

# ***SAES-422 Multistate Research Activity Accomplishments Report***

**Project No. NC 140 and Title: Improving Economic and Environmental Sustainability in Tree-Fruit Production Through Changes in Rootstock Use**

**Period Covered: Oct. 1, 2014 to Sept 30, 2015**

**Annual Meeting Dates: November 2-5, 2015, UC Davis, Davis, CA**

## **2014-15 Published Written Works**

### **Books**

Ayala, M., J.P. Zoffoli, and G.A. Lang. 2014. Proceedings of the 6th International Cherry Symposium. Acta Hort. 1020 (536 pages).

Long, L., G. Lang, S. Musacchi, and M. Whiting. 2015. PNW 667 cherry training systems. Pacific Northwest Ext. Publ. 667:50–56.

Ward, D., W.P. Cowgill Jr., J.L. Frecon, G.C. Hamilton, J.R. Heckman, L.S. Katz, N. Lalancette, B.A. Majek, D. Polk. 2014. "New Jersey Commercial Tree Fruit Production Guide." Rutgers Cooperative Extension Bulletin E002. 229 pp.

### **Refereed Journal Articles**

Bielenberg, D.L., B. Rauh, S. Fan, K. Gasic, A.G. Abbott, G.L. Reighard, W.R. Okie and C.E. Wells. 2015. Genotyping by sequencing for SNP-based linkage map construction and QTL analysis of chilling requirement and bloom date in peach [*Prunus persica* (L.) Batsch]. PLoS ONE, DOI:10.1371/journal.pone.0139406.

Butler, B, A Wallis, CS Walsh, E Snyder and T von Thun. 2014. High-density orchard systems for Maryland; Field testing advanced selections from the Geneva apple rootstock breeding program. Horticulture Technology Newsletter. December, 2014: 11-12.

Duyvelshoff, C. and J. A. Cline. 2013. Ethephon and Prohexadione-Calcium Influence the Flowering, Early Yield, and Vegetative Growth of Young ‘Northern Spy’ Apple Trees. *Scientia Horticulturae* 151:128-134.

Fallahi, E., C. Rom, B. Fallahi, and Sh. Mahdavi. 2015. Leaf and Fruit Mineral Nutrient Partitioning Influenced by Various Irrigation Systems in ‘Fuji’ Apple over Four Years. *Journal of the American Pomological Society* 69(3): 137-147.

Fallahi, E., B. Fallahi, B. Shafii, and Z. Zamani. 2014. Long-term Yield and Harvest Time Fruit Quality Attributes in Various ‘Fuji’ Apple Strains. *Hortscience*. 49(3):281-284.

Fallahi, E., B.Fallahi, and B.Shafii. 2014. A Long-time Assessment of Yield and Harvest Quality Attributes Among Five Strains of 'Fuji' Apples. *European Journal of Horticultural Science*. 79(4): 212-217.

Gasic, K., Reighard, G. L., J. Windham and M. Ognjanov. 2015. Relationship between fruit maturity at harvest and fruit quality in peach. *Acta Hort* 1084(2):643-648.

Gasic, K., G. Reighard, W. Okie, J. Clark, T. Gradziel, D. Byrne, C. Peace, T. Stegmaier, U. Rosyara and A. Iezzoni. 2015. Bacterial spot resistance in peach: functional allele distribution in breeding germplasm. *Acta Hort* 1084(1):69-74.

Johnson, R.S., G.L. Reighard, T.G. Beckman, E.D. Coneva, K.R. Day, E. Fallahi, M.J. Newall, T.L. Robinson and D. Wolfe. 2015. Environmental Effects on Fruit Ripening and Average Fruit Weight for Three Peach Cultivars. *Acta Hort* 1084(1):453-458.

Kenealy, L., G. Reighard, B. Rauh, and W. Bridges, Jr. 2015. Predicting Peach Maturity Dates in South Carolina with a Growing Degree Day Model. *Acta Hort* 1084(2):749-752.

Kon, T.M., and J.R. Schupp. 2015. Pollen tube growth in apple: A Review. *J. Amer. Pomological Soc.* 69(3):158-163.

Mayer, N.A., G. L. Reighard and W. Bridges.. 2015. Peach rootstock propagation under intermittent mist system. *Acta Hort* 1084(1):53-62.

Mayer, N.A., B. Ueno and G. L. Reighard . 2015. Selection of *Prunus mume* as rootstocks for peaches on PTSL site. *Acta Hort* 1084(1):89-96.

Pokharel, R. R., and G. L. Reighard. 2015. Evaluation of Rootstock Effect on Tolerance to Iron Chlorosis and Cytospora Canker in Peaches. *Acta Hort* 1084(1):159-164.

Pokharel, R. R., G. L. Reighard and D. Reich. 2015. Deficit irrigation for iron chlorosis did not affect fruit production and quality in peach. *Acta Hort* 1084(1):409-414.

Pokharel, R. R., and G. L. Reighard. 2015. Evaluation of biofumigation and soil solarization on peach replant disease. *Acta Hort* 1084(2):577-584.

Reighard, G., Bridges, Jr., W., Archbold, D., Wolfe, D., Atucha, A., Pokharel, R., Autio, W., Beckman, T., Black, B., Lindstrom, T., Coneva, E., Day, K., Johnson, R.S., Kushad, M., Parker, M., Robinson, T., Schupp, J. and Warmund, M. 2015. NC-140 Peach Rootstock Testing in Thirteen U.S. States. *Acta Horticulturae Acta Hort* 1084:225-232 [http://www.actahort.org/books/1084/1084\\_32.htm](http://www.actahort.org/books/1084/1084_32.htm)

Reighard, G.L., W. Bridges, Jr., D. Archbold, A. Atucha, W. Autio, T. Beckman, B. Black, E. Coneva, K. Day, M. Kushad, R. Pokharel, R.S. Johnson, T. Lindstrom, M. Parker, T. Robinson, J. Schupp, M. Warmund and D. Wolfe. 2015. NC-140 Peach Rootstock Testing in 13 U.S. States. *Acta Hort* 1084(1):225-232.

