

ANNUAL REPORT OF COOPERATIVE REGIONAL PROJECT

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Hatch Act, as Amended August 11, 1955

January 1 to December 31, 2001

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

| State/Province | Cooperators ² | | | | Plantings ¹ | |
|------------------------|--------------------------|------------------|---------------|------------|------------------------|-------|
| | | | | | 1995 | 1999 |
| AL | | | | | - | H |
| AR | Curt Rom* | Donn Johnson | Ron McNew | Pat Fenn | H | - |
| CT-NH | Richard Kiyomoto* | | | | P | P |
| GA | Dan Horton* | | | | H,P | - |
| ID | Esmaeil Fallahi* | Krishna Mohan | | | - | P |
| IN | Peter Hirst* | Rick Foster | Paul Pecknold | | - | H |
| MA | Duane Greene* | Wes Autio | Jon Clements | | H | H,P |
| ME | Rena Moran | | | | H | - |
| MI | Alan Jones* | Phil Schwallier | Randy Beaudry | Greg Lang | H,P | H,P,P |
| MO | W. Hal Schaffer* | M. Warmund | | | H | H |
| NC | Turner Sutton* | Dick Unrath | | | H,P | H |
| NH | Bill Lord* | | | | H | H |
| NJ | Win Cowgill* | Bill Tietje | Joe Goffreda | Dean Polk | H | H |
| NY-I | Ian Merwin* | | | | H | H |
| NY-G | D. Roseberger* | Susan Brown | D. Straub | Jim Schupp | H,P | H,P |
| OH | David Ferree* | Mike Ellis | Diane Miller | | 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. Elana Garcia* | Lorraine Berkett | | | H | H |
| WA | Bruce Barritt* | | | | H | H |
| WI | Teryl Roper* | | | | H | H |
| WV | Alan Biggs* | Henry Hogmire | | | P | H |
| USDA/ARS | Stephen Miller* | | | | H | H |
| British Columbia | Cheryl Hampson | Harvey Quamme | | | H | H |
| Ontario | John Cline | | | | H | H |
| Nova Scotia | Danny 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 18 states and 2 Canadian provinces consisting of 28 uniform plantings of new promising cultivars and advanced selections. Multi-state, uniform test orchards of 26 cultivar scion/rootstock combinations was planted in 1995. A protocol was established by the technical committee to collect core data in order to provide the basis for uniform observations to meet stated project objectives. A second test orchard of 20 cultivars encompassing 29 sites was planted in the spring of 1999. Locations where both horticulture and pest susceptibility studies will be established include MA, MI, NY, and NC. 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. Two project cooperators (MA and NJ) continue to provide WWW access (<http://virtualorchard.net/ne183/default.html>) 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.

Object 1. Evaluate horticultural qualities and pest susceptibilities of new apple cultivars

The first uniform test planting for the project was planted at multiple locations in 1995 with 5 replications of single trees of 18-26 cultivars (Arlet, Creston, Braeburn, Cameo, Enterprise, Fuji (BC Type II), Gala Supreme, Ginger Gold, Golden Delicious (Gibson strain), Golden Supreme, GoldRush, Honeycrisp, Fortune, NY 75414-1, Orin, Pristine, Sansa, Senshu, Shizuka, Suncrisp, Sunrise, Yataka) and rootstock combinations with controls for both scion cultivar and rootstock. At some sites separate horticultural and pest study trials were planted and maintained. At other sites, both horticultural and pest susceptibility characteristics were studied in the same plots. The 1999 season was the third cropping season for the trial orchards at most locations. 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 in the test orchard and for the uniform assessment of pest and disease observations.

A second uniform planting of new promising apple cultivars and advanced selections was planted in the spring of 1999. This second planting will also have a primary designation of either horticultural or pest susceptibility studies. Plantings for horticulture are located in GA, ID, IN, MA, MI (two locations), NH, NJ, NY-G (two locations) NC, OH, OR, PA (two locations), UT, VT, WA, Ontario, and British Columbia. Plantings for pest susceptibility studies will be located in CT, MA, MI, NY-G, NC, and VA. Cultivars included: Golden Delicious (Gibson strain), McIntosh (Rogers strain), Ambrosia, BC 8S-25-33, BC 8S-27-51, BC 8S-26-50, Coop 25, Coop 29, Coop 39, CRQ10T17, CQR 12-750, Delblush, Hampshire, Jubilee Fuji, Pinova, MN 1824 (Zestar), NJ 90, NJ 109, NY 75907-72, NY 75907-49, NY 65707-19, Pink Lady, Runkel, Autumn Gold.

