*	Kathryn Taylor			H,P	-
ID	Esmail Fallahi*	Krishna Mohan			-	P
IN	Peter Hirst*	Rick Foster	Paul Pecknold		-	H
MA	Duane Greene*	Wes Autio	Jon Clements	Dan Cooley	H	H,P
ME	Renaë Moran*				H	-
MI	George Sundin*	Phil Schwallier	R. Beaudry	Greg Lang	H,P	H,P,P
MO	W. Hal Schaffer*	M. Warmund			H	H
NC	Dick Unrath*	J. Obermiller	M. Parker		-	H
NH	William Lord*				H	H
NJ	Win Cowgill*	Bob Belding	Joe Goffreda	Dean Polk	-	H
		Bill Tietjen				
NY-I	Ian Merwin*	M. Brown	R. Reisinger		H	H
NY-G, HV	D. Roseberger*	Susan Brown	D. Straub	Jim Schupp	-	H,P
		K. Maloney				
OH	Diane Miller *	David Ferree	Mike Ellis		H	H
OR	Anita Azarenko*	S. Mehlenbacher			H	H
PA	Rob Crassweller*	George Greene	Jayson Harper	K. Hickey	2 x H	2 x H
		L. Hull	J. Travis			
UT	Schuyler Seely*	T. Lindstrom			-	H
VA	Keith Yoder*	Ross Byers			P	P
VT	M. Elena Garcia*	Lorraine Berkett			-	H
WA	Bruce Barritt*				H	H
WI	Teryl Roper*	Kevin Kosola			H	H
WV		Alan Biggs	H. Hogmire		-	-
USDA/ARS	Stephen Miller*				H,P	H
British Columbia	Cheryl Hampson	Harvey Quamme			-	H
Ontario	John Cline				H	H
Nova Scotia	Charlie Embree	Robert Prange	D. Davidson		-	H
Administrative Advisor	Robert Seem					

¹ H - designates horticultural planting (objective 1) , P- designates Pest Management Planting (objective 2)

² *- designates a voting member for participating state/institution

Objectives:

- I. Evaluate horticultural qualities and pest susceptibilities of new apple cultivars, strains, and advanced selections at numerous locations throughout the United States to determine both the limitations and the positive attributes of these cultivars.
- II. Develop horticultural and pest management strategies for new cultivars or cultivar strains that are emerging as commercially accepted cultivars.
- III. Compare the costs of production and profitability of new apple cultivars.

Progress of the Work and Principal Accomplishments

Project objectives are being met by 24 states and 3 Canadian provinces consisting of two uniform trials of new promising cultivars and advanced selections. The first uniform test orchard of 26 cultivar scion/rootstock combinations was planted in 1995 in 28 different sites. Eighteen of these are still maintained. A second trial of 20 cultivars encompassing 29 sites was planted in the spring of 1999. Locations where both horticulture and pest susceptibility studies are established include CT, ID, MA, MI, NY and VA. Several cooperators have additional cultivar test orchards from which corroborating data to support observations in the uniform test orchard can be obtained or from which additional data may be generated. Project cooperators in MA and NJ continue to provide WWW access (<http://www.ne183.org>) to annual reports and results. Upon completion of each study, final results, conclusions and recommendations will be made available on the WWW. The NE-183 listserv (ne183@virtualorchard.net) continues to be an extremely effective communication tool for cooperators to share results, facilitate committee business, and plan future meetings.

Objective 1. Evaluate horticultural qualities and pest susceptibilities of new apple cultivars, strains, and advanced selections at numerous locations throughout the United States to determine both the limitations and the positive attributes of these cultivars.

The first uniform test planting for the project was planted at multiple locations in 1995 with 2-5 single-tree replications of 21 cultivars and one numbered selection. These are Arlet, Braeburn, Cameo, Creston, Enterprise, Fuji (BC Type II), Gala Supreme, Ginger Gold, Golden Delicious (Gibson strain), Golden Supreme, GoldRush, Honeycrisp, Fortune, NY 75414-1, Orin, Pristine, Sansa, Shizuka, Suncrisp, Sunrise and Yataka. In the pest management trials, Senshu and Pioneer Mac were also included. Separate “horticultural” and “pest study” trials were planted and maintained at some sites. At other sites, both horticultural and pest susceptibility characteristics were studied in the same plots. The horticultural sub-committee developed a core data set for tree growth measurements and flowering, fruiting and fruit quality. A pest control sub-committee developed guidelines for pest management and for uniform assessment of pest and disease observations in the pest plantings. Data from each site was submitted to the project coordinators and to the statistician.

