Growing Healthy Crops and Healthy Profits

December 6-8, 2005
Grand Rapids, Michigan

Great Lakes EXPO
FRUIT, VEGETABLE & FARM MARKET

Apple I

Tuesday afternoon 2:00 pm

Moderator: Joe Klein, MSHS Past President

2:00 p.m. Club Varieties and Other New Developments in the Variety Mix

Wanda Heuser Gale, Summit Tree Sales, Lawrence

2:20 p.m. New Apple Rootstocks

Gennaro Fazio, Plant Genetic Resources Unit, USDA ARS, Geneva, NY

2:50 p.m. Apple Rootstocks for Michigan

Ronald Perry, Horticulture Dept., MSU

3:10 p.m. Euregap Certification for Apple Growers

Juliet Carroll, New York State IPM Program, Cornell Univ.

3:40 p.m. Reducing Use of DPA (Trust Report)

Randy Beaudry, Horticulture Dept., MSU

New Apple Rootstocks

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One of the most critical decisions in the establishment of a new orchard is the choice of a suitable rootstock that is well adapted to the new orchard environment and that will enhance the capability of a scion to bear fruit. This choice should be dictated by the horticultural characteristics of the rootstock and its ability to perform on site rather than what is currently available in the stockyard of a particular nursery. The decision is particularly difficult with newly developed apple rootstocks since the development of on site knowledge about any apple rootstock is a very resource intensive and time consuming effort. Publicly funded institutions that test the performance of apple rootstocks in many locations in the U.S. like the NC-140 have done an excellent job at giving the best approximation of what rootstocks are adapted to general regions in the U.S and is particularly good at establishing what is not suited for a particular region. I would say then that the ultimate test occurs when the grower plants a test plot on his site – sometimes that test plot is the whole new orchard and sometimes it's just a small portion of a new planting. New rootstocks are a risky business. Although much of that risk has been born by well serving institutions like NC140 that have rooted the bad ones out there is still a significant portion that is left for the individual grower. So why risk planting new rootstocks? Why develop new rootstocks? To be worth the effort new apple rootstocks would have to subscribe to two standards: 1. they should perform at least just as good as the old ones and 2. they should have something more than the old ones. That something more may be increased disease resistance, increased tolerance to cold, increased productivity, biennial bearing avoidance. Whatever that something more is, it has the potential of improving the productivity of the orchard and increasing the return to the grower. If there is a lot of money in planting a new scion variety there is also a lot of money by maximizing the yield of that scion by utilizing a proper rootstock. Apple rootstock breeding programs worldwide have dwindled from about 12 in the 1970's to two or three today depending on the standards that are used to define a breeding program. Breeding new apple rootstocks is very resource and time intensive and few institutions in the world have been able to keep them active beyond a certain point. The Geneva® Apple Rootstock Breeding program was initiated in 1968 by Dr. James Cummins and Dr. Herb Aldwinckle, with the objective of developing rootstock genotypes with improved disease resistance to diseases common in eastern North America such as fire blight (*Erwinia amylovora*), and crown rot (*Phytophthora* spp) as well as having improved horticultural characteristics (yield, propagation, cold tolerance, etc.). Dr. Cummins led the program until his retirement in 1993. In 1998 the Cornell University rootstock breeding program was converted to a joint breeding program with the United States Department of Agriculture (USDA) with a USDA breeder as the lead scientist (William Johnson from 1998-2000 and currently Gennaro Fazio) and with Cornell scientists as cooperators. From the 30 year effort in apple rootstock breeding a large number of selections have been developed and are in various stages of testing of propagation characteristics in the nursery, and productivity and dwarfing in the orchard. The most advanced selections have been tested in orchard trials at the New York State Agricultural Experiment Station in Geneva, New York, on growers' farms across New York State, in multi-location national rootstock trials conducted by the NC-140 group including Michigan, and in several other countries. Several nurseries around the world have been licensed to propagate the Geneva® stocks but at the present time only nurseries in the USA and New Zealand have commercial production.

The Geneva breeding is still actively making new crosses and creating new apple roostocks that utilize the more exotic wild species from Kazakhstan (*Malus* sieversii) and the Caucasus (*Malus orientalis*) being preserved at the USDA ARS Plant Genetic Resources Unit in Geneva, NY. In addition to showing resistance to fire blight this new plant material is also showing resistance to some of the Apple Replant Disease complex components. We are also working on development of new methodologies to evaluate the plants at the molecular level to expedite the breeding and selection process. We are confident that the new rootstocks being developed will serve the U.S. industry in its breadth and will provide better alternatives to current rootstocks.