Horticultural Characteristics: Harvest date form the 99 planting has been discontinued for many sites. A round table discussion of varieties in this planting from each state and province gave an overall impression and potential of the varieties and selections in the 95 planting. Each variety was voted on by the one member from each site in attendance. A variety was voted for if it was thought there was potential for commercial production (Table 1)

Member votes of which varieties are suitable for commercial production. Only those sites with members in attendance voted.

| Cv | State or Province | | | | | | | | | | | | | |
|----------------|-------------------|----|----|----|----|----|----|----|-----|----|----|----|----|----|
| | BC | IN | MA | ME | NJ | NY | NS | OH | ONT | PA | VA | VT | WA | WI |
| Arlet | | | x | | | x | | x | | | | x | | |
| Braeburn | x | | x | | x | | | | | | x | | | |
| Cameo | | | | | | | | | | x | x | | x | |
| Creston | x | | | x | | x | | x | | | | x | | |
| Enterprise | | x | | | x | | | | | x | x | | | |
| Fortune | | | | | | x | x | | | | | x | | |
| Fuji BC2 | | | x | | x | | | | | x | x | | | |
| Gala Supreme | | | | | | | | | | | | | | |
| Gingergold | | | x | | x | x | x | | x | x | x | x | | x |
| Goldrush | | x | | | x | x | | x | | x | x | | | |
| Golden Supreme | | | x | x | | | | | x | | x | x | | x |
| Honeycrisp | | x | x | x | x | x | x | x | x | | | x | | x |
| NY75414 | | | | | | | | | | | | x | | |
| Orin | | | | | | | | | | | | | | |
| Pristine | | x | | x | x | | x | | | x | | x | | |
| Shizuka | | | x | x | | x | | | x | | | | | |
| Suncrisp | | | x | | x | x | | | | x | | | | |
| Sunrise | x | | | | | x | | | x | | | x | | x |
| Yataka | | | | | | x | | | | x | | | | |

In the 99 planting, the trees are growing well in most locations and have started to develop a good canopy with secondary branching. Trees varied in size (height, spread and TCSA) both within and across locations. Most cultivars bloomed and fruited at all sites. However, at individual sites, some cultivars had light bloom and/or did not set many fruit due to variable weather. Variation in order of bloom among the cultivars was apparent when sites were compared. However, the order of fruit maturity was relatively consistent across sites. Precocity of cultivars was noted as an important attribute for the cultivar.

Several sites had studies of fruit maturation rates among the cultivars and how fruit quality develops during maturation (PA, VA, ONT-CA). Fruit size, color, soluble solids content and acidity varied significantly among the cultivars. With light crop loads and vigorous growth of young trees, physiological disorders such as Ca-deficiency induced fruit bitter pit was observed on some cultivars in some locations

Fruit Quality characteristics: Now that all cultivars in all states are fruiting it is possible to evaluate the fruit on attractiveness, flavor, crispness, juiciness, etc. Several states submitted fruit quality comments in their individual state reports. However, it was concluded due to the age of this planting, a more accurate picture will develop when trees fruit for several seasons

Pest Susceptibility Characteristics: Tree losses due to fire blight occurred in several locations: NC lost one Hampshire tree to fireblight; in WV, shoot blight was first observed in late May. Among the 144 trees (includes filler and border trees) in the planting, 26 trees exhibited fire blight strikes. Sixty percent of the Nittany trees and 24% of the Suncrisp trees had FB shoots removed. Other trees with at least one strike included NY79507-49 and —72, Delblush, Pink Lady, Ambrosia, NJ109, Coop 39 and Runkel. An Ambrosia tree had FB shoots removed on 4 separate dates. No tree has succumbed to FB at this time. In NY (Ithaca), one more tree Hampshire died, apparently from fireblight. Generally, trees and fruit were faced with a medium to heavy scab pressure. However, little scab was observed. In Ohio, there was a severe fireblight infection in 2000 and as a result 60 of 100 trees died due to infection of the rootstock to fireblight.