Reighard, G.L. and D.R. Ouellette. 2015. Manipulating Bloom and Harvest Dates in Peach Using a Strain of PLMVd. *Acta Hort* 1084(1):221-224.

Reighard, G. L. and B. Rauh. 2015. Predicting Peach Fruit Size Potential from GDD 30 Days Post-Bloom. *Acta Hort* 1084(2):753-758.

Sauerteig, K. A. and J.A. Cline. 2013. Mechanical blossom thinning of 'Allstar' peaches influences yield and quality. *Scientia Horticulturae* 160:243-250.

Zhang, Q., M. Han, C. Song, X. Song, C. Zhao, H. Liu, P.M. Hirst and D. Zhang. 2014. Optimizing planting density for production of high-quality apple nursery stock in China. *N.Z. J. Crop and Hort. Sci.* 43:1-11.

### **Symposium Proceedings**

Coneva, E. and J. Pitts. 2015. Assessment of Fire Blight Tolerant Asian Pear Cultivars in Alabama. *HortScience* 50(9):S35. (Abstr.).

Coneva, E Gregory L. Reighard, and J. Pitts. 2015. Peach Rootstock Evaluation in Alabama. *HortScience* 50(9):S51. (Abstr.).

Coneva, E and J. Pitts. 2015. Evaluation of Fire Blight Tolerant Asian Pear Cultivars for Alabama. NACAA Annual Meeting, Sioux Falls, SD. (Abstr.).

Walsh, C. 2015. Field performance of Asian pear trees in the hot, humid summer conditions of the Mid-Atlantic region of the United States., ISHS Pear Symposium, Leuven Belgium.

Kon, T.M. and J. Schupp. 2015. Apple pollen tube growth and spur leaf injury in response to thermal shock temperature and duration. *HortScience* 50(9):S110-S111. (Abstr.)

Kon, T.M., J. Schupp, H.E. Winzeler, and M.A. Schupp. 2015. The effect of mechanical string thinner spindle rotation speed on apple spur bud removal. *HortScience* 50(9):S358-S359. (Abstr.)

Lang, G.A. 2015. Integration of Renewable Canopy Architectures and Precocious Rootstocks Optimize Sweet Cherry Yields, Fruit Quality, and Labor Efficiency, ASHS annual conference, New Orleans, LA, Aug. 4-7.

Lang, G.A. 2015. Fruiting Wall Canopy Training System Trials in Sweet Cherries, nectarines, Plums, and Apricots, Great Lakes Fruit Workers annual meeting, Geneva, NY; Nov. 9-11.

Thompson, A. and G. Peck. 2015. The Effects of Rootstock and Fertilizer Selection on Apple Orchard Productivity and Soil Microbial Ecology. *HortScience* 50(9): S178. (Abstr.)

### **Poster Presentations**

Beckman, T.G. Progress in the Development of Moderate-Chill Peach Cultivars for the Southeastern United States. Presented at the Amer. Soc. Hort. Sci. Annual Meeting. Aug. 4-7, 2015, New Orleans, LA. [poster]

Belisle, C., D. Jackson, D.J. Chavez, and K. Adhikari. 2015. A Survey of Fruit Quality Characteristics of Georgia Peach (*Prunus persica* L.) Cultivars. Amer. Soc. Hort. Sci. Annual Meeting. Aug. 4-7, 2015, New Orleans, LA. [poster].

Chavez, D.J. and J. Cook. 2015. Effect of Bloom and Fruit Thinning on Quality Characteristics of 'Harvester' and 'Redglobe' Peach Fruit Varieties in Georgia. Amer. Soc. Hort. Sci. Annual Meeting. Aug. 4-7, 2015, New Orleans, LA. [poster].

Chavez, D.J. and J. Cook. 2015. The Effect of Gibberellic Acid (GA3) and Aminoethoxyvinylglycine (AVG) on Late-Season Peach [*Prunus persica* (L.) Batsch] Varieties in Middle Georgia. Amer. Soc. Hort. Sci. Annual Meeting. Aug. 4-7, 2015, New Orleans, LA. [poster].

Coneva, E.D., G.L. Reighard, and J. Pitts. 2015. Peach rootstock evaluation in Alabama. SR-ASHS, Atlanta, GA. Jan. 30 – Feb. 1, 2015. [poster]

Coneva, E.D., G.L. Reighard, and J. Pitts. 2015. Assessing peach rootstocks in Alabama. SE Regional Fruit & Vegetable Conference. Savannah, GA. Jan. 8-11, 2015. [poster]

Conlan, E., M.A. Olmstead, J.W. Olmstead, J.G. Williamson, D.J. Chavez, E.D. Smith, O. Lindstrom, and J. Liu. 2015. An Analysis of Historical Freeze Events and Determination of Blueberry and Peach Critical Bud Temperatures to Aid Growers in Freeze-related Risk Assessments. Amer. Soc. Hort. Sci. Annual Meeting. Aug. 4-7, 2015, New Orleans, LA. [poster].

Reighard, G.L., F. Souza and R. Pio. 2015. Peach cell number and size is affected by crop load, cultivar and GDD. ISHS Xth Symposium on Modeling in Fruit Research and Orchard Management. June 2-5, 2015. Montpellier, France. [poster]

Reighard, G.L., W. G. Henderson and W. G. Henderson, Jr. 2015. Irrigation Scheduling Based on Soil Water Volume Increases Profitability of Peach Production. ISHS Symposium on Innovation in Integrated and Organic Horticulture. June 8-12, 2015. Avignon, France. [poster]

## **Popular Articles**

Autio, W., J. Cline, T. Einhorn, G. Lang, R. Marini, G. Reighard, and T. Robinson. 2015. 2014 Progress Report – Brief summaries of NC-140 rootstock trials. *Compact Fruit Tree* 48(2): 6-8.

