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Title: Apple Rootstock and Cultivars Evaluation

Submitted to: Patti Keller

State Horticultural Association of Pennsylvania
480 Mountain Road
Orrtanna, PA 17353

Submitted by: Robert Crassweller
(814) 863-6163
rmc7@psu.edu

Proposed Project **6/1/2019 - 5/31/2020** **Total Project Request: \$20,810**

AUTHORIZED UNIVERSITY OFFICIAL

Christina Wagner DATE *12/13/18*

Christina Wagner
Research Administrator - Pre-award
College of Agricultural Sciences
107 Agricultural Administration Building
University Park, PA 16802-2602
Tel: 814-865-5419
Fax: 814-865-0323
Email: L-AG-contgrts@lists.psu.edu

John W. Hanold DATE *12/13/18*

John W. Hanold
Assoc. VP for Resresearch
Office of Sponsored Programs
The Pennsylvania State University
110 Technology Center Building
University Park, PA 16802-2602
Tel: 814-865-1372
Fax: 814-865-3377
Email: osp@psu.edu

EIN: 24-6000376
DUNS No: 00-340-3953

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Please reference PSU Ref. Number in all correspondence.

**Research Grant Proposal
To
State Horticultural Association of Pennsylvania, Inc.**

TITLE: Apple Rootstock and Cultivar Evaluations
PERSONNEL: Robert M. Crassweller and James R. Schupp
Organization: The Pennsylvania State University
Phone: 814-863-6163 **Address:** 7 Tyson Building, University Park, PA 16802
e-mail: rmc7@psu.edu

DURATION OF PROJECT: 2016 – 2021 (continuing)

JUSTIFICATION: Rootstocks are the primary method used to control tree size to allow for increased tree density. We know that initial higher density translates into greater early yields and a faster return on investment (Robinson, 2005). One of the three challenges that Tustin (2014) outlined to increasing orchard productivity across all tree fruit crops was the use of rootstocks to control vigor and increase floral precocity. While this has been dramatically increased in apples and to some extent in cherries it still lags behind in pears and peaches. The ongoing thrust of the NC-140 regional research project and the continued efforts that began with the NE-183 regional research project have been the foundation of Penn State's horticultural efforts to keep the Mid-Atlantic fruit industry competitive and up-to-date on the latest technology in rootstocks and cultivar evaluation.

Orchard intensification is a proven method to achieve high fruit quality and hasten growers' return on investment in apple production; however the primary peach production system is low density open vase, and this system hasn't changed significantly in over 150 years. The missing factor needed for increasing peach planting density is size-controlling rootstocks. Further study of these and other new rootstocks is needed to determine how well these trees survive and perform under our conditions, and what the final tree size of each will be at full maturity.

New cultivars are continuously being released; in particular a number have been released from countries in Eastern Europe. It is essential that these cultivars be evaluated under Pennsylvania growing conditions. Currently, we have in excess of 150 distinct cultivars planted at PSU research stations. We have the largest number of disease resistant apple cultivars on the east coast. An Asian pear cultivar trial was added in 2010 at the Rock Springs and is now yielding valuable information on their performance.

OBJECTIVES:

1. To establish a new peach rootstock trial and to continue the evaluation of tree fruit rootstock plantings established in previous years.
2. To evaluate new and promising apple, European and Asian pear cultivars, both disease resistant and non-resistant for their suitability and production characteristics under Pennsylvania conditions.

PROCEDURES:

ROOTSTOCK WORK: (For a complete listing of plantings see Table 1).

In 2014, a peach rootstock planting was established at the Fruit Research and Extension Center to evaluate the performance of Coralstar on five rootstocks at 5, 7.5, and 10 foot in-row tree spacing in a high density quad V planting system. Development of one or more well-adapted dwarfing rootstocks is the missing element to increasing tree density in peach orchards. Tree size control in peach orchards has strong potential to increase labor efficiency in high density peach growing systems, with or without other labor-saving technology.