In PA, populations of white apple leaf hopper (WALH) were low across all cultivars and no statistical differences between cultivars were found. Differences in populations of ERM were found between the various cultivars. The cultivar Fortune had the lowest mite population and Golden Delicious on M9 had surprisingly the highest population. Cultivars with notable low STLM populations during the last count include Sansa, NY 75414-1 and Yataka/Mark. Sansa was consistently ranked the cultivar with the lowest STLM population during each of the three years. Other cultivars showing low STLM populations include Golden Delicious/Mark and Yataka/Mark. Cultivars having the highest ranking (i.e., highest populations over each of the three year period) include Cameo, Fortune, Fuji and Pristine.

Objective 2. Develop horticultural and pest management strategies for new cultivars

In MA, leaf scab evaluation on June indicated that seven cultivars (Roger McIntosh, NJ 90, Zestar, NJ 109, Hampshire, BC 8526-33, and Ambrosia

Coop 29, NJ 90, NJ109, NY 65707-19, NY 75907-49, and NY 75907-72, appear to have resistance to scab and cedar-apple rust (Table 5). In VA, Hampshire, Runkel and Zesta appear to be resistant to cedar-apple rust on foliage, comparable to resistance of McIntosh which was previously recognized. Jubilee Fuji, Zesta, and Ambrogia demonstrated considerable resistance to powdery mildew under relatively heavy pressure. As in 2000, the scab-resistant cultivar CQR10T17 was the most heavily infected with cedar-apple rust. NY 65707-19 and Scarlet O Hara appear to be the most susceptible to Brooks spot. Grouping the cultivars by ripening date and accumulated wetting hours did not show any mid-late season cultivars with resistance to sooty blotch or flyspeck. Zesta apparently ripened early enough to escape these diseases. The most prevalent rots in the planting were Bot rot and bitter rot. NY 65707-19 and Hampshire were cultivars that ripened after 26 September which had no rots at harvest. All but four of the original 1999 planting trees have survived. The largest trees are Red Yorking and CQR10T17; the least vigorous is NY 65707-19. In NY (Cornell) hawthorn rust occurred on NY 79507-49, Coop 29, NY 79507-72, Runkel, Delblush, Zestar, NY 65707-19, NJ 90, Hampshire, and Cortland. Cedar apple rust occurred on NJ 109, Golden Delicious, Scarlet O'Hara, Ambrosia, Jubilee Fuji, Corail, Chinook, CQR10T17, BC8S-26-50, CQR 12T50, Coop 39, and Mutsu. Within each group, cultivars are listed in order of increasing susceptibility based on percentage of leaves with visible rust lesions in late June. Only Delblush, Jubilee Fuji, and CQR12T50 commonly showed aecia of both rust species. Neither rust species was able to form aecia on McIntosh. However, McIntosh and all of the cultivars susceptible hawthorn rust developed severe rust-induced leaf spot. Rust-induced leaf spot develops when other pathogens invade damaged cells created by aborted cedar apple rust infections on cultivars that are resistant to cedar apple rust. All cultivars were susceptible to quince rust infections on fruit. Based on results of these assessments, none of the cultivars can be grown without fungicide protection in areas where rust inoculum is abundant.

In WV, the 23 cultivars on M.9 337 rootstock, the pest susceptibility was as follows. For RAA, the least susceptible were Braeburn, Ginger Gold, Goldrush, Honeycrisp, NY75414-1, Orin, Sansa, Senshu, Suncrisp and Pioneer Mac, and the most susceptible were Enterprise and Cameo. For SA, the least susceptible were Goldrush and Honeycrisp, and the most susceptible were Shizuka, Cameo, Enterprise and Arlet. For ERM, the least susceptible were Enterprise and Pioneer Mac, and the most susceptible were Yataka, Pristine, Arlet and Shizuka. For JB, the least susceptible were Golden Supreme, Goldrush, Sunrise, Pioneer Mac and Sansa, and the most susceptible were Enterprise, Gala Supreme, Yataka and Senshu. For STLM, the least susceptible were Sansa and Golden Delicious, and the most susceptible were Fortune and Cameo. For WALH, the least susceptible were Braeburn and Golden Delicious, and the most susceptible were Enterprise, Shizuka, Creston and Suncrisp. For TPB, the least susceptible were Yataka and Creston, and the most susceptible was Cameo. For PC, the least susceptible were Fuji Red Sport #2 and Braeburn, and the most susceptible were Ginger Gold, Yataka and NY75414-1. For CM & OFM, the least susceptible were Sunrise, Pristine and Sansa, and the most susceptible were Golden Delicious, Cameo, Shizuka, Goldrush and Gala Supreme. A total of 51 internal larvae were collected from fruit examined at harvest, consisting of 78% CM and 22% OFM. For TABM & RBLR, the least susceptible were Pristine and Sunrise, and the most susceptible were Gala

