In North America, fruit tree producers continue to suffer losses due to cold temperatures, diseases, poor soil conditions, and graft incompatibility. With a highly competitive international market, consumer demand for high quality fruit, and strong pressure to reduce chemical use, fruit tree growers are seeking economically and environmentally sustainable production schemes. Many fruit tree growers are adopting high-density systems. The central component of a high-density system is the rootstock, the part of the tree that controls final tree canopy size. Limiting canopy size allows for more trees per acre, but rootstocks can have serious weaknesses (rootstock may influence productivity, fruit quality, pest resistance, and stress tolerance); and though potential returns of high-density plantings far exceed those of low-density plantings, they cost 10 to 20 times more per acre to establish.

Conflicting information about rootstocks, diverse orchard practices, differing experimental procedures, and a poor relationship with the tree fruit industry have resulted in costly planting and management errors. Rootstocks cannot be recommended unless there is coordinated, uniform research investigating their suitability in a range of conditions. Furthermore, fruit trees are long-lived perennials, so a minimum of eight years must pass to obtain an indication of rootstock performance and potential for improved profitability.

Multistate Research Project Coordinates Research on Sustainable Rootstocks

Multistate Research Project NC-140 forged a viable international partnership between universities and the tree fruit community. Together, they leveraged federal and state dollars to conduct innovative research on fruit tree rootstock genetics, production, management, and economics. In recognition of the group’s exceptional collaboration and research impacts, NC-140 received the 2015 Experiment Station Section Excellence in Multistate Research Award from the Experiment Station Committee on Organization and Policy.

Over the past five years, they evaluated rootstocks of temperate-zone fruit trees from around the world, regularly measuring tree growth, root anchorage, size control, soil and climatic adaptability, and pest and disease resistance. Based on their experimental plot results, the group used state-of-the-art genomic tools and breeding programs to develop improved rootstocks for temperate-zone fruit trees. The team also developed new protocols for screening rootstocks, improved propagation techniques, and facilitated acquisition of rootstocks to accelerate their adoption among growers. In addition, NC-140 offered detailed recommendations regarding use of these new rootstocks, distributing research-based information through Extension, web sites, written material, and educational programs.

Multistate Research Project Provides Rootstocks for Higher-Yielding, Easier to Manage, More Sustainable Orchards

NC-140’s uniform, multi-location trials have drastically reduced evaluation time for new rootstocks from more than 40 years to just 10 years. Results from these trials are accelerating the process of identifying, propagating, and commercializing high-performing rootstocks, meaning new rootstocks are available to growers sooner. Education and Extension efforts have made reliable information on rootstock performance easier to access. Selecting more suitable rootstocks has led to higher yields for producers and improved fruit quality for consumers, ultimately enhancing the economic viability of tree fruit farms. Over the last 30 years, fruit growers in North America have steadily transitioned to higher density orchards that
take up less land, increase production efficiency, accommodate automation technology, and rely on fewer chemicals. For example:

- With NC-140 recommended rootstocks, yields will increase by 20% per acre, and fruit size will increase by 10%, and tree losses due to disease will decline by 10%.
- By utilizing NC-140 recommended rootstocks, farmers will receive significantly earlier returns on investments related to tree establishment, moving the average break-even year from eight to five years after planting.
- Transitioning from large, unwieldy apple trees spaced far apart to compact rows of high-yielding, small trees, has eased apple orchard maintenance and harvesting labor and increased profitability.
- 98% of all New Jersey orchards now use apple, pear, peach, and cherry dwarfing rootstocks as a direct result of NC-140 research and Extension, particularly through Rutgers Cooperative Extension outreach.
- Over the last 15 years in Indiana, use of superior performing rootstocks from NC-140 trials has increased 660%, with an estimated crop value increase of more than $12,000 per acre.
- Sweet cherry acreage has increased by 10,000 acres since 1995, in large part due to the plantings of dwarfing Gisela rootstocks, first tested on a large scale by NC-140. Planting density has jumped from 100 to 415 trees per acre, with an estimated annual increase of $260 million of fresh fruit.
- Based on NC-140 results, 200 acres of trees in Massachusetts were planted with dwarfing rootstock in 2014. On this acreage, pruning and harvest labor declined by 50%, fruit quality and size increased by 20%, and profit increased by 50%.
- NC-140 trials have helped Utah peach growers select rootstocks that are more tolerant of alkaline soils.
- With apples alone, NC-140 science and outreach has increased mature orchard yields by 20%, enhanced fruit size by 10%, increased highest grade fruit by 20%, decreased time on investment return by 30%, and provided estimated economic gains of $200 million.
- The use of NC-140 recommended dwarfing rootstocks will result in a 50% reduction in canopy volume and a concomitant 50% reduction in pesticide usage on 200,000 acres. The reduction in pesticide use will net environmental benefits and save $150,000,000 in pesticide cost and application. For example, chemical and pesticide cost and application is down by nearly 40% among apple orchards using dwarf rootstocks, and on 200 acres planted with dwarfing rootstock in Massachusetts, reduced tree canopy volume has led to a 70% decline in pesticide use.