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THE OHIO STATE UNIVERSITY

Newsletter Extension

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Calendar

December 16: Fruit & Vegetable Policy Development Meeting, contact Mike Pullins, (614) 249-2424.

January 3-4, 2000: Kentucky State Horticultural Society/Kentucky Vegetable Growers Association Annual Meeting & Trade Show, Holiday Inn North, Lexington, KY. Program includes discussion on "How to Affect Hardiness and Bloom Date on Peaches". For more information contact John Strang, Dept. Of Horticulture, U of KY (606) 257-9000.

January 13-14: Greenhouse Food Production Workshop, OARDC Fisher Auditorium, Wooster. Contact Mary Donnell, (419) 354-6916,

January 24-26: Indiana Horticultural Congress, Adam's Mark Hotel, Indianapolis, IN. Contact Jim Simon at (716) 494-1328 for more information.

January 28-30, Power Show Ohio, Ohio State Fairgrounds, Columbus, Ohio.

February 7-9: Pre-Conference Tours for the Ohio Fruit & Vegetable Growers Congress in conjunction with the North American Farmer's Direct Marketing Conference and Ohio Roadside Marketing Conference, Cincinnati, OH. For information contact Mike Pullins at (614) 249-2424.

February 10-12: Ohio Fruit & Vegetable Growers Congress, Cincinnati, OH. More details later.

Hats Off to Rich & Betty Eshleman

On November 18th the Agricultural Committee of the Sandusky County Chamber of Commerce presented the Sandusky County Farmer of the Year award to our friends, Rich and Betty Eshleman, of Clyde. The Eshlemans operate a 200 acre fruit farm located on Maple Avenue, north of Clyde.

The Chamber held their 34th annual Town and Country Banquet at Old Zim's Wagonshed. They have been honoring area farmers since 1966. Rich and Betty attended the banquet along with their family and were surprised and delighted to accept the award. Area implement dealers Gibbs, Streaker, and Buhrows contributed substantial gift certificates.

As you might recall, we held the North Central Ohio Tree Fruit IPM program's 1997 Twilight Training Fruit Meeting at the Eshleman Farm. Rich and Betty also hosted a day of education and fellowship last June as the Ohio Fruit Growers Society met there for their summer tour.

Congratulations Rich and Betty on being recognized for the fine work that you do!

North Central Regional Research Project NC-140

Rootstock and Interstem Effects on Pome and Stone Fruit Trees

October 1, 1997, to September 30, 2002

Justification The NC-140 Regional Research Project is designed to address a number of high-priority areas within the North Central Region, as well as other parts of North America. This project seeks to enhance economically and environmentally sustainable practices in temperate fruit production by focusing on rootstocks.

With the increasingly competitive international market, the growing demand for higher quality fruit by consumers, the strong pressure to reduce chemical use, and an ever increasing need to enhance the economic efficiency of production, tree-fruit growers must look to alternative, economically, and environmentally sustainable management schemes of production. Growers who want to stay profitable must establish high-density plantings with much smaller trees using new cultivars. These high-density plantings may cost 10 to 20 times more to establish than low-density plantings, thus greatly enhancing the economic risk. Potential returns of high-density plantings, however, far exceed those of low-density plantings, particularly during the first 10 years, often returning the grower's initial investment much sooner than the less-costly, low-density plantings. The central component of high-density systems is the rootstock. It is this part of the tree which provides dwarfing and allows for high-density plantings. As part of the tree, rootstock influences many factors in addition to tree size, particularly productivity, fruit quality, pest resistance, stress tolerance, and thus profitability.

As the industry moves from low- to high-density plantings, several rootstock-related problems must be addressed. New pome- and stone-fruit rootstocks cannot be recommended without reservations until there is sustained research as to soil and climatic adaptability, root anchorage, size control, precocity, productivity, pest resistance, and propagation. In general, field testing of rootstocks in an orchard setting requires a minimum of ten years to assess accurately the potential for improved profitability, reduction of inputs, and enhancement of production efficiency. With year-to-year variation in weather, this time span is necessary to obtain a true indication of rootstock performance.