Supreme, Fortune, Cameo and Enterprise. For AM, no injury was found on 16 of the cultivars, and of the remaining 7 the most susceptible were Shizuka and Braeburn. The highest percentage of clean fruit occurred with Sansa, Pristine and Sunrise, while Shizuka and Cameo had the lowest. Of the three cultivars on both M.9 337 and MARK rootstocks (Braeburn, Golden Delicious and Yataka), susceptibility to all foliage pests combined was higher on M.9 337 for all three cultivars. Susceptibility to all fruit pests combined was also higher on M.9 337 for Golden Delicious and Yataka, but slightly higher on MARK for Braeburn due only to a significantly higher level of injury from TPB. When all pests and both rootstocks were considered, the susceptibility of these three cultivars on MARK was in the lowest category, comparable to Sansa and Pioneer Mac on M.9 33. In NY (Cornell), infestation from plum curculio was light and most entries showed a general tolerance for this pest. Ginger Gold and Sunrise were notable for their susceptibility. NY 75414-1, Orin, and Pristine were more susceptible to European apple sawfly. Infestation pressures from tarnish plant bug were severe.

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

No report was presented

Usefulness of Findings:

The 95 trial has provided useful findings after its first six seasons. Precocity of these cultivars is now known. Data on yield efficiency has shown cultivars that are productive relative to tree size. The time of harvest and amount of early yield is critically important for developing recommendations of specific cultivars in specific growing regions and for specific purposes. For instance, in this trial, some cultivars could be deemed as summer cultivars because they ripened in July or August in southern or warm areas; however, the same cultivars could be considered autumn cultivars when grown in more northern or cooler areas. The time of maturity dictates market potential and value of a specific cultivar in a specific location. Some variation in both fruit external and internal quality (size, color, russet, firmness, soluble solids) occurred both among cultivars and was apparent among sites particularly northern vs. southern sites. This information is useful in determining the potential for growing the new cultivars in specific growing regions, the possible use of the fruit (processing vs. direct market vs. wholesale market) and will help growers develop an understanding and expectation of potential cultivar performance and management which will be necessary to maximize fruit quality traits. The 99 planting is young and a more accurate picture will develop as the trees age and more data are gathered and analyzed.

Information on the foliar pest and disease susceptibility has now been observed for 3-5 years on the 95 planting. The multiple year observations allow study of genotype by environment interactions for the pest or disease susceptibility. This season represented the fourth opportunity to evaluate the pest and disease susceptibility of the fruit for the 95 planting and the second year for the 99 planting. The pest and disease susceptibility information will be useful for making recommendations for controlling potential problems, or for growers to anticipate possible crop damage and implement appropriate avoidance or protection strategies. Furthermore, the information on both foliar and fruit pest and disease 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. Therefore these plantings are a valuable educational resource in addition to their research function.

Work Planned for Next Year:

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 95 planting. Plans for a 2004 trial will continue.

Publications:

Belding, R.D., W.P. Cowgill Jr., J.L. Frecon, G.C. Hamilton, J.R. Heckman, L.S. Katz, N. Lalancette, B.A. Majek, D. Polk, P.W. Shearer, W.H. Tietjen. 2001. New Jersey Commercial

Barritt, B.H. 2001. Apple varieties, quality and consumers. Proc. Wash. Sta. Hort. Assoc. 96:96-103.

Barritt, B.H. 2001. Apple quality for consumers. Compact Fruit Tree 34(2):54-56.

Barritt, B.H. 2001. Apple variety management. Compact Fruit Tree 34(2):57-59.

Bocuzzo, L., M. E. Garcia, and L. P. Berkett. 2001. Evaluation of three methods for determining freeze damage to dormant apple wood. HortScience 36 (3): 527. Oral Presentation at the 98th International Conference of the Am. Soc. Hort. Sci., Sacramento, CA.