Autio, W.R., J.M. Clements, and J.S. Krupa. 2015. An evaluation of Cornell-Geneva and Budagovsky apple rootstocks with Honeycrisp, the 2010 NC-140 Apple Rootstock Trial after five years. *Horticultural News* 95(2):6-11.

Autio, W.R., J.M. Clements, and J.S. Krupa. 2015. An evaluation of Cornell-Geneva and Budagovsky apple rootstocks with Honeycrisp, the 2010 NC-140 Apple Rootstock Trial after five years. *Fruit Notes* 80(2):6-11.

Clements, J.M. and W.R. Autio. 2015. Vineland and Geneva rootstocks in the 2014 NC-140 Apple Trial at UMass Cold Spring Orchard. *Horticultural News* 95(1):1-3.

Clements, J.M. and W.R. Autio. 2015. Vineland and Geneva rootstocks in the 2014 NC-140 Apple Trial at UMass Cold Spring Orchard. *Fruit Notes* 80(1):1-3.

Cline, J., 2014. Rootstock Performance when Growing 'Honeycrisp'. Newsletters. Cline, J. A. and J. Zandstra. 2014. Rootstock Performance when Growing 'Honeycrisp'. *Orchard Network* 18(1):2-3

Cline, J., 2013. A Brief Summary of Selected Apple Research Projects Supported by the OAG and/or OMAFRA at the University of Guelph, Simcoe. *Orchard Network* 17(4):2-3

Cooley, Daniel, J. Clements, W. Cowgill, 2015. An Annual Fire Blight Management Program for Apples: An Update. Horticultural News 95-2, pgs 18-26

Cowgill, W., R. Magron, J.M. Clements, and W.R. Autio. 2015. Two new NC-140 apple trials: Vineland and Geneva rootstocks with Honeycrisp and Fuji at Rutgers Snyder Farm. Fruit Notes 80(3):6-8.

Cowgill, W., R. Magron, J.M. Clements, and W.R. Autio. 2015. Two new NC-140 apple trials: Vineland and Geneva rootstocks with Honeycrisp and Fuji at Rutgers Snyder Farm. Horticultural News 95(3):6-8.

Crassweller, R. M. & D. E. Smith. 2015. Apple rootstock trials at Rock Springs – 2014. PA Fruit News 95(1):41-45.

Crassweller, R. M. & D. E. Smith 2015. Second generation apple training system trials – 2014. PA Fruit News 95(1):49-53.

Crassweller, R. 2015. Carbohydrate model results in 2014 for four locations in PA. PA Fruit News 95(2):21-23.

Crassweller, R. & D. Smith. 2015. Nutritional analysis of new apple cultivars in high density plantings – 2014. PA Fruit News 95(2):24-26.

Baugher, T., A. Anderson, T. Jarvinen, J. Schupp, E. Winzeler and M. Schupp. 2015. Competitive orchard systems and technologies. Pennsylvania Fruit News 95(2):20.

Kon, T. and J. Schupp. 2015. Investigating forced heated air treatments as a blossom thinning strategy for apple. Pennsylvania Fruit News 95(1):68-69.

Kon, T. and J. Schupp. 2015. Changing orchard design: from 40' x 40' to fruiting walls. Crunch Time, Adams County Fruit Grower Association newsletter. July 2015:6-8.

Lang, G.A. 2015. How canopy structures affect productivity. American Fruit Grower 135(9):26-27.

Lang, G.A. 2015. Non-tunnel covering systems for sweet cherries. American Fruit Grower 135(5):30-32.

Miller, D.D. 2015. Apple Rootstock Trial Results in Ohio. Ohio Produce Growers and Marketers Association Quarterly 2015 (1)

Peck, G. 2015. 2014 Progress Report to the Virginia Apple Research Program: NC-140 Rootstock Trial for Central Virginia. Virginia Fruit 91 (1):7 (Apr 2015).

Peck, G. and K. Yoder. 2015. 2014 Progress Report to the Virginia Apple Research Program: Continued Investigations into New Rootstocks, Cultivars, and Training Systems for Virginia. Virginia Fruit 91(1):8-12 (Apr 2015).

Schupp, J., E. Winzeler, M. Schupp, T. Kon, T. A. Baugher, T. Jarvinen, A. Anderson and A. Tabb. 2015. Labor Efficient Apple and Peach Systems for Profitability. Pennsylvania Fruit News 95 (1):26-29.

Schupp, J., E. Winzeler, M. Schupp and T. Kon. 2015. Peach Rootstock Trials: A 2014 Update.

Pennsylvania Fruit News 95 (1):46-48.

Thompson, A. and G. Peck.. 2015. 2014 Progress Report to the Virginia Apple Research Program: Finetuning fertilizer recommendations for young apple trees in high-density plantings. Virginia Fruit 85(1):3-6 (Apr 2015).

Yoder, K. and G. Peck. 2015. 2014 Progress Report to the Virginia Apple Research Program: Apple Rootstock Susceptibility to Tomato Ring Spot Virus (TmRSV). Virginia Fruit 91 (1):13-14 (Apr 2015).

Winzeler, H. E. and J. R. Schupp. 2015. Potential for using Mid-Atlantic processing fruit in hard cider production. Pennsylvania Fruit News 95(2):29-30.

### **Other Creative Works**

Coneva, E. and J. Pitts. 2015. Update on Peach Rootstock Evaluations in Alabama. Alabama IPM Communicator. Alabama Cooperative Extension System (ACES).

Coneva, E. and J. Pitts. 2015. Update on Peach Rootstock Evaluations in Alabama. Alabama Fruit and Vegetable Growers Association (AFVGA) Newsletter.

Coneva, E. 2015. Update on Peach Rootstock Evaluations in Alabama. Timely Information Sheet. Alabama Cooperative Extension System. Horticulture Series.