The following manuscripts are currently being prepared:

Introduction and Background
Tree Growth and Yield
Fruit Quality and Sensory Evaluation
Flowering and Biennial Bearing

Disease Susceptibility
Pest Problems
Rootstocks
Nutrition
Climate and Weather
Tree Death

One to two cooperators have been selected to draft each paper. In addition, popular press articles will be written upon completion of technical manuscripts.

Researchers at some sites continue to maintain this planting and to collect data from these trees. These cooperators have collected some of the following list of parameters: tree size, yield, fruit quality, susceptibility to attack by insects and mites, disease susceptibility, storability (postharvest), winter hardiness, whole tree fresh and dry weight, and phytotoxicity to agricultural chemicals. Postharvest studies are conducted in cooperation with the NE-105 Multistate Project. In West Virginia, the comprehensive study on fruit and foliage injury by ten different insect pests was continued. Next year, several sites plan to continue collecting data from this planting.

A second uniform planting of new promising apple cultivars and advanced selections was planted in the spring of 1999. This second planting also has a primary designation of either horticultural or pest susceptibility studies. Plantings for horticulture are located in GA, ID, IN, MA, MI (two locations), MO, NH, NJ, NY (two locations) NC, OH, OR, PA (two locations), UT, VT, WA, WI, WV, Nova Scotia, Ontario, and British Columbia. Plantings for pest susceptibility studies will be located in CT, MA, MI, NY, and VA. Cultivars included are Golden Delicious (Gibson strain), McIntosh (Rogers strain), Ambrosia, Delblush, Hampshire, Jubilee Fuji, Pinova, Cripp's Pink (Pink Lady), Runkel, Autumn Gold, Chinook (BC 8S-27-51), Silken (BC 8S-25-33), Sundance (Coop 29), Scarlet O'Hara (Coop 25), Crimson Crisp (Coop 39) and Zestar!™. Numbered selections included are BC 8S-26-50, CRQ10T17, CQR 12T750, NJ 90, NJ 109, NY 75907-72, NY 75907-49, and NY 65707-19. At the annual meeting, there was a roundtable discussion of selections and cultivars with cooperators site reporting what they have learned, so far. An account of this is available in the meeting minutes.

Horticultural Characteristics: In the 1999 planting, the trees continue to grow well in most locations and have developed a good canopy. One site reported slow tree growth due to drought and others have reported a few tree losses due to fire blight or deer feeding. Cultivars varied in tree size (height, spread and TCSA), bloom date, maturity date, yield and preharvest drop. Most cultivars bloomed and fruited at all sites. However, a few sites reported light bloom and/or light fruit set due to frost, poor pollination weather or biennial bearing.

Fruit Quality Characteristics: Most sites had sufficient cropload to take measurements of fruit quality. Fruit size, color, soluble solids content and acidity varied significantly among the cultivars. Sensory evaluation indicated differences in preference and more sites plan to conduct this next year. In MA, BC8S-26-50, Hampshire, Jubilee Fuji, NJ90, Silken and Zestar! were rated as most desirable. In NJ, Zestar!™, NJ109 and COOP 29 were rated with high eating quality. In PA, Ambrosia and September Wonder (Jubilee Fuji) were rated as most desirable. In VT, Zestar!™, Delblush and NJ109 were rated as

most desirable. In WV, September wonder, Crimson Crisp and NJ90 scored high in sensory evaluations. In NC, cultivars that may have good potential in this area are Zestar!™, CQR12T50, Jubilee Fuji, Ambrosia, Chinook and Autumn Gold. Disorders such as cracking, water core, sunburn and bitter pit were apparent and varied between cultivars. Some sites plan to conduct storage studies next year.

Building a photography database for the website was added to the protocol. To do this, each site was encouraged to take three photos of each cultivar or selection.