Current research:

Apple Rootstock Fire Blight Resistance Evaluation: In collaboration with Dr. Aldwinckle and Dr. Robinson we are confirming the field resistance to fire blight of Geneva® elite apple rootstocks. This is done by inoculating young trees (3-4th leaf) of the same scion and different rootstocks with virulent strains of E. amylovora. The evaluation of the survivability of an apple rootstock to a field infection is quite a laborious and expensive task that is needed prior to release of these rootstocks in order to provide accurate planting recommendations to growers. Alternatives to the extremely susceptible M.9 and M.26 are needed in order to avoid tree loss caused by the rootstock phase of fire blight. The utilization of a resistant apple rootstock improves the survivability of a fire blight stricken tree – if the rootstock survives the grower is able to prune away scion branches and start over the next year a scenario that is much better than the loss of the whole tree.

Apple Replant Disease Tolerance Evaluation: We have seen evidence that some elite Geneva® Apple Rootstocks have resistance/tolerance to pathogens associated with the Apple Replant Disease (ARD) complex. We are conducting trials in cooperation with the Washington State Tree Fruit Research Commission and USDA ARS scientist Dr. Mazzola to elucidate genetic resisitance to ARD. We are also studying ARD in NY in collaboration Cornell scientists Dr. Merwin, Dr. Thies, and Dr. Nelson. As more land is replanted we hope to come up with the identification of environmentally friendly alternatives to soil fumigation in the form of apple rootstocks resistant to replant disease.

Evaluation of Field Performance of Apple Rootstocks in Several US Locations: We are collaborating with several researchers and growers all over the US and the world to find rootstocks adapted to certain apple growing areas. We continue to search for the best growers to place field trials of 200-300 trees to gain and disseminate knowledge about the Geneva® series of rootstocks.

Disease Screening of Seedlings Derived from Recently Collected Wild Apple Accessions: We are evaluating and utilizing disease resistance to fire blight, root rot, apple scab and other diseases that has been characterized by Dr. Aldwinckle (Cornell University) and Phil Forsline (USDA ARS PGRU Geneva) in wild apple accessions recently acquired by the USDA from Kazakhstan and other Asian countries. Breeding with new sources of resistance is important for the future development of apple rootstocks.

New Geneva® Apple Rootstocks

Finally, we would like to announce the release of three new clonal apple rootstocks in the U.S., Geneva® 41 and Geneva® 935 and Geneva® 202. Because these rootstocks have been released recently they may not be available in high numbers for a few more years. I have also included the descriptions of less recently released rootstocks (in apple rootstock years) below.

Geneva® 41 (G.41)

G.41 is a dwarfing apple rootstock which originated from a cross made in 1975 of 'Malling 27' X 'Robusta 5'. It was tested as CG.3041. It was released for commercial propagation by licensed nurseries in the USA in 2005. This rootstock produces a tree that is similar in size to M.9T337 (about 30% the size of trees on seedling rootstock. It is highly resistant to fire blight and *Phytophthora*. It is very winter hardy but its tolerance to woolly apple aphids is unknown. In the stoolbed G.41 is a relatively shy rooter and will require the use of tissue culture mother plants to improve its rooting. It also produces some side shoots in

the stoolbed. In the orchard its precocity and productivity have been exceptional, surpassing M.9. It also has excellent fruit size and induces wide branch angles. It has very good winter hardiness. It produces very few burrknots or root suckers. Although it is similar in tree size and yield efficiency to G.16 it does not have the virus sensitivity of G.16. It has similar graft union strength as M.9 and will require a trellis or individual tree stakes. G.41 has been evaluated extensively in the national NC-140 rootstock trial since 1998. It has also been tested in France where it was shown to be smaller in tree size the M.9Pajam2 but more productive while producing similar fruit size as M.9. G.41 appears to be best suited for high density plantings in fire blight prone areas and may be the best alternative to M.9 in high fire blight areas. Orchards planted with this rootstock should be planted at densities of 2,000-4,000 trees/ha.