Kon, T. and J. Schupp. 2015. Think warm thoughts. Pennsylvania Fruit Times.  
<http://extension.psu.edu/plants/tree-fruit/news/2015/think-warm-thoughts-possible-frost-event-s-in-the-forecast> April 23, 2015.

Kon, T. and J. Schupp. 2015. An In-Depth Look at Bloom. American Fruit Grower  
<http://www.growingproduce.com/fruits/apples-pears/an-in-depth-look-at-bloom/>

Schupp, J. 2015. Promoting return bloom of apple. Pennsylvania Fruit Times.  
[http://extension.psu.edu/plants/tree-fruit/news/2015/promoting-return-bloom-of-apple-trees?utm\\_campaign=Fruit+Times&utm\\_medium=email&utm\\_source=newsletter&utm\\_content=newsletter\\_title](http://extension.psu.edu/plants/tree-fruit/news/2015/promoting-return-bloom-of-apple-trees?utm_campaign=Fruit+Times&utm_medium=email&utm_source=newsletter&utm_content=newsletter_title)

Schupp, J. 2015. Is everything (still) just peachy? <http://extension.psu.edu/plants/tree-fruit/news/2015/is-everything-still-just-peachy?> March 6, 2015

Winzeler, H. E. and J. R. Schupp. 2015. Potential for using Mid-Atlantic processing fruit in hard cider production. Pennsylvania Fruit Times <http://extension.psu.edu/plants/tree-fruit/news/2015/potential-for-using-mid-atlantic-processing-fruit-in-hard-cider-production-an-analysis-of-tannin-content-titratable-acidity-levels-ph-and-soluble-solids-content> March 12, 2015

Wolfe, D. D. Archbold, J. Johnston, and G. Travis. 2015. Rootstock Effects on Apple and Peach Tree Growth and Yield. Fruit and Vegetable Crops 2014 Research Report. University of Kentucky College of Agriculture, Agricultural Experiment Station publication. PR-688:8-9.  
<http://www2.ca.uky.edu/agc/pubs/PR/PR688/PR688.pdf>

## **7. Scientific and Outreach Oral Presentations.**

Beckman, T.G. "Performance of MP-29 Rootstock in Grower Trials". Presented at the SE Prof. Fruit Workers Meeting. Oct. 6-8, 2015, Montgomery, AL.

Black, Brent. 2015. 2009 Redhaven planting (South Shore Farms). Annual winter tour (21 Jan. 2015) of the Utah State Horticulture Association (USHA).

Black, Brent. 2015. A progress report of apple and cherry rootstock trials. Annual USHA winter meetings (22 Jan. 2015).

Black, Brent. 2015. Cherry rootstocks in the 2010 high density tart planting USHA summer tour (30 June 2015).

Blatt, SE. 2015. "Rootstocks and fireblight and spotted wing... oh my! Updates on a few things of interest." Nova Scotia Fruit Growers Association Annual Convention, Greenwich, Nova Scotia, January.

Blatt, SE. 2015. Nova Scotia Fruit Growers Association Field Tour. August 2015. Discussion of ongoing rootstock trials and introduction of Modi trial.

Chavez, D.J. 2015. Peach Research at UGA: Listening, Learning, and Preparing for the Future. Invited guest lecture. SE Reg. Fruit & Veg. Conference. Jan. 8-11, 2015. Savannah, GA.

Chavez, D.J. and J. Cook. 2015. Effect of Prodigal (gibberellic acid, GA3) and Retain (aminoethoxyvinylglycine, AVG) on peach varieties in middle Georgia. Presented at the SE Prof. Fruit Workers Meeting. Oct. 6-8, 2015, Montgomery, AL.

Cline, J. A. 2014. Use of Plant Bioregulators for Annual Bearing. Georgian Bay Orchard Tour. Ontario Apple Growers.

Cochran, D.R. 2015. NC-140 2010 Dwarf apple rootstock trial. Iowa State University Fruit and Vegetable Field Day, Hort Station. August 10, 2015, 150 attendees.

Coneva, E. 2015. Peach Rootstock Evaluation. Chilton Area Peach Production Meeting. Clanton, January 27, 2015.

Coneva, E. and J. Pitts. 2015. Evaluation of Fire Blight Tolerant Asian Pear Cultivars for Alabama. NACAA Annual Meeting, Sioux Falls, SD, July 13-17, 2015.

Coneva, E. and J. Pitts. 2015. Evaluation of Fire Blight Tolerant Asian Pear Cultivars for Alabama. AACAAS Annual Meeting, Auburn, AL, June 3-5, 2015.

Coneva, E. and J. Pitts. 2015. Fire Blight Tolerant Asian Pear Cultivars for Alabama. Southeast Regional Fruit and Vegetable Conference, Savannah, GA, Jan. 8-10, 2015.

Coneva, E. Gregory L. Reighard, and J. Pitts. 2015. Assessing Peach Rootstocks in Alabama. Southeast Regional Fruit and Vegetable Conference, Savannah, GA, Jan. 8-10, 2015.

Coneva, E. and J. Pitts. 2015. Fire Blight Resistant Apple Rootstock Trial in Alabama. Southeast Regional Fruit and Vegetable Conference, Savannah, GA, Jan. 8-10, 2015.

Coneva, E 2015 Home and Wildlife Expo, Chilton REC, AL. “NC-140 Tree Fruit Trial Demonstration.” (Attendance 2000+), August 8, 2015.

Cowgill, W. 2014. North Jersey Fruit Meeting, Broadway, NJ, 67 growers

Cowgill, W. 2015. North Jersey Twilight Fruit Meeting, May, 07; Rutgers Snyder Farm, Pittstown, NJ 52 growers

Cowgill, W. 2015. North Jersey Twilight Horticultural Research Meeting, Rutgers Snyder Farm, September 15, 2015– 68 growers

Einhorn, T. 2015. The use of PGRs, root pruning and new, dwarfing rootstocks to balance vigor and production. Washington State Horticultural Association’s 111th Annual Meeting, Yakima, WA, December 9, 2015. Oral presentation to members of the Pacific Northwest fruit industry.