A new NC-140 peach rootstock trial was planted at FREC in 2017 to evaluate the performance of 8 rootstocks with the cultivar Cresthaven. Multiple four-tree plots were planted at 6 ft. by 17 ft., and trained to perpendicular V. The rootstocks will be evaluated for survival, adaptation to the climate, tree size control, yield, fruit quality, and freedom from physiological defects, such as root suckers. This trial includes the most recent introductions from Europe and three promising new releases from the breeding program at UC Davis: Controller 6, Controller 7, and Controller 8.

Apples: We continue to maintain and collect data on the 2014 NC-140 uniform rootstock trial of Aztec Fuji and Honeycrisp on Vineland 1, 5, 6, 7, G.214, G.890, G.969, M.9T337 and M.26. In 2016 we added small plantings of Scifresh and Royal Red Honeycrisp on G.41, G.935 and M.9Nic29 and Regal 10-45 on G.11 and M.9T337. In 2017 we added a planting of IFO#1 and IFO#5 rootstocks developed in New Zealand with Royal Red and Minn B42 rootstocks. These rootstocks were developed to have resistance to *Photophthora sp.*, woolly apple aphid, fire blight, tolerance to water logging with a range of tree sizes. The standard rootstocks are Royal Red on G.41 and G.890. Royal Red Honeycrisp on IFO#2 with the control trees was planted in 2018.

A new uniform NC-140 apple rootstock planting is scheduled for the 2019 growing season. The scion cultivar will be Gala (Simmons strain). There will be ten rootstocks evaluated: IFO#5, G.41, G.11, G.214, G.4814, G.969, G.935 & B.10 with M.9T337 and M.26 as comparison controls.

Two new Cornell-Geneva rootstock trials were established at FREC in 2018 (Table 1). Both with Gala, the first consisting of 11 fully dwarfing rootstocks (Bud. 9 to M. 9 size), and the second consisting of 7 rootstocks in the M.26 size category.

CULTIVAR WORK:

Scab Resistant Cultivars: A planting of GoldRush on G.11 and Crimson Crisp on M.9Nic 29 was established in 2017 at Rock Springs as part of a multi-site planting in conjunction with the USDA SCRI grant "Supporting Pennsylvania New Farmers in the Start-up, Re-strategizing & Establishing years. Half of the trees were treated with MycoApply mycorrhizal spray to the roots. We are monitoring the growth of the trees in comparison to nontreated trees. We continue to maintain nearly 50 scab resistant cultivars included in these are the Golden Sunshine Series from the Czech Republic. The latest release from this program, UEB-I 648/1 on B.10, was planted in 2018.

We continue to monitor performance of new cultivars including Premier Honeycrisp, Lady in Red Cripp's Pink, Regal 10-45 (as outlined in rootstock trials) and three advanced selections from the MAIA, MDD3-75 (Summerset), MDD3-80 (as yet unnamed) and MDD5-41 (Rosalee). They are siblings of EverCrisp (Fuji x Honeycrisp crosses). Mt. Evereste and Mt. Blanc crab apple pollinators from France both being resistant to apple scab and fire blight. The former is for early blooming apple cultivars and the latter is for later blooming cultivars. Currently we have the following Honeycrisp strains planted at Rock Springs: Standard, Cameron Select, Firestorm, MN B42, Premier, and Royal Red. We continue to maintain the Asian Pear cultivar trial as part of a multi-state trial.

Other Apple Cultivars: A 2014 apple planting at FREC includes Premiere Honeycrisp, compared with another early-maturing selection of Honeycrisp, and trial plantings of MN44, MN55, and Sweet Cheeks.

European Pear Cultivars: In 2016, a trial of fire blight resistant European pear cultivars was planted, with Harrow Sweet, Harrow Crisp, Sunrise, US446, US69426-038, US84907-069, US84907-140, US84907-144, US84907-160, and US84907-166, compared to Golden Russet Bosc and Bartlett as commercial standards. All trees are on the precocious, fire blight-resistant OHxF87 rootstock and trained on a 4-wire trellis to bi-axis at 4' x 12' spacing. The trees will be assessed for their growth and productivity, and the fruit will be evaluated for time of maturity, storage, size, and sensory characteristics.