Disease and Pest Susceptibility Characteristics: Five sites reported conducting tests on foliar susceptibility to cedar apple rust, apple scab and powdery mildew. Cultivars were also evaluated for fruit susceptibility to apple scab, rust, bitter rot, black rot, and moldy core. In CT, there was very little scab, powdery mildew, or bitter rot, but rust was prevalent. Rust was low on Sansalma and PioneerMac and heavy on Braeburn and Goldrush. Fruit inoculations with bitter rot indicated the lowest lesion growth on Suncrisp and most rapid growth on Gingergold. In NY cedar apple rust, was prevalent, with Ambrosia, BC 8S-26-50, Chinook, Coop 39, CQR 10T17, Mutsu, NJ109, Scarlet O'Hara and Golden Delicious being most susceptible. In VA, COOP29, NY 65707-19 and NY 79507-72 appear to have some resistance to scab and the rusts, and NY 79507-49 resistance to scab and cedar apple rust, but not to quince rust. Hampshire, NJ90, Runkel, and Zestar!™ also appear to have resistance to cedar apple rust. Under heavy pressure, Ambrosia, Hampshire, Jubilee Fuji, NY 85707-19, and Zestar!™ had considerable resistance to powdery mildew. Susceptibility to sooty blotch, flyspeck, Brooks spot and other rots was also evaluated. In WV, studies were conducted on cultivar susceptibility to bitter rot and black rot. In MA, McIntosh, Hampshire and Silken had significantly more leaf scab than all other cultivars. Silken and CQR 12T50 and NY 65707-19 had the most frog-eye leaf spot. All cultivars exhibited foliar mildew symptoms although CQR 10T17 (Princess), NJ90, Sundance and Scarlet O'Hara had the most. Incidence of sooty blotch, flyspeck and summer rots was minimal for all cultivar at harvest.

One site, WV, reported results on pest susceptibility. A study on the presence of fruit/foliar injury by 10 different insect pests was continued. Low aphid and mite populations occurred, so no data was recorded for these pests. Pest injury continues to be higher for trees on M.9 rootstock compared to Mark.

Objective 2. Develop horticultural and pest management strategies for new cultivars or cultivar strains that are emerging as commercially accepted cultivars.

NY and MN, fifty strains of Honeycrisp with potentially better color have been planted and will be evaluated for improved color, but similar fruit quality as the original strain.

In NY, two studies have been initiated with the cultivar, Honeycrisp. Results of the chemical thinning trial indicate that Honeycrisp is very sensitive to Accel (Valent Biosciences), and this should not be used to thin this cultivar. All chemical thinners tested provided thinning activity. Results of the bitter pit control study indicate calcium sprays during summer substantially reduce bitter pit, but did not completely prevent it.

Objective 3. Compare the costs of production and profitability of new apple cultivars

No report was presented.

Usefulness of Findings

This project provides an objective evaluation of new apple cultivars and selections. Results of these studies enable growers determine which new cultivars are suitable for their climate and their market so that they can make informed choices for new apple plantings. The 1995 trial has provided useful findings on bloom and harvest dates, fruit appearance and eating quality within each site. These results are used by growers to understand the potential cultivar performance and determine management practices needed to maximize yield and fruit quality. As data is gathered and analyzed from the 1999 planting, differences in cultivar performance are becoming apparent.

Information on the foliar pest and disease susceptibility has now been observed for cultivars in the 1995 planting. The multiple year observations allow study of genotype by environment interactions for the pest or disease susceptibility. The pest and disease susceptibility information will be useful for making recommendations for controlling potential problems, and for growers to anticipate possible crop damage and implement appropriate avoidance or protection strategies. Furthermore, the information on both foliar and fruit damage obtained from the trial (Objective I) will aid in developing decision-making protocols for insects and diseases (Objective II). The information of fruit yield potential, fruit quality and pest susceptibility observed in the uniform test (Objective I) will assist in development of production cost and profitability models for the new cultivars (Objective III).

The plantings at the various sites have been used extensively for grower demonstrations and field visits. Apple growers use the results of this research to find out potential strengths and weaknesses of particular cultivars before planting them. Growers can also be better prepared to manage the different problems associated with growing a particular cultivar. Therefore, these plantings are a valuable resource for extension/outreach and the apple industry, in addition to their research function.

Work Planned for Next Year

The current project will continue through 2004. Cooperators will apply for a one-year extension by Sept. 1, 2003, in order to complete the necessary data collection and publishing. A committee was formed to discuss the need for a future rewrite or the possibility of beginning as a new project with different objectives. A subset of possible objectives was drafted and subcommittees formed to focus on the potential rewrite.

Trees in the 1999 multi-state uniform trials will be maintained according to protocols developed by the technical committee. Each site is requested to collect the core data set and individual sites indicated additional studies of fruit quality, storage potential, and composition may be conducted. It is the decision of the individual cooperator to maintain and collect data from 1995 planting.

Publications

Refereed

Ferree, D. C., B. L. Bishop, J. R. Schupp, D. S. Tustin and W. A. Cashmore. 2001. Influence of flower, spur characteristics, and position in the clusters on fruit set and growth of apple cultivars. *J. Hort. Sci. and Biotech.* 76:1-8.