Einhorn, T. 2015. Practical strategies to improve management and profitability of pear orchards. Washington State Horticultural Association’s 111th Annual Meeting, Yakima, WA, December 9, 2015. Oral presentation to members of the Pacific Northwest fruit industry.

Einhorn, T. 2015. Management strategies to exploit stresses. WSU Fruit School, Apple and Pear Horticulture, Wenatchee, WA, November 18, 2015. Oral presentation of my research results to members of the PNW tree fruit industry. Meeting hosted by WSU Extension.

Einhorn, T. 2015. Managing growth and development of sweet cherry. IV International Seminar on Cherries, Curico, Chile, October 20, 2015. Oral presentation of my research results to members of the Chilean tree fruit industry. Meeting hosted by Patricio Espinosa, PEC.

Einhorn, T. 2015. MCAREC Field Day- Pear horticultural research. Hood River, OR, July 21, 2015. Oral presentation of my research results to members of the Oregon and WA tree fruit industry. Meeting hosted by MCAREC.

Einhorn, T. 2015. Using rootstocks, cultivars, training systems, root pruning and PGRs to achieve early production in pear. 2015 Hood River Winter Horticulture Meeting, Hood River, OR, February 6, 2015. Oral presentation to members of the regional fruit industry. Meeting hosted by Steve Castagnoli, Hood River County Extension.

Einhorn, T. and Gibeaut, D. 2015. Water, PGRs and Freeze: 2014 Sweet Cherry Update. 2015 Cherry Research Review and MCAREC Update, the Dalles, OR, February 5, 2015. Oral presentation of research results to members of the regional fruit industry. Meeting hosted by MCAREC and Lynn Long, OSU Wasco County Extension.

Einhorn, T. 2015. Techniques to promote early bearing and vigor control of pear trees. 2015 North Central Washington Pear Day, Wenatchee, WA, January 21, 2015. Oral presentation of research results to over 200 members of the North Central Washington and greater regional fruit industry. Meeting hosted by Tim Smith, WSU Chelan /Douglas/Okanogan County Extension.

Einhorn, T. 2015. Sweet Cherry Research Update: Cold hardiness, Water management, and PGRs. 2015 North Central Washington Stone Fruit Day, Wenatchee, WA, January 20, 2015. Oral presentation of research results to over 200 members of the North Central Washington and greater regional fruit industry. Meeting hosted by Tim Smith, WSU Chelan /Douglas/Okanogan County Extension.

Einhorn, T. 2015. OSU Horticultural Update. 72nd Annual Cherry Institute, Yakima, WA, January 16, 2015. Oral presentation of research results to several hundred industry members, and regional peers.

Fallahi, E. November, 2014. NC-140 Fuji/Rootstock Progress Report. Annual conference of NC-140, Clemson, South Carolina, attendance 41.

Fallahi, E., November 20-21, 2014. NC-140 Fuji/Rootstock Report. Annual Conference of the Idaho State Horticultural Society, Nampa, Idaho; Attendance 110.

Fallahi, E. March 5, 2015. Training on Growing Apples on Different Rootstocks. Idaho apple growers. March Tour, 56 in attendance.

Fallahi, E. August, 28, 2015. Performance of Apple Rootstocks under Intermountain West Conditions. University of Idaho Pomology Program Fruit Field Day, Growers and Public audience. Attendance 980.

Hannan, J. and D.R. Cochran. 2015. NC-140 2015 Organic apple rootstock trial. Wills Family Orchard, Adel, IA. July 13, 2015, 20 attendees.

Kon, T.M. and J.R. Schupp. 2015. Apple pollen tube growth and spur leaf injury in response to thermal shock temperature and duration. The American Society for Horticultural Science Annual Conference, New Orleans, LA

Kon, T.M., J.R. Schupp, H.E. Winzeler, and M.A. Schupp. 2015. The effect of mechanical string thinner spindle rotation speed on apple spur bud removal. The American Society for Horticultural Science Annual Conference, New Orleans, LA

Kon, T.M. and J.R. Schupp. 2015. Thinning apple early: risks, rewards, and alternative strategies. Penn State Fruit Research and Extension Center Field Day, Biglerville, PA. 09 July.

Kon, T.M. and J.R. Schupp. 2015. Apple crop load management: is mechanical thinning effective? In-Depth Tree Fruit Meeting, Winchester, VA. 23 Apr.

Kon, T., J. Schupp, M. Schupp, and H.E. Winzeler. 2015. Investigating forced heated air treatments as a blossom thinning strategy for apple. The Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA. 28 January.

Lang, G.A. 2015. Small-Scale Cherry Production, Big Market Opportunities, Indiana Horticultural Congress, Indianapolis, IN; Jan 21.

Lang, G.A. 2015. High Tunnel Cherries and Other Stone Fruits - Impose Your Own Climate Change?, Indiana Horticultural Congress, Indianapolis, IN; Jan 22.

Lang, G.A. 2015. Impose Your Own Climate Change: Different Covering Strategies Affect Stone Fruit Growth, Yield, Fruit Quality, and Diseases, SW Hort Days, Benton Harbor, MI; Feb 5.

Lang, G.A. 2015. Stone Fruit Game-Changers: Fruiting Wall Training Systems and High Tunnels, Ontario Fruit & Vegetable Conference, Niagara Falls, ON; Feb 19.

Lang, G. 2015. Pruning High Density Sweet Cherries, MSUE Cherry Crop Load Management & Pruning workshop, Traverse City, MI, Apr. 23.

Lang, G.A. 2015. How Studies in Plant Physiology Change Sweet Cherry Production, MSU Science Festival, East Lansing, MI; Apr 18.

Lang, G. 2015. High Density Training Systems and Protected Production of Sweet Cherries and Stone Fruits, MSU Clarksville Research Center Field Day, Clarksville, MI, June 23.