The establishment of the NC-140 technical committee enabled researchers from IL, IN, IA, KS, KY, MA, MI, MO, NY, **OH**, and WI to develop a coordinated effort in apple rootstock research through the uniform testing of rootstocks and multiple genetic systems, and to discuss critically, evaluate, and coordinate other rootstock research

Objectives & Procedures

Objective 1: *To evaluate the performance of pome- and stone-fruit rootstocks in various environments and under different management regimes.*

To evaluate improved rootstock material and climatic and edaphic factors as related to tree performance, present replicated and randomized uniform plantings will be maintained, and new plantings will be established across North America under NC-140. Promising new and existing rootstocks and multiple genetic systems possessing desirable characteristics have been or will be selected. They will be evaluated with respect to precocity, productivity, size control, anchorage, suckering, pest resistance, adaptability, and production efficiency.

To provide a more thorough knowledge of tree performance, studies will be conducted to evaluate the performance of various orchard systems, including different cultivars on new and existing rootstocks and multiple genetic systems under various high-density orchard management systems. These systems will be evaluated as to precocity, productivity, ease of management, and production efficiency.

State plantings (including Ohio) being maintained for evaluation or proposed are as follows:

(a) A uniform rootstock trial for pear was established in 1988 at 15 locations (AR, CO, KY, NY, MD, **OH**, two in OR, two in WA, WV, BC, NS, and two in ONT). Depending on environment, sites are testing the performance and adaptability of two cultivars (selected from d'Anjou, Bosc, Comice, Clapp's Favorite, Magness, Harrow Delight, Maxine, Red Bartlett, and Bartlett) on OHxF.40, OHxF.217, OHxF.333, OHxF.339, OHxF.513, EM Quince C clones, *Pyrus calleryana* seedling, and *P. betulaefolia* seedling rootstocks with Bartlett seedling serving as the standard for comparison. Tree size (trunk cross-sectional area, tree height, and canopy spread), yield, yield efficiency, and fruit size will be measured each year of the project. Additionally, characteristics such as anchorage and longevity will be appraised.

(b) Apple rootstock plantings through 1984 only evaluated the performance of one cultivar on the candidate rootstocks. To gain further information on rootstock performance and the potential interaction between scion cultivar and rootstock, a coordinated cultivar-by-rootstock trial was planted in 1990 at 16 locations (CO, GA, IN, IA, two in KS, KY, ME, MA, MI, **OH**, TN, PA, UT, VA, and QUE). This trial consists of all combinations of Smoothee Golden Delicious, Nicobel Jonagold, Empire, and Law Rome on M.9 EMLA, B.9, Mark, O.3, and M.26 EMLA. OR, UT, and WV) included the rootstocks CG.228, CG.239, CG.253, CG.707, CG.760, and CG.934 and MM.106 and MM.111 as standard controls. Evaluation of growth and production efficiency will be conducted as in other apple rootstock trials.

(c) In 1994 an apple rootstock trial with Gala as the scion cultivar and dwarf rootstocks was planted in a total of 26 locations (AR, CO, GA, IL, IN, IA, ME, MA, MI, NJ, two in NY, NC, **OH**, OR, two in PA, SC, TN, UT, VT, VA, two in WA, WI, BC, NB, NS, ONT, and Australia). Rootstocks included were M.9 EMLA, M.26 EMLA, M.27 EMLA, M.9 RN29, M.9 Pajam 1, M.9 Pajam 2, B.9, B.491, O.3, V.1, P.2, P.16, Mark, P.22, B.469, M.9 Fleuren 56, V.3, and M.9 NAKBT337). Evaluation of growth and production efficiency will be conducted as in other apple rootstock trials.

(d) In 1994 an apple rootstock trial with Gala as the scion cultivar and semidwarf rootstocks was planted in a total of 26 locations (AR, GA, IL, IN, IA, KY, ME, MI, NJ, NY, NC, **OH**, OR, PA, SC, TN, UT, VT, VA, two in WA, WI, BC, NB, NS, ONT, and Australia). Rootstocks included P.1, V.2, G.11, CG.13, G.30, and M.26 EMLA. Evaluation of growth and production efficiency will be conducted as in other apple rootstock trials.