Geneva® 935 (.935)

G.935 is a semi dwarfing apple rootstock which originated from a cross made in 1976 of Ottawa 3 X 'Robusta 5'. It was tested as CG.5935. It was released for commercial propagation by licensed nurseries in the USA in 2004. This rootstock produces a tree slightly larger in size than M.26 or about 50% the size of trees on seedling rootstock. It is resistant to fire blight, and *Phytophthora* root rot, but is not resistant to woolly apple aphid. It has good propagability in the stoolbed and produces a large tree in the nursery. G.5935 is the most precocious and productive semi dwarf CG rootstock available. It has similar or better efficiency as M.9 along with excellent fruit size and wide crotch angles. It produces very few burrknots or root suckers. It is very winter hardy. It produces a free standing tree but often the high croploads require a support system to hold up the crop. It is best suited for moderate tree densities with a minimal support system or with high planting densities of spur type scion varieties. Orchards planted with this rootstock should be planted at densities of 1,500-2,500 trees/ha.

Geneva® 202 (G.202)

G.202 is a semi dwarfing apple rootstock which originated from a cross made in 1975 of 'Malling 27' X 'Robusta 5'. It was tested as CG.4202. It was released for commercial propagation by licensed nurseries in New Zealand in May 2002 and in the USA in 2004. This rootstock produces a tree that is slightly larger in size than M.26 or about 50% the size of trees on seedling rootstock. It is resistant to fire blight, *Phytophthora* root rot, and woolly apple aphid. G.202 performs moderately well in the stoolbed and produces good quality nursery trees. In the orchard its precocity and productivity have been similar to M.26. It produces very few burrknots or root suckers. G.202 has been tested extensively in New York state and in the national NC-140 trials. In addition it has been tested in New Zealand and France. In New Zealand, it has been found to be much more productive than M.26. It appears that G.202 is best suited for climates that have problems with woolly apple aphid. Orchards planted with this rootstock should be planted at densities of 1,500-2,500 trees/ha.. Presently it is only available in New Zealand but rootstock nurseries in the US are beginning production of this stock.

Geneva® 30 (G.30)

G.30 is a semi dwarfing apple rootstock which originated from a cross made in 1974 of 'Robusta 5' and 'Malling 9'. It was tested as CG.6030. It was released for commercial propagation by licensed nurseries in the USA in 1994. This rootstock produces a tree that is between the size of M.26 and M.7, about 50-60% the size of trees on seedling rootstocks. When allowed to carry heavy crop loads from an early age, trees on G.30, are often closer in size to M.26. G.30 shows strong resistance to fire blight, *Phytophthora* root rot and good tolerance to apple replant disease. It is very winter hardy and performs well on a variety of soil types and in both warm and cold climates. G.30 is not resistant to woolly apple aphids. It produces a few root suckers and burrknots. G.30 has extremely high yield efficiency (similar to M.9) and produces large fruit size. Cumulative yield efficiency has been 3-5 times better than M.7. Its primary weaknesses are: it produces numerous spines along each shoot in the nursery layerbed which require significant hand labor to remove. Secondly, G.30 appears to have brittle wood and the graft union especially with Gala has been found to be significantly weaker than other rootstock genotypes. It is recommended that a sturdy, multi-wire trellis support systems be used with this rootstock. G.30 has been

evaluated extensively in the national NC-140 rootstock trials, and in France. In addition, G.30 has been widely planted commercially in the US on a limited scale. G.30 has performed very well in many locations and appears to be best adapted to replant soils, weak vigor scion cultivars and areas with short growing seasons. Orchards planted with this rootstock should be planted at moderate densities of 1,000-1,500 trees/ha, but it will require tree support in all situations.

Geneva® 16 (G.16)