Lang, G.A. 2015. Advances in Management and Production of Cherries with Row Covers, High Tunnels, and Greenhouses, IV International Cherry Seminar, Curico, Chile; Oct 20.

Miller, D.D. 2015. Apple Rootstock Trial Results in Ohio. Ohio Produce Growers and Marketers annual meeting, Jan. 19, 2015. Kalahari Convention Center, Sandusky, OH. Attendance 50.

Miller, D.D. 2015. 2010 NC-140 Rootstock Planting. Fruit Growers Marketing Association annual meeting, Aug. 25, 2015. Bachman's Sunny Hill Fruit Farm, Carroll, OH. Attendance 60.

Parker, M.L. Keys to maximizing orchard productivity in the SE. 2015. Southeastern Apple Growers Meeting Proceedings. pp. 51-56.

Parker, et. al., 2015 Integrated orchard management guide for commercial apples in the Southeast. Edited by J. Walgenbach. NC Cooperative Extension Service, Raleigh. AG-572. 88 pp.

Parker, M.L. January 2015. Keys to Maximizing Orchard Productivity in the SE. Southeastern Apple Growers Meeting, Asheville, NC. Commercial grower audience. Attendance 125.

Parker, M.L. January 2015. Peach Production Orchard Tour and Workshop with an emphasis on peach rootstocks and subsequent management. Attendance 55.

Parker, M.L. January 2015. North Carolina Peach Growers Society. Carthage, NC. Commercial grower audience. Attendance 80.

Parker, M.L. February 2015. Western District Apple School, Hendersonville, NC. Commercial grower audience. Attendance 110.

Parker, M.L. February 2015. Keys to Maximizing Orchard Productivity in the Brushy Mts., Wilkesboro, NC. Commercial grower audience. Attendance 40.

Peck, G. 2015. Designing and Establishing a Hard Cider Orchard. Delivered at CiderCON 2015, Chicago, IL. Producer audience. Attendance: 65.

Peck, G. 10-13 Feb 2015. Winter Fruit Schools. Tall Spindle Orchard Systems in Virginia. Delivered at five separate locations. Producer audience. Attendance: 250.

Peck, G. 25 Aug 2015. Commercial Organic Apple Production Field Day. Site Selection and Orchard Design. Winchester, VA. Producer audience. Attendance: 50.

Peck, G. 25 Aug 2015. Commercial Organic Apple Production Field Day. Cultivar and Rootstock Selection. Winchester, VA. Producer audience. Attendance: 50.

Rahn, Z., J. Schupp, H.E. Winzeler, and T. Kon. 2015. Fire blight resistant pear varieties: fruit quality and sensory evaluation. The Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA. January 28.

Reighard, G.L. 2015. Crop load management: Cultivar and thinning considerations. SE Regional Fruit & Vegetable Conference. Savannah, GA. Jan. 9, 2015.

Reighard, G.L. and G. Henderson. 2015. Aminoethoxyvinylglycine delays maturity and increases firmness in late season peaches. SR-ASHS, Atlanta, GA. Feb. 1, 2015.

Reighard, G.L. 2015. Crop load management: cultivar and thinning considerations in a high chill year. Peach Update Meeting. Edgefield, SC. February 19, 2015.

Reighard, G.L. 2015. Crop load management: cultivar and thinning considerations in a high chill year. Oconee Fruit Grower Meeting. Walhalla, SC. February 18, 2015.

Reighard, G.L., T. Feng, K. Gasic, F. Souza and R. Pio. 2015. Cell division and enlargement in peach mesocarp cells affected by time of thinning. IN: Workshop on Molecular Physiology & Genetics of Fruit Growth & Development. August 6, 2015. ASHS Annual Conference, New Orleans, LA.

Reighard, G.L., T. Feng, and K. Gasic. 2015. Early fruit thinning enhances upregulation of genes for cell division and growth in peach. Southeastern Professional Fruit Workers Conference, October 6-8, 2015. Montgomery, AL.

Schupp, J. R. 2015. Pruning by the Numbers. The Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA. January 27.

Schupp, J. R. 2015. Peach Pruning and Training. The Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA. January 28.

Schupp, J. R. 2015. Peach Rootstock Trials. The Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA. 28 January.

Schupp, J. 2015. Managing high density apple and peach plantings with advanced horticultural techniques. Penn State Fruit Research and Extension Center Field Day, Biglerville, PA. 09 July.

Schupp, J., H. E. Winzeler, T. Baugher, L. Kime, T. Kon, and M. Schupp. 2015. Peach Systems Trial: 8 year summary. The Mid-Atlantic Fruit and Vegetable Convention, Hershey, PA. January 28.

Schupp, J. 2015. Growing apples of consistent size and quality. North Carolina State University Cooperative Extension Winter Apple School, Flat Rock, NC. 4 Feb.

Schupp, J. 2015. Does water quality affect the efficacy of NAA stop drop sprays? North Carolina State University Cooperative Extension Winter Apple School, Flat Rock, NC. 4 Feb.

Schupp, J. 2015. Apple pruning demonstration. North Carolina State University Cooperative Extension Winter Apple School, Flat Rock, NC 5 Feb.

Schupp, J. R. 2015. Effect of water quality on Stop Drop Efficacy. Adams County Fruit Growers Winter Fruit School, Biglerville, PA. 16 February

Schupp, J. 2015. Peach rootstocks: Current options and upcoming developments. Michigan Spring Peach Update. Benton Harbor, MI. 10 March.

Schupp, J. R. 2015. The Penn State Fruit Research Center: A university – grower interface. Nuffield Scholars. 13 March

Walsh, C. 2015. Cumberland-Shenandoah Fruit Workers Conference. December 2014

Walsh, C. 2015. Preliminary Results from the Gala, Pink Lady Geneva Rootstock Trial at WMREC

Walsh, C. 2015. Field-testing advanced selections from the Geneva apple rootstock breeding program 2014 Updates.