(e) In 1994 a peach rootstock trial was established in 22 locations (AR, CO, GA, IL, IN, KS, KY, MD, MS, MI, two in MO, two in NJ, NY, **OH**, SC, TN, UT, and ONT). Redhaven on Lovell, Bailey, Tennessee Natural 281-1, Nemaguard, Stark's Redleaf, GF.305, Higama, Montclar, Rubira, Ishtara, Myran, S.2729, Chui Lum Tao, Tzim Pee Tao, H7338013, H7338019, BY520-8, Guardian, and Ta Tao 5/Lovell rootstocks were included. Tree size (trunk cross-sectional area, tree height, and canopy spread), time of bloom, yield, yield efficiency, suckering, time of ripening, fruit size, and mortality will be assessed at each site. At four sites (KS, MO, **OH**, and SC), the effects of these rootstocks on low-temperature tolerance of flower buds will be assessed.

Objective 2: *To assess and improve asexual propagation techniques of pome- and stone-fruit rootstocks.*

Laboratory, greenhouse, and field studies will evaluate the propagation characteristics of existing and new rootstocks and develop improved means of asexual propagation for different materials. Studies contributing to this project include: (1) developing improved tissue-culture techniques to propagate apple, pear, and cherry rootstocks (NY, **OH**, and OR); (2) managing tissue-culture-propagated material after removal from culture (NY); (3) improving softwood and hardwood cutting techniques (GA, NY, and OR); comparing the effects of seedling and asexually propagated peach rootstocks on tree mortality and performance (GA); and (4) overcoming poor rootstock selection in the orchard with inarching (IA and MO).

Objective 3: *To improve the ability to identify pome- and stone-fruit rootstocks through morphological, biochemical, and genetic differences.*

Various means of rootstock identification will be evaluated during the term of this project. Generally, the rootstocks included under objective 1 will be the focus of these studies, but other rootstocks will be studied as well. Projects will evaluate four means of identification of rootstocks: (1) characterizing morphological differences in rootstock material to enhance identification in stool beds or of liners (PA); (2) utilizing isozyme analysis to identify rootstocks (NY and ONT); (3) adapting randomly amplified polymorphic DNAs to rootstock identification (MA, ME, MI, and NY); and (4) determining the suitability of Fourier transformed infrared spectroscopy as a means of identifying apple rootstocks (CO).

Objective 4: *To develop new and better pome- and stone-fruit rootstocks through breeding and genetic engineering, and to acquire new rootstocks from breeding programs in other parts of the world.*

To enhance tree performance and pest resistance, traditional breeding programs will pursue improved rootstocks for apples (AR, NY, and NS), pears (OR and WV), and peaches (GA). Furthermore, genetic engineering procedures will be used to enhance pest resistance of apple rootstocks (NY). Many rootstock breeding programs exist worldwide. Significant effort will be made to acquire as much material as possible for future tests (AR, KY, MA, MI, NY, **OH**, BC, and NS).

Objective 5: *To determine biotic and abiotic stress tolerances of pome- and stone-fruit trees in relation to new and existing rootstocks.*

Studies will be done to determine stress tolerance of fruit trees as influenced by new and existing rootstocks. Many of these studies will involve rootstocks used in the various trials listed under Objective 1. These include: (1) the cold hardiness of rootstocks and the influence of rootstock on scion cold hardiness for apple (IA, MN, NY, SD, UT, BC, NB, and NS), peach (KS and MO), and cherry (UT); (2) the influence of the interaction of rootstock, scion, interstem, and planting depth on cold hardiness (IA); (3) high-temperature sensitivity of apple roots (PA); (4) effects of root pruning and restriction on tree performance (MD); (5) effects of soil moisture levels on apple tree performance as affected by rootstock (KY and NY); and (6) the influence of rootstock on mineral-stress sensitivity in apple (MI and **OH**).