G.16 is a dwarfing apple rootstock which originated from a cross made in 1981 of 'Ottawa 3' and *Malus floribunda*. It was tested as CG.3016. It was released for commercial propagation by licensed nurseries in the USA in 1998. This rootstock produces a tree that is the size of vigorous clones of M.9 such as Pajam2 or Nic29, about 35-40% the size of trees on seedling rootstocks. G.16 shows strong resistance to fire blight, *Phytophthora* root rot and some tolerance to apple replant disease. It has good propagability in layerbeds, and very vigorous growth in layerbeds, nurseries, and during the first 2 years in orchard plantings. It is very good mid-winter hardiness but can be susceptible to early winter freeze events in the nursery or during the first few years in the orchard when it grows vigorously. G.16 is not resistant to woolly apple aphids, and is hypersensitive to the 3 common latent virus (Apple Stem Grooving, Apple Stem Pitting and Chlorotic Leaf Spot viruses). Infected scion wood results in death of the trees in the nursery or the first year in the orchard. Nursery propagation requires virus free scion wood to ensure success. It has very high yield efficiency (similar to M.9) and does not produce burrknots or root suckers. Fruit size is similar or slightly less than with M.9. G.16 has been evaluated extensively in the national NC-140 rootstock trial since 1998. It has been planted commercially in the USA on a limited scale. G.16 appears to be best suited for high density plantings in fire blight prone areas. Orchards with this rootstock should be planted at high densities of 2,000-4,000 trees/ha.

Geneva® 11 (G.11)

G.11 is a dwarfing apple rootstock which originated from a cross made in 1978 of 'Malling 26' X 'Robusta 5'. It was tested as CG.3011. It was released for commercial propagation by licensed nurseries in the USA in 1999. This rootstock produces a tree that is similar in size to M.9 (about 30-40% the size of trees on seedling rootstock). It has moderate fire blight tolerance (similar to M.7) and good resistance to *Phytophthora* root rot but it is not resistant to woolly apple aphids. It has good propagation characteristics in the stoolbed and in the nursery. G.11 has very high yield efficiency (similar to M.9) and large fruit size (similar to M.9). It produces very few burrknots or root suckers. G.11 has been tested in 2 national NC-140 trials and in several NY state trials. Its tree size has been either slightly smaller or slightly larger than M.9 with yield efficiency as good or in some cases significantly better than M.9. It has also been tested in France, Germany, Italy, Spain and Poland where trees on G.11 were 15% smaller than M.9Pajam2 but with 14% greater productivity and similar fruit size as M.9Pajam2. G.11 appears to be best suited for high density plantings. Orchards planted with this rootstock should be planted at densities of 2,000-4,000 trees/ha.

Eurepgap Certification for Apple Growers

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Abstract:
Cornell Cooperative Extension (CCE), the NYS Integrated Pest Management Program (IPM), and NYS Department of Agriculture and Markets (NYSDAM) wrote the Eurepgap Audit Workbook for NY Apple Growers, conducted Eurepgap certification training workshops, engaged Eurepgap auditors in the training sessions, and reached 126 members of the NYS apple industry. To date, all apple growers in NY that have been audited, have passed the Eurepgap certification required by European Union apple markets. The objectives of Eurepgap are to ensure food safety, environmental protection, and worker health, safety and welfare in the production of fresh produce. The European export market is worth $13 M to the NY apple industry.

Background and justification:

Issue - New York apples are prized in England and Europe where imports exceed 700,000 bushels of Empire, McIntosh, and Gala. At a value to New York's economy of $18.00 per bushel, this amounts to 13 million dollars. Recently, European retailers have required that all apple growers importing into the European Union (EU) certify their farms under Eurepgap. The Eurepgap protocol has 210 control points that apple growers are audited against to pass certification. Growers must pay for yearly audits, maintain detailed records, and demonstrate compliance with requirements that, in a few cases, exceed those of NY and the USA. New York apples are stored, packed, shipped, and brokered by several NY packinghouses, and each has taken a different approach in addressing Eurepgap certification. The NY Apple Association estimates almost half of NY apple growers will need to meet Eurepgap standards, including 70 percent of Empire, 20 percent of McIntosh, and 40 percent of Gala acreages. In 2002 and 2003 Eurepgap certification was voluntary. However, New York's 2004 apple crop must be Eurepgap certified to qualify for the EU export market. Growers of Empire apples, especially hard hit, have threatened to 'push-out' their orchards, at the expense of the orchard agro-ecosystem and the NY economy. Because the Eurepgap control points principally address integrated fruit production, the NYS IPM Program was pivotal in coordinating the statewide project addressing apple Eurepgap certification.

Objectives:

1. Develop educational materials in print and electronic versions for NY apple growers to facilitate Eurepgap certification – CCE & IPM.
2. Contact Eurepgap-approved auditing firms to discuss audit pricing for NY apple growers – NYSDAM.
3. Conduct Eurepgap certification audit workshops in the major apple-growing regions of NY – CCE, IPM, NYSDAM.
4. Provide updates to apple growers of changes in Eurepgap Control Points and Compliance Criteria – CCE & IPM.