Walsh, C. 2015. Anna Wallis, Brian Butler and Chris Walsh (Attendance, 60).

Walsh, C. 2015. Western Maryland Twilight Meeting. August 2015

Walsh, C, B. Butler, K. Peter. 2015 Tour of ongoing fruit tree research. (Attendance, 70 from MD, PA, VA and WV)

Wolfe, D. 25 June 2015. Apple and peach rootstock trials in Kentucky. UKREC Horticulture Field Day. Homeowner / grower audience. Attendance 20.

Yoder, K. 25 Aug 2015. Commercial Organic Apple Production Field Day. Disease Management. Winchester, VA. Producer audience. Attendance: 50.

#### ***8. Fund Leveraging, specifically, collaborative grants between stations and members.***

NC-140 members have written research proposals and attracted extramural funding associated or directly related to the five objectives of this project from local, regional, national and international funding sources. For fiscal year 2014/2015, funding and matching funds reported by members amounted to **\$3,701,088** from primarily commodity groups, state and competitive grant sources.

Hampson, C. 2015. Costs of supporting the 2010 NC-140 apple rootstock trial and one independent rootstock trial AAFC BC Growers \$2,000.00

Nielsen, D. 2015. Costs of supporting the 2010 NC-140 cherry rootstock trial Ag Food Can \$2,000.00

Cochran, D. 2015. Optimizing the Cropping Potential and Profitability of Organic and Sustainable Apple Orchards Through the Use of Dwarfing Rootstocks Iowa Dept Ag \$12,700.00

Fallahi, E. 2015. Evaluation of leaf minerals and fruit quality attributes of mature 'Aztec' Fuji trees on different rootstocks, tree girdling, and canopy designs ID Dept Ag \$53,500.00

Fallahi, E. 2015. Selection for suitable rootstocks to improve yield, growth and fruit quality attributes and leaf minerals of 'Aztec' Fuji apples. ID Dept Ag, \$50,500.00

Fallahi, E. 2015. Pest and disease control of rootstock projects. Wilbur Ellis. \$4,000.00

Fallahi, E. 2015. Labor and equipment (in-kind) from Idaho fruit industry for operation of various apple rootstock projects. Idaho Fruit Industry. \$5,800.00

Fallahi, E. 2015. New cold storage facilities for fruit research Univ Idaho \$800,000.00

Hirst, P. 2015. Support tree fruit research Ostermeyer Endowment \$15,000.00

Hirst, P.M., R.E. Foster and J. Beckerman 2015 Return Bloom Fund contributions to support tree fruit research Indiana Horticultural Society \$5,000.00

Wolfe, D. 2013-2015. New peach/nectarine cultivar planting Cumberland Valley Nursery \$1,000.00

Wolfe, D. 2009-2015. Apricot, peach, nectarine cultivar planting Gardens Alive \$15,000.00

Wolfe, D., Ingram, Saha, Dunwell, Strang, Woods. 2015. Infrastructure for Kentucky Horticulture. Technical Staff from KY Agricultural Dvlmnt Board /KY Hort. Council \$550,000.00

Lang, G. 2015 Competitive Orchards 2020: Integrating Tree Fruit Cropping Physiology, Canopy Architectures, Climate Modification Technologies, and Pest Management Strategies Project GREEN \$37,500.00

Lang, G. 2015 Apple Rootstock Evaluations. Mich Apple Com Apple Res Comm \$14,741.00

Lang, G. 2015 Sweet Cherry Orchard Designs. Mich Cherry Com Mich Cherry Comm \$10,000.00

Lang, G. 2015 Trellised Protected Orchard Systems IFTA \$8,000.00

Lang, G. 2015 Fruiting Wall Orchard Systems for Stone Fruits IFTA \$4,000.00

Lang, G. 2015 Fruiting wall and high tunnel stone fruit production MSHS \$7,892.00

Lang, G. A. Iezzoni, N. Rothwell, R. Perry, 2014-2015. Propagation of MSU Cherry rootstocks for research trials GREEN \$14,092.00

Lang, G. 2015 In-kind use of apple rootstock plot Al-Mar Orchards, Flushing \$2,500.00

Lang, G. 2015 Electronic pruners Peach Ridge Orchard Supply \$3,500.00

Lang, G. 2015 In-kind use of apple rootstock plot Rasch Orchards \$2,500.00

Parker, M. 2013-2015 Developing Management Strategies for Tree Fruit NCDA&CS Specialty Crop Block Grant \$84,000.00

Parker, M. 2014. Apple Rootstock Evaluations. NC Apple Growers Association. \$5,700.00

Parker, M. 2015. Support of apple research NC Legislature/Special Bill funding for apple research \$11,930.00

Cowgill, W. 2015 NC 140 rootstock research NJ Horticultural Society \$4,500.00

Cowgill, W. 2015 Rootstock and other plots maintenance NJ Ag Industry Support- dollars and in kind total \$22,000.00

Shengrui Yao, Heyduck, R. and Guldan, S. 2014-2017. Organic apple high density planting in New Mexico, NM Specialty Block Grant \$27,242.00

Forge, T, Neilsen, D, Wiersma, P, Blatt, S, Song, J, Forney, C, Burgher-MacLellan, K, Kalmokoff, M and Cline, J. 2015-2018. Developing more resilient tree fruit production systems from the ground up: rootstocks with enhanced tolerance to emerging biotic threats to orchard health AAFC \$518,000.00

Miller, D.D. 2015. Fruit research support Ohio Apple Marketing Program \$10,000.00

Cline, J and J. Zandstra. 2014. Rootstock research support Canadian Horticultural Council \$30,000.00

Gibeaut, D., T. Einhorn and L. Long 2015. New programs to increase sweet cherry fruit size and improve harvest quality. Wash Tree Fruit Research Com and Oregon Sweet Cherry Com. \$117,973.00