Stress tolerance of rootstocks and multiple genetic systems in relation to pathogenic organisms will be investigated including: (1) apple rootstock tolerance of or resistance to fireblight (NY and VA), crown rot

(NY and BC), and lesion nematode (NY and ONT); (2) pear rootstock tolerance of or resistance to fireblight (MD and WV); (3) cherry rootstock tolerance of or resistance to Prune Dwarf virus (WA) and Prunus Necrotic Ringspot virus (WA); (4) investigate the use of mulch insulation for reducing the incidence of cytospora canker in peach rootstocks (KS); and (5) root survival following attack by root-feeding nematodes, fungi, or insects in apple (PA) and peach (WV).

Impact of Accomplishments:

The impact of the accomplishments of this project on the commercial fruit industry and society at large is significant. In some cases, promising rootstocks have moved ahead, while in other cases concerns were raised which resulted in the discontinuation of particular rootstocks. In still other cases, NC-140 data resulted in a slowing down of commercial adoption. Results from this project have saved the industry millions of dollars in costs from poor rootstocks and have helped earn millions of dollars from more productive and adapted rootstocks and training systems as the industry has moved to new cultivars. Helping the fruit industry stay competitive and healthy has benefitted society at large by providing a safe and inexpensive fruit supply and by improving the economy of rural America.

Specific impacts were:

- The demonstration of which climatic areas are suitable for M.9 apple rootstock and where the risk of fireblight is too severe for its use.
- The identification of B.9 as a superior dwarfing apple rootstock with widespread adaptability and superior performance in northern fruit growing areas resulting in its large-scale commercial propagation and sale by several nurseries.
- The identification of Bailey peach rootstock as a superior rootstock for northern fruit-growing areas resulting in an expansion of its commercial propagation and sale by several nurseries.
- The development and identification of Guardian as superior peach rootstock with resistance to peach tree short life by SC and GA (this has resulted in immediate adoption and tremendous demand for this rootstock by nurseries and growers in the southeastern United States).
- The identification of virus susceptibility of several Gisela cherry rootstocks and the subsequent slowing down of commercialization of these stocks until more data are acquired.
- The prevention of commercialization of the GM cherry rootstocks due to poor performance.
- The discontinuation of Mark apple rootstock due to serious declines in tree vigor induced by soil line swelling as the trees aged.

Detailed Accomplishments for Apples:

The final results of the 1984 apple rootstock project, which was planted in 31 states and compared 15 rootstocks, were summarized and published in 10 papers in the Fruit Varieties Journal 50 (1), 1996. Major points from those papers are: Tree loss was greatest on P.22 (32%) and MAC.39 (21%). Trees on P.18, A.313, B.490, MAC.1, and M.4 had trunk cross-sectional areas and yield efficiencies similar to seedling. P.1 produced trees similar in size, production, and yield efficiency to M.7 EMLA. C.6 and M.26 EMLA resulted in trees of similar size, yield, and yield efficiency. MAC.39 and B.9 had similar trunk cross-sectional area, yield, and yield efficiency, but trees on B.9 were shorter with smaller spread. Fruit size over six years from trees on P.22, M.4, and seedling was small, while fruit size tended to be large from trees on P.18, A.313, and C6. Practical recommendations to the fruit industry are that P.1 could be an alternative rootstock for M.7 in regions where lack of winter hardiness is a concern. In the M.26-tree-size class, there was no clear advantage to suggesting alternatives to M.26. In the M.9-tree-size class, B.9 should be considered where M.9 has not been sufficiently hardy. Tree losses were highest in six Midwestern sites, exceeding 20%. B.9 had the best survival of the dwarfing rootstocks in this study. Sites in KS, GA, IL, CA, VA, MO, NC, and MI had trees with 39 to 16% larger-than-average trunk cross-sectional area, while trees in TN, PA, and Mex were 40% smaller than the average of all sites. Averaged across rootstocks, sites with the greatest yield efficiency were MA, CA, **OH**, and BC and those with lowest efficiency were KS, TN, MN, NY, AR, and NC.

Actively involved Ohio researchers include Drs. Dave Ferree and Diane Miller. Ohio will host the 2000 meeting of the NC 140 as well as the NC 183 Committees next November 3-7.

