Introduction:

The joint Cornell University and United States Department of Agriculture-Agricultural Research Service (USDA-ARS) Apple Rootstock Breeding and Evaluation Program develops new rootstock cultivars with an emphasis on productivity, yield efficiency, ease of nursery propagation, fire blight resistance, tolerance to extreme temperatures, resistance to the soil pathogens of the sub-tropical regions of the US, and tolerance to apple replant disorder.

In many trials in North America and other worldwide locations all of the released GENEVA® rootstocks have demonstrated a “per acre productivity” and “tree yield efficiency” similar or higher than current commercial standards M.9 and M.26.

General Characteristics of GENEVA® Apple Rootstocks

- Disease resistance
  - Fire blight
  - Crown and root rots (*Phytophthora*)
  - Replant disease complex*

- Pest resistance
  - Woolly apple aphid*

- Other characteristics
  - All are dwarf types that differ within dwarf sizes
  - Cold hardiness*

*Applies to some GENEVA® Apple Rootstocks.
## GENEVA® Apple Rootstocks

<table>
<thead>
<tr>
<th>Traits</th>
<th>D1148</th>
<th>D1147</th>
<th>D3610</th>
<th>D3539</th>
<th>D4950</th>
<th>D6263</th>
<th>D3609</th>
<th>D4190</th>
<th>D2737</th>
<th>D4951</th>
<th>D3785</th>
<th>D3540</th>
<th>D5107</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arranged in order by size (smallest to largest)</td>
<td>M.9 T337</td>
<td>M.9 T337</td>
<td>M.9 T337</td>
<td>M.9/M.26</td>
<td>M.26</td>
<td>M.26</td>
<td>M.26</td>
<td>M.26</td>
<td>M.7</td>
<td>M.7</td>
<td>M.7</td>
<td>M.7</td>
<td>M.7/MM.106</td>
</tr>
<tr>
<td>Woolly Apple Aphid Resistance</td>
<td>No</td>
<td>No</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>No</td>
<td>No</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>No</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Fire Blight Resistance</td>
<td>Resistant</td>
<td>Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td>Very Resistant</td>
<td></td>
</tr>
<tr>
<td>Replant Disease Complex Resistance</td>
<td>Partial</td>
<td>Partial</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>No</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
</tr>
<tr>
<td>Crown and Root Rots (Phytophthora)</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td>Tolerant</td>
<td></td>
</tr>
<tr>
<td>Cold Hardiness</td>
<td>Yes</td>
<td>Partial: Good Mid-winter, Bad early-cold</td>
<td>Yes</td>
<td>TBD</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes- Good Mid-winter</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Productivity/Yield Efficiency-as good or better than M.9</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Low suckering and burr knots</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Medium</td>
<td>Yes</td>
<td>Medium</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Susceptibility to latent viruses</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

TBD: To Be Determined.
(a) Remarks: G.41 has presented weak graft unions with the following scions: Cripps Pink, Scilate, and Honeycrisp. The well feathered trees are prone to breakage in strong winds in the first 2-3 years and additional care needs to be taken to prevent breakage. Breakage risk decreases with time.

**Recommendation:** Use plant materials that have been tested and are “clean” of viruses.

Licensing for all varieties is available as exclusive or non-exclusive in selected Domestic and International Territories.

**Chart data valid as of September 20, 2018,** and supplied by Cornell University apple rootstock breeding team members, Gennaro Fazio, PhD., USDA Breeder, Terence Robinson, PhD, Cornell Breeder, and Herb Aldwinckle, PhD., Professor Emeritus.
Released GENEVA® Apple Rootstocks
Arranged by Tree Size

M.27 Size
M.9 T337
M.9 PAJ 2
M.26
M.7-MM106

Seedling Size

G.65
G.11
G.41
G.16
G.814
G.213
G.214
G.935
G.222
G.202
G.969
G.30
G.210
G.890

The GENEVA® Apple Rootstocks perform differently in Washington State conditions in comparison to the data displayed here that was collected in New York State.

Please contact your local extension agent for growing predictions for these varieties in your region.
Geneva® Apple Rootstock Technical Bulletin:

Plants derived from in-vitro culture (micropropagation) to be used directly as liners.

As the implementation of micropropagation of Geneva rootstocks is becoming widespread we have a few recommendations and suggestions about the nursery phase of such material:

1. Micropropagation nurseries need to stress the importance of the recommended planting method for the in-vitro plantlets when planting into the field. It is very important to have a rootstock stem (shank) on the tree that is planted a minimum of 4 in/10 cm below soil line and budded 6 in/15 cm above soil line. The problem arises because the in-vitro plants have root systems that are at the soil line of the pot (crown). Part of the traits of apple rootstocks is provided by the shank, and if there is no or little shank, then the properties of dwarfing and precocity are reduced – reducing potential yield.

2. The material is usually very delicate compared to normal liners, therefore planting in good weather conditions and providing moisture and other nursery care is very important to produce successful liners.

Scientific Contact:
Gennaro Fazio
315-787-2480
gennaro.fazio@ars.usda.gov
630 W. North St., Geneva, NY
www.ars.usda.gov/