Einhorn, T. 2015. Improving fruit set, production efficiency and profitability of pears. NW Pear Bureau and Fresh Pear Research Committee \$41,885.00

Whiting, M., T. Einhorn, and I. Hanrahan. 2015. Effect of near-harvest irrigation on fruit quality Washington Tree Fruit Research Com and Oregon Sweet Cherry Com \$45,833.00

Einhorn, T. and B. Tuck. 2015. New and Continuing Pear Rootstock, Training System, and Cultivar Evaluations Columbia Gorge Fruit Growers Commission \$94,962.00

Autio, W., R. Marini, T. Robinson, G. Reighard, G. Lang, and T. Einhorn. 2015. NC-140 Rootstock Research Trial Coordination International Fruit Tree Association \$20,000.00

Crassweller, R. M. & D. E. Smith. 2015. Apple rootstocks and cultivar evaluations State Horticultural Association of Pennsylvania Research Committee. \$8,123.00

Crassweller, R. M. & D. E. Smith. 2015. Second generation apple system trials State Horticultural Association of Pennsylvania Research Committee \$9,000.00

Crassweller, R. M. 2015. Extending carbohydrate model to PA growers for determining apple tree response to chemical thinners State Horticultural Association of Pennsylvania Research Committee \$2,569.00

Crassweller, R. M. & D. E. Smith. 2015. Nutritional analysis of new apple cultivars in high density plantings. State Horticultural Association of Pennsylvania Extension Committee \$1,702.00

Crassweller, R., and J. Schupp. 2015. Rootstock and cultivar evaluations State Horticultural Association of Pennsylvania Research Committee \$12,799.00

Kon, T.M. and J.R. Schupp. 2015. A novel blossom thinning approach for apple: quantifying thermal transfer and damage to non-target tissues. State Horticultural Association of Pennsylvania Research Committee. \$14,095.00

Kon, T.M. and J.R. Schupp. 2015. Evaluating the pollen tube growth model as a timing aid for blossom thinners in the mid-Atlantic. State Horticultural Association of Pennsylvania Extension Committee \$2,478.00

Krawczyk, G., K. Peter and J. Schupp. 2015. Effect of exclusion netting on integrated pest and disease management and fruit quality of apples. State Horticultural Association of Pennsylvania Research Committee \$19,554.00

Schupp, J. 2015. Testing mechanical and hand artificial spur extinction for Cropload management of apple State Horticultural Association of Pennsylvania Research Committee. \$9,487.00

Schupp, J. and T. Baugher. 2015. Cropload and fruit nutrient studies in commercial Honeycrisp orchards to determine best practices for minimizing bitter pit. State Horticultural Association of Pennsylvania Research Committee. \$10,100.00

Reighard, G. 2015. Guardian® seed sales South Carolina Foundation Seed \$173,000.00

Reighard, G. 2015. Screening peach rootstocks for adaptability, productivity, and tolerance to Armillaria and bacterial canker. South Carolina Peach Council research grant. \$4,000.00

Robinson, T. and B. Black. 2015. Rootstock interactions and their effect on graft union break strength of apple. International Fruit Tree Association \$10,000.00

Black, B. and G. Fazio. 2015. A Comparison of Water Relations Among Fruit Tree Rootstocks Utah Ag. Experiment Station Grant \$17,946.00

Black, B. 2015. A Comparison of Water Relations and WUE Among Fruit Tree Rootstocks Utah Dept. Ag. & Food, Specialty Crop Block Grant \$31,029.00

Peck, G.M. and M. Williams. 2014-2017. Towards ecologically-based fertilizer recommendations that improve soil quality in high-density apple orchards. USDA-NIFA, Southern Sustainable Agriculture Research and Extension Program (SSARE). \$140,000.00

Peck, G.M. and K.S. Yoder. 2014-2016. Advancing Organic Apple Production in Virginia VA Department of Agriculture and Consumer Services-Specialty Crop Block Grant \$38,166.00

Peck, G.M. 2014-2015. Fine-tuning fertilizer recommendations for young apple trees in high-density plantings. Virginia Apple Research Program \$10,000.00

Peck, G.M. 2014-2015. Continued Investigations into New Rootstocks, Cultivars, and Training Systems for Virginia. Virginia Apple Research Program. \$5,000.00

Peck, G.M. 2014-2015. NC-140 rootstock trial for Central Virginia Virginia Apple Research Program \$6,265.00

Yoder, K.S. and G.M. Peck. 2014-2015. Apple rootstock susceptibility to Tomato Ring Spot Virus  
Virginia Apple Research Program \$8,000.00

Yoder, K.S. and G.M. Peck. 2014-2016. Susceptibility of new apple rootstocks to Tomato Ringspot  
Virus Virginia Agricultural Council. \$9,500.00

Peck, G.M. 2015-2016. Integrated Approaches for Reducing Synthetic Fertilizer Inputs in Apple  
Orchards. Virginia Agricultural Council. \$21,683.00

Peck, G.M., K.S. Yoder, and D. Carbaugh. 2015-2016. New Rootstocks, Cultivars, and Training  
Systems for Virginia Virginia Apple Research Program. \$6,000.00

Peck, G.M., A.T. Thompson, and D. Carbaugh. 2015-2016. Fine-tuning fertilizer recommendations for  
young apple trees in high-density plantings: Year Three, 2015. Virginia Apple Research Program  
\$10,000.00.

Musacchi, S., Kate Evans and Karen Lewis. 2013. Rootstock and systems trial Washington Tree  
Fruit Research Commission \$58,594.00

Musacchi, S., Karen Lewis, Karina Gallardo, Tom Auvil. 2014-2017. Rootstock and Systems Trial.  
Washington Tree Fruit Research Commission. \$133,495.00

Evans, K. and Amit Dhingra. 2015-2018. Developing the foundation for U.S. pear rootstock breeding  
PNW Pear Bureau. \$273,253.00