A complete copy of this report is available at: http://virtualorchard.net/nc140/1997/renewal.htm

Final Ruling on Juice HACCP Expected Next Year

Sources: Fruit Times Newsletter, Vol.18, No. 19; and U. S. Apple Association

The FDA proposed in April of 1998 that all juice processors develop an HACCP plan that includes control measures to produce at least a 5-log pathogen reduction (a decrease in the number of bacteria to 1 - one hundred thousandth of the initial level). HACCP, which stands for Hazard Analysis Critical Control Point, is a systematic and preventive method for identifying potential hazards in a food operation and then prescribing control measures to minimize those hazards to an acceptable level. HACCP plans are required for all meat and seafood processors and both the FDA and USDA seem committed to extending the concept to the rest of the food industry.

In its original proposal, FDA did not specify a specific intervention technology (e.g., pasteurization), but instead proposed a flexible performance standard that could be met through cumulative steps. They reasoned that fruit juice processors might be able to prevent contamination by not using dropped fruit and by culling, washing, brushing, and sanitizing the surface of fruit. However, in a November 23, 1999 notice in the Federal Register, the FDA expressed concern that pathogens could become internalized within fruit tissues and therefore not be accessible to external treatments. They cited several studies using citrus and apple fruit that showed internalization of bacteria either in the orchard or in packing house flume water.

The agency is requesting comment by January 24, 2000 on 4 issues:
1. Internalization and survival of pathogens in produce used to produce juice, especially citrus
2. Applying and measuring the 5-log reduction standard
3. Methods for monitoring application of heat treatment of juice
4. The costs and benefits of complying with FDA's current, more stringent approach to safety.

Of note is FDA's particular interest in citrus and apple fruit, and the possibility of pathogens surviving internally. Because of the agency's concern, the November notice reported the FDA view that measurement of the 5-log reduction should begin after the juice is extracted.

From these and other hints that the FDA has dropped, we can probably assume that the extracted juice itself will have to be treated to achieve the 5 log reduction. Although other technologies are being developed, such as UV light disinfection, the only scientifically validated way to achieve this goal is through heat pasteurization.

The FDA juice website is http://www.cfsan.fda.gov

Preliminary Monthly Climatological Data for Selected Ohio Locations November 1999

Weather	Monthly	Normal	Year-to-Date	Normal	Average	Normal	Average	Normal	Mean	Normal
Station	Precip.	Monthly		Year-to-Date	High	High	Low	Low	Temp.	Mean
Location		Precip.		Precip.						
Akron-Canton	3.54	3.01	33.97	33.87	54.0	49.7	34.9	34.2	44.4	42.0
Cincinnati	1.42	3.46	28.87	38.18	59.3	53.3	37.7	35.3	48.5	44.3
Cleveland	3.31	3.17	29.27	33.54	54.6	50.0	37.1	35.0	45.8	42.5
Columbus	1.95	3.22	24.89	35.23	57.9	51.4	37.1	34.3	47.5	42.8
Dayton	1.85	3.07	27.30	33.71	57.8	51.3	36.9	34.4	47.3	42.9
Elyria	3.16	3.17	28.37 revised	32.89	57.2	51.9	34.3	35.1	45.8	43.5
Fremont	1.59	2.78	25.55	31.97	53.3	49.3	28.2	32.1	41.8	40.7
Mansfield	2.26	3.51	31.36	36.59	54.0	49.2	33.9	33.9	44.0	41.6
Norwalk	2.96	2.91	32.03 revised	32.87 revised	54.8	49.8	34.1	33.0	44.5	41.4
Toledo	1.46	2.81	27.17	30.03	55.3	48.5	34.2	31.5	44.8	40.0
Wooster	2.27	2.93	26.54 revised	33.57 revised	56.1	49.3	34.4	31.8	45.2	40.5
Youngstown	3.88	3.11	39.54	34.39	53.4	48.4	35.1	33.6	44.3	41.0

Temperatures in degrees F, Precipitation in inches:

Record Highs set: 9th - Mansfield 72°, Toledo 74°, Youngstown 72° ; 10th - Toledo (tied) 68° ; 22nd - Mansfield 66° ; 23rd - Mansfield 69°, Toledo (tied) 71°, Youngstown (tied) 69° ; 24th - Mansfield 63°, Youngstown (tied) 61°.

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