Using Molecular Methods to Identify Historic Apple Cultivars in 100-Year-Old Orchards in Wyoming

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Introduction
The last remnants of 19th- and early 20th-century apple plantings struggle to survive in isolated, nearly forgotten, or abandoned orchards, and the identity of most of these varieties has been lost. Molecular techniques offer powerful methodologies for the identification of heirloom, historic, and novel apple cultivars in apple orchards planted in the late 19th and early 20th centuries in Wyoming. In addition, there have been no efforts to grow or maintain important apple cultivars in a centralized location to preserve the germplasm for future generations. An apple germplasm repository orchard was planted in spring 2017 at the Sheridan Research and Extension Center (ShREC).

Objectives
Our objectives are to (1) investigate the use of molecular genotyping techniques to identify heirloom, historic, and novel apple cultivars in approximate 100-year-old orchards in Wyoming; and (2) establish a germplasm repository orchard at ShREC.

Materials and Methods
The present study is using a comparative approach to identify heirloom, historic, and novel apple cultivars in Wyoming. DNA is extracted from trees of unknown cultivars located in historic orchards or from individual trees remaining in historic farmsteads around Wyoming. Microsatellite or simple sequence repeats (SSRs)—types of molecular fingerprints (aka genetic markers)—are compared with those from the Germplasm Resources Information Network (GRIN) database operated by the U.S. Department of Agriculture (USDA) Agricultural Research Service. Pieces of woody growth collected from the trees were grafted onto Antonovka rootstock (Malus antonovka helps to create a hardy, full-sized tree from the heirloom/historic/novel cultivars). In 2017, two- to four-year old saplings were planted into a newly established germplasm repository orchard at ShREC (Fig. 1).

Results and Discussion
The final total for Wyoming trees sampled was 993. We also included 450 additional cultivars mentioned in early Wyoming Horticultural Society bulletins and other apple books, journal articles, and private lists that were not previously in the GRIN database. We were able to obtain comparator reference samples of these 450 cultivars from the USDA-managed apple orchard in Geneva, New York, and the Seed Savers Exchange in Decorah, Iowa. Thirty cultivars were positively identified from Wyoming, with 58% of the samples directly matching comparator genotypes in the GRIN database. Because identifications were based on a comparison of microsatellite loci with known cultivars, this suggests that additional reference samples are needed for comparison. It also may suggest that there are a number of novel cultivars derived from incidental crosses between apples in some of the larger orchards in the past 100 years.

Information on more than 200 apple trees found still living in Wyoming can be found on our website at www.wyomingappleproject.com. On our website you’ll find (1) City Pamphlets, which include apple information for numerous locations around Wyoming; (2) Apples of Wyoming: Lost and Found, which lists all cultivars; (3) the Wyoming Apple Key, which has more than 400 drawings and photos of apples collected from USDA watercolor drawings and the GRIN database to help apple enthusiasts narrow down which cultivars they may have; and (4) information on the history of the apple cultivars, local homesteads, orchards, and nurseries.

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Figure 1. ShREC students and field crews plant bench-grafted apple trees from Wyoming orchards into the new germplasm repository orchard at ShREC in spring 2017.