- Greene, D.W. and S.A. Weis. 2001. Evaluation and growing of Honeycrisp in New England. *Compact Fruit Tree* 34(4):100-103.
- Schupp, J. R., E. Fallahi and I. J. Chun. 2002. Effect of particle film on fruit sunburn, quality and maturity of 'Fuji' and 'Honeycrisp' apples. *HortTech*. 12:87-90.
- Schupp, J. R., E. Fallahi, and I. J. Chun. 2002. Effect of Surround[®] Particle Film on Fruit Sunburn, Maturity and Quality of 'Fuji' and 'Honeycrisp' Apples N. Y. *Fruit Quarterly* 10(1):17-19.
- Schupp, J. R., Rosenberger, D. A., Watkins, C. B., Cheng, L., and Hoying, S.A. 2001. Understanding the bitter pit problem in Honeycrisp. Pages 1-8 in: *Apple Handling and Storage: Proc. Storage Workshop 2001*, Cornell University, Ithaca. Natural Resource, Agriculture, and Engineering Service (NRAES) Publication 153, Cornell University, Ithaca, NY. 130 p.
- Schupp, J., Straub, R., Rosenberger, D., and Watkins, C. 2001. Managing Honeycrisp for production and quality. *Compact Fruit Tree* 34:107-109.

Refereed in Press

- Biggs, A.R. and S.Miller. (in press). Relative susceptibility of selected apple cultivars to *Botryosphaeria dothidea*. *HortSci*.
- Privé, J.P., J. Cline, C. Embree, E.Fava, and D. Nichols. 2002. Physiology and efficacy of apple treated with prohexadione-calcium in three Canadian provinces. *Acta Hort.* (in press).
- Wargo, J.M., I.A. Merwin, and C.B. Watkins. (in press). Fruit size, yield and market value of 'Goldrush' apple are affected by amount, timing and method of nitrogen fertilization. *HortTechnology* 13:xx-yy.

Abstracts

- Embree, C.G., D.J. Hebb and A. Grant. 2002. Early performance of Honeycrisp on M.26 in Nova Scotia. *International Hort. Congress*, poster presentation and abstract.

Extension Publications and Presentations

- Autio, W.R., J.R. Schupp, C.G. Embree and R.E. Moran. 2002. Early performance of Cortland, Macoun, McIntosh, and Pioneer Mac apple trees on Various rootstocks in Maine, Massachusetts and Nova Scotia. *J. Amer. Pomol. Soc.* (in press).
- Barritt, B.H. 2002. It's a business—Invest wisely. *Good Fruit Grower* 53:40.
- Barritt, B.H. 2002. New apple varieties as marketable products. *Good Fruit Grower* 53:64.
- Barritt, B.H. 2002. Organic apples: Fad or our future. *Good Fruit Grower* 53(16):(in press).
- Barritt, B.H. 2002. Understanding quality means thinking like a consumer. *Good Fruit Grower* 53(16):(in press).
- Brown, S. and K. Maloney. 2002. Apple cultivars: A Geneva perspective. *New York Fruit Quarterly* 10 (2): 3-8.
- Bushway, A. A., W. Hu, J. R. Schupp, T. M. Work and S. I. Koller. 2002. Quality Characteristics of Five Disease-Resistant apple cultivars. *J. Amer. Pomological Soc.* 56:94-105.