BUDGET:**Allotment to Rob Crassweller in 2019**

Salaries (Donald Smith)	\$7,620.00
Fringe Benefits	\$2,969.00

Fringe benefits are computed using the fixed rates of 38.97% applicable to Category I Salaries, 14.74% applicable to Category II Graduate Assistants, 7.81% applicable to Category III Salaries and Wages, 0.18% applicable to Category IV Student Wages, and 25.34% for Category V, Postdoctoral Scholars and Fellows, for fiscal year 2019 (July 1, 2018, through June 30, 2019). If this proposal is funded, the rates quoted above shall, at the time of funding, be subject to adjustment for any period subsequent to June 30, 2019, if superseding Government approved rates have been established. Fringe benefit rates are negotiated and approved by the Office of Naval Research, Penn State's cognizant federal agency.

Miscellaneous (trees, support system supplies)	\$1,246.00
Total requested for Rob Crassweller	\$11,835.00

Allotment to Jim Schupp in 2019

Hourly wages	\$8,000.00
Fringe Benefits	\$624.00

Fringe benefits are computed using the fixed rates of 38.97% applicable to Category I Salaries, 14.74% applicable to Category II Graduate Assistants, 7.81% applicable to Category III Salaries and Wages, 0.18% applicable to Category IV Student Wages, and 25.34% for Category V, Postdoctoral Scholars and Fellows, for fiscal year 2019 (July 1, 2018, through June 30, 2019). If this proposal is funded, the rates quoted above shall, at the time of funding, be subject to adjustment for any period subsequent to June 30, 2019, if superseding Government approved rates have been established. Fringe benefit rates are negotiated and approved by the Office of Naval Research, Penn State's cognizant federal agency.

Supplies	\$351.00
Total requested for Jim Schupp	\$8,975.00

TOTAL	\$20,810.00
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REFERENCES

Robinson, T. 2005 Should New York apple growers move up to higher tree densities. NY Fruit Quart. 13:27-31.

Tustin, S. 2014. Future orchard planting systems – Do we need another revolution. Acta Hort. 1058:27-36.

Table 1. Rootstock plantings at either FREC or HRF

Year Planted	Location*	Cultivars	Rootstocks
2014	HRF	Aztec Fuji	M.26, M.9T337, V.1, V.5, V.6, V.7, G.214
2014	HRF	Honeycrisp	M.26, M.9T337, V.1, V.5, V.6, V.7, G.890, G.969
2014	FREC	Coralstar	Bailey, Guardian, Krymsk 86, KV 10123 & Empyrean II (Penta)
2016	HRF	Regal 10-45	M.9T337, G.11
2016	HRF	Scifresh, Royal Red Honeycrisp	M.9Nic29, G.41, G.935
2017	FREC	Cresthaven	MP-29, Densipac, Nanopac, Controller 6, Controller 7, Controller 8, Guardian®, Lovell
2017	HRF	Royal Red & MN B42 Honeycrisp	IFO# 1, IFO# 5, G.41, G.890
2018	HRF	Royal Red Honeycrisp	IFO#2, G.41, G.890
2018	FREC	Gala (dwarf)	Bud 9, CG 3010, CG 3902, CG 4002, CG 4011, CG 4013, CG 4288, CG 4809, G. 41, G. 814, G. 202
2018	FREC	Gala (M. 26 class)	CG 4292, CG 5008, CG 5030, CG 5257, G.210, G.222, G.935
2019	HRF	Gala (Simmons cv.)	IFO#5, G.41, G.11, G.214, G.4814, G.969, B.10

*HRF = Hort. Research Farm, Rock Springs, FREC = Fruit Research & Extension Center, Biglerville