Cowgill, W.J., Jr., J. Compton 2001. 'North Jersey Tree Fruit Annual Report-Rutgers Cooperative Extension Bulletin E002N, 123 total pages

Cowgill, W.P., Compton, J.M., Adickes, D. 2001. New Bloom Thinner for Apples. Horticultural News, Vol. 81 (3) 6-9

Cowgill, W., J. Clements, 2001. New Zealand Conference Video. Compact Fruit Tree Vol 34 (2)

Crassweller, R. M. 2001. Apple cultivar development - NE-183 and Beyond. PA Fruit News 81(4):24-27.

Garcia, M.E. and L.P. Berkett. 2001. Scab resistant cultivars: A biological alternative in organic apple production. First Annual Symposium in Organic Fruit Production. Grand Junction CO.

Garcia, M. E. and L. P. Berkett. 2001. Summary of the University of Vermont Apple Cultivar Evaluation of the 1995 NE-183 Planting. Available as an Extension publication and on the web at: <http://orchard.uvm.edu/uvmapple/hort/95NE183CultivarEvaluationSummary.pdf>

Lalancette, N., W.P. Cowgill, J. Compton, K. Foster 2001. 'Sensitivity of Apple Cultivars to Azoxystrobin Fungicide. Proceedings: 76th Cumberland - Shenandoah Fruit Workers

Conference, Winchester, VA.

Merwin, I.A., Byard, R., Robinson, T.L., and Carpenter, S. 2001. Developing an integrated program for diagnosis and control of replant problems in New York apple orchards. *New York Fruit Quarterly* 9(1):11-15.

Tree Fruit Production Guide. Rutgers Cooperative Extension Bulletin E00N, 160 total pages

Wargo, J.M, Merwin, I.A., and Watkins,C.B. 2000 Effects of ReTain, nitrogen fertilization, and mid-summer trunk scoring on fruit color and quality of 'Jonagold' apples. *New York State Fruit Quarterly* 8(4):24-26

Refereed Journals:

Ferree, D. C. and J. C. Schmid. 2001 Compariosn of Melrose strains and selections. *J. Amer. Pom. Soc.* 55(2): 89-94.

Ferree, D. C., B. L. Bishop, J. R. Shupp, D.S. Tustin, W.M. Cashmore. 2000. Influence of flower type, position in the cluster and spur characteristics on fruit set and growth of apple cultivars. *J. Hort. Sci. and Biotech.* 76(1):1-8.

Oliveira, M.T. and Merwin, I.A. 2001 Soil physical conditions in a New York orchard after eight years under different groundcover management systems. *Plant and Soil* 234:233-237.

Extension Publications and Presentations:

Extension Out-Reach —North Jersey Fruit Meeting, March 13, 2001; Broadway, NJ, 75 attendees, growers -North Jersey Twilight Fruit Meeting, April 19, 2001; Rutgers Snyder Farm, Pittstown, NJ, 45 attendees, growers -North Jersey Horticultural Research Twilight Mtg., August 30, 2001; Snyder Farm, Pittstown, NJ, 75 attendees, organic and conventional growers -South Jersey Field Day and Tour, August 20, 2001; RAREC, Upper-Deerfield, NJ, 204 Attendees, Growers, Industry and Extension personnel \

An oral presentation describing new apple cultivars was presented to the Fredrick County, VA apple growers in May. A paper, Relative Susceptibility of Selected Apple Cultivars to *Colletotricum acutatum* by A. Biggs and S. Miller was published in *Plant Disease*. A poster, Pest susceptibility of new apple cultivars by H. Hogmire and S. Miller, was prepared and presented at the Entomological Society of America meeting and a paper on same presented at the Cumberland-Shenandoah Fruit Workers Conference.

Website: The website was maintained by Win Cowgill, NJAES and Jon Clements, UMASS. We maintain the internet registration for NE183 at <http://www.NE183.org/> Articles, photographs and reports will continue to be archived at this site. All requirements for web page design for regional projects have been 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).

Book Chapters

Merwin, I.A. (in press). Orchard Floor Management Systems. In: Apples: Botany, Production and Uses (D.C. Feree, ed.) CABI Publ., Wallingford, England.

APPROVED:

| | |
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| Chair, Technical Committee | Date |

| | |
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| <u>Robert Seem</u> | <u>Sept. 18, 2002</u> |
| Administrative Advisor | Date |