- Crassweller, R. M. (coordinator) 2002. Commercial Tree Fruit Production Guide. The College of Agricultural Sciences, The Pennsylvania State University. 283 pp.
- Embree, C.G. 2002. Blossom and Fruitlet Thinning Trial 2000 Report. AAFC Technical Publication.
- Embree, C.G. and D. Hebb. 2001. An evaluation of tree density and support systems for specialty cultivars. Technical report:01-07.
- Embree, C.G. and W.E. Craig. 2001. Stocks for Apple and Pear, March 2001. Prepared by the Atlantic Committee on Fruit Crops. Published by the Authority of the Atlantic Provinces Agricultural Services Co-ordinating Committee. Publication ACC 1202.
- Greene, D.W. 2002. Evaluation of new apple varieties, 1998 observations: A report to the New England Tree Fruit Growers Research Committee. Fruit Notes 67:13-19.
- Greene, D.W. and NE183 Cooperators. 2002. 1999 NE183 Planting Apple Cultivar Descriptions. Web publication at <http://www.ne183.org/planting/1999/cultivardescriptions.htm>.
- Merwin, I.A. 2002. Apple Rootstocks--feature article in The Ithaca Journal, Oct. 7, 2002.
- Merwin, I.A. Orchard site preparation: What works and what doesn't? Proceedings of the New England Fruit Growers Mtg. Sturbridge, MA, Jan. 9, 2002
- Merwin, I.A. Orchard floor management: Long-term impacts on fruit yields and nutrient availability. Proceedings of the New England Fruit Growers Mtg. Sturbridge, MA, Jan. 9, 2002
- Rom, C.R. and J.B. Fausett. 2002. Fireblight symptom expression in apple research orchards-2001. In, Clark, J.R. and M.E. Evans, eds., Horticultural Studies 2001. Arkansas Agricultural Experiment Station Research Series 494:28-34.
- Rosenberger, D., J. Schupp, C. Watkins, K. Iungerman, S. Hoying, D. Straub, and L. Cheng. 2001. Honeycrisp: promising profit maker or just another problem child? NY Fruit Quarterly 9(3):9-13. <http://www.nysaes.cornell.edu/hort/fq/fall01/FQfall2001.pdf>
- Rosenberger, D., J. Schupp, C. Watkins, S. Hoying and L. Cheng. 2002. Effects of foliar applications of calcium, boron, and Flint fungicide on incidence of bitter pit. Pages 15-16 in: The New York State Apple Research and Development Program: Ten Years of Successful Research Support for the Apple Industry (T. Robinson, ed.). NY Fruit Quarterly 10(2):3-17. <http://www.nysaes.cornell.edu/hort/fq/summer02/summer02fq.pdf>
- Vance, L.A. and C.R. Rom. 2002. Chill and heat unit accumulation at four sites in Arkansas, 1999-2000. In, Clark, J.R. and M.E. Evans, eds., Horticultural Studies 2001. Arkansas Agricultural Experiment Station Research Series 494:37-39.
- Weis, S.A., D. Greene and W. Bramlage. 2002. Comparing the harvest and storage characteristics of Mutsu and Shizuka apples. Fruit Notes 67:1-4.

Book Chapters

Field Days and Research Presentations

- Cowgill, W. A variety showcase Sept. 2002 at Rutgers Snyder Research and Extension Farm. Attended by 50 growers.
- Cowgill, W. Twilight meeting with a tour of the NE-183 planting. April 2002. Attended by 40 growers.

Embree, C. One invited talk on Honeycrisp production. Located at the University of Maine Highmoor Farm Summer Tour, July 23, 2002 in Monmouth, ME. Attended by 40 growers.

Merwin, I.A. Two invited talks at the New England Fruit Meetings in Sturbridge MA on Jan 9, 2002.

Merwin, I.A. Fruit Tree Soil Management. Ontario Fruit and Vegetable Growers mtg., St. Catherines, ON. Feb. 20, 2002.

Merwin, I.A. Workshops on Fruit-Tree Varieties, Growing and Pruning, Cornell Gardening Day, March 16, 2002 at Ithaca, NY

Merwin, I.A. Cider apples and fermentation. Presentation on Oct. 12, 2002 at Bellwether Cider Co, Ithaca, NY.

Merwin, I.A. Presentation on apple variety identification at Schuyler County Apple Harvest Festival, Oct. 13, 2002. 300 people attending, Watkins Glen, NY

Merwin, I.A. Featured guest on call-in radio show "In the Garden" with Andre Viette. July 27th, 2002. Broadcast live all across the southern US.

PennState. A Fruit Grower Field day at the Fruit Research and Extension Center in Biglerville, July 11, 2002 toured both plantings. Attended by 40 growers.

PennState et al. A variety showcase and sampling at the Mid-Atlantic Fruit and Vegetable Conference, Jan. 30, 2002.

Schwaller, P. Apple Variety Showcase at the Great Lakes Expo.

Website

The web site, www.NE183.org, was maintained by Win Cowgill, NJAES and Jon Clements, UMASS. Articles, photographs and reports will continue to be archived at this site. The meeting minutes and annual report are available on the website. The members-only section contains state reports and a member database. In 2002, the NE-183 website logged over 10,000 unique visits from 57 countries. Popular pages included the 'home' page, cultivar descriptions, and the annual meeting minutes. Common search terms used to find the NE-183 included "apple", "cultivar(s)", and "fruit". Requirements for web page design for regional projects are being met as outlined by the Cooperative State Research, Education, and Extension Service (CSREES) and the North Central Regional Association of Agricultural Experiment Station Directors (NCRA).

APPROVED

Rena Moran 2002
 Chair, Technical Committee Date

Robert Seem 2002
 Administrative Advisor Date