Procedures:

Response - At an April 2003 meeting organized by the NY Apple Association to discuss Eurepgap certification, the NYSDAM committed to supporting the NYS IPM Program and Cornell Cooperative Extension (CCE) in developing a Eurepgap educational program for NY apple growers. The Fruit IPM Coordinator, Carroll, provided statewide harmonization of the educational program offered within the three CCE Commercial Fruit Program regions. NYSDAM successfully lobbied auditing firms for reduced Eurepgap audit pricing and developed a brochure advertising the Eurepgap workshops. A workbook for apple growers entitled 'Eurepgap Audit Workbook For New York State Tree Fruit Growers' was developed and written by IPM and CCE containing typical answers to the 210 control points in the Eurepgap certification protocol and included sources of additional information. CCE of Orleans County published the Audit Workbook in 2003 and 2004. A CD electronic version of the Eurepgap Audit Workbook and the Eurepgap web-based documents was produced to accompany the Audit Workbooks. Posters and bulletins on preventing microbial contamination of produce, courtesy of the Cornell Good Agricultural Practices Program, were included in the Audit Workbooks. Eight daylong workshops were held in the winters of 2003-2004 and 2004-2005 (Table 1). Workshops provided in-depth coverage of all 210 Eurepgap control points and associated compliance criteria in the Audit Workbook. Growers were encouraged to ask questions and promote discussions on topics of concern. Eurepgap auditors were present at the workshops held in the winter of 2003-2004 and were able to contribute to greater understanding of the Eurepgap certification process.

Table 1. Eurepgap Workshops conducted in 2003 - 2005.

Date	Location	Audience	#
12/16/03	Highland, NY (Hudson Valley & NE NY)	Apple growers and Eurepgap auditors	20
12/17/03	Newark, NY (Lake Ontario region)	Apple growers and Eurepgap auditors	17
1/20/04	Albion, NY (Lake Ontario region)	Apple growers and Eurepgap auditors	25
1/22/04	Highland, NY (Hudson Valley & NE NY)	Apple growers and Eurepgap auditors	16
3/23/04	Albion, NY (Lake Ontario region)	Apple growers and packers/shippers	20
12/15/04	Newark, NY, (Lake Ontario region)	Apple growers and packers/shippers	7
12/17/04	Lockport, NY, (Lake Ontario region)	Apple growers and packers/shippers	13
1/14/05	Highland, NY, (Hudson Valley region)	Apple growers and packers/shippers	8

Results and discussion:

Impact - As of January 2005, 126 members of the apple industry have been educated on the Eurepgap protocol and received the Eurepgap Audit Workbook and CD. Ten percent of those attending were potential multiplier audiences who would be assisting growers in the Eurepgap certification process. Meeting Eurepgap certification preserves a key export market for NY apples and its continuing 13 million dollar contribution to the state's economy. The price of a Eurepgap audit was reduced, benefiting NY apple growers experiencing prior years of poor market returns. Growers praised the thoroughness of the Audit Workbook in demystifying the Eurepgap protocol and dispelling the fear associated with contemplating an audit. Those attending the Eurepgap training sessions and using the Audit Workbook have 'impressed' auditors with their ability to sail through the certification audits. The Eurepgap training program has reduced the tension and stress on the NY apple industry and given apple growers the confidence to undertake a Eurepgap audit. Because the Eurepgap protocol addresses integrated fruit production, environmental conservation, and food safety, the audit process will foster greater awareness of how apple production practices can contribute to and support environmental conservation and a safe food supply. Apple growers have upgraded their farm operations, as needed to meet Eurepgap certification, through the building of improved pesticide storage facilities, developing wildlife conservation plans, establishing systems for record keeping and traceability, to name a few examples, all of which have positive, long-term impacts on apple production in NY. Growers who attended the Eurepgap workshops and used the Audit Workbook reported saving up to 80% of the time it would have

taken to prepare for the audit without the Workbook and workshop. To date, every NY apple grower undertaking a whole farm audit has met the Eurepgap certification requirements.

References:

Eurepgap Fruit and Vegetable Documents are available online at http://www.eurep.org/fruit/Languages/English/documents.html

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