Identification of Superior Apple Cultivars for Cider Production in Michigan

Chris Gottschalk†, Phil Schwallier*, and Steve van Nocker‡

‡ Department of Horticulture, Michigan State University, East Lansing, MI 48824
† Graduate Research Assistant, Plant Breeding, Genetics, and Biotechnology, Michigan State University, East Lansing, MI 48824
*MSU Extension, Michigan State University, East Lansing, MI 48824

Abstract

The hard cider industry has exhibited increasing growth both in sales and product diversity, and is now valued at more than 400 million dollars. With this industry expansion, interest in producing traditional ciders using cider-specific apples has also grown. These specific cultivars, although rich in historical use, have had little-documented production in Michigan. We recently proposed and received funding to evaluate and identify superior cultivars for cider production in Michigan. This project has three main objectives including; establishment of a replicated cultivar trial, evaluation of the USDA *Malus* germplasm accessions and Midwest Apple Improvement Association (MAIA) selections for cider quality, and improvement of our extension cider web resource - ciderapples.msu.edu. The variety trial will evaluate 60 of the most promising and historically important cider cultivars at five replicated sites in Michigan. The evaluation of germplasm and breeding selections will total close to 100 cultivars, with each analyzed for its cider-specific qualities. The previously established web resource will be used as a communication platform to release the data generated from this project through a trait database for the public to quickly access information and to provide recommendations on cider cultivars.

Objective 1 - Establishment of replicated cultivar trial

Our aim is to establish five trial plantings of 60 cultivars with ten trees per cultivar. The main site will be located in Clarksville, MI at the Clarksville Research Center (CRC) and will be integrated into the already established Great Lakes Cider Apple Collection (GLCAC). This location will be open to the public in future years of organized tours and integrated into the cider web resource for off-site reference. The four remaining sites will be placed in participating grower orchards. These locations will be located as far south as Paw Paw, MI in the Lower Peninsula to as far north as Germfask, MI in the Upper Peninsula (Fig. 1). Two sites will have the cultivars grafted onto 'M106' rootstock in a free-standing planting system. The other three sites; one grower site will have the cultivars grafted on 'Bud9' in a trellis supported high-density system, another will use a free-standing planting system on 'M7', and the final site at the CRC will have the cultivars grafted onto an 'M9' virus-free clone rootstock and will be planted in the already established trellis supported medium-density GLCAC. Once old enough for bearing, these trees will be used to evaluate for production qualities and for fruit/juice characteristics. In addition, we will be able to test for regional differences in the resulting cider produced for each cultivar.

Figure 1. Map of locations for planned replicated trial plantings. A) Germfask, MI - M7 in a free-standing system. B) Lake Leelanau, MI - Bud9 in a high-density trellis system. C) St. Johns, MI - M106 in a free-standing system. D) Clarksville, MI - M9 and clones in a vertical-axis trellis system. E) Paw Paw, MI - M106 in a free-standing system. Location D will be placed into the existing Clarksville Research Center and will serve as the main experimental orchard.

Objective 2 - Evaluation of the USDA *Malus* germplasm accessions and Midwest Apple Improvement Association (MAIA) selections

This objective's goal is to identify promising historically-described cider cultivars and novel breeding selections that could be of interest for cider producers in Michigan. To evaluate historically-described cider cultivars we will be making four collection trips to the USDA *Malus* collection in Geneva, NY for the next two years to sample fruit from ~100 cultivars (see Table 1). These accessions will be collected at four-time points throughout the harvest season and brought back to Michigan for processing. The fruit that returns with us will be assessed for appearance and described, evaluated for maturity, and processed for cider-specific evaluations. The cider-specific evaluations will include measurements of sugar content, acidity, pH, tannic acid content, oxidative potential, and will undergo volatile profiling pre- and post-fermentation. Each accession will be additionally evaluated for disease presence and production traits while in NY. We will also be evaluating >20 breeding selections from Midwest Apple Improvement Association for cider-specific traits. This fruit will be sourced from the trial plantings located at the South West Research and Extension Center in Benton Harbor, MI.

USDA Accessions			
Anaros	Dunkerton Late Sweet	McClintock Grimes	Shaw Ribston
Annie Elizabeth	Esopus Spitzenburg	Melba	Skyrme's Kernel
Antonovka Kamenichka	Fall Pippin	Middleton Fameuse	Snow
Antonovka Shafran	Fall Russet	Milton	Spartan
Battleford	Gloria Mundi	Mollie's Delicious	Splendor(Stark)
Bessemianka Michurina	Golden Nugget	Monroe	Sweet Coppin
Bietigheimer	Gravenstein Washington Red	Mother	Tolman Sweet
Bisbee Giant Winesap	Haralson	Paragon	Trembletts Bitter
Blenheim Orange	Honeygold	Perrine Yellow Transparent	Turley
Burgundy	Ingram	Rambo-Red Summer	Virginiagold
Calville Blanc	Jonagold	Red Astrachan	Wealthy
Chestnut Crab	Lady	Red Spitzenburg	Wealthy Double Red PC-310
Chisel Jersey	Liberty	Rhode Island Greening	Winter Banana
Cornish Gilliflower	Lodi	Roberts Crab	Yellow Transparent
Cortland	Lord Seedling	Rosemary Russet	
Cox's Orange Pippin	Maiden Blush	Sergeant Russet Golden Delicious	

Table 1. List of USDA *Malus* germplasm accessions that are undergoing evaluations for cider use.

Objective 3 - Improvement of the extension cider web resource ciderapples.msu.edu

In 2016 we launched the extension focus web resource ciderapples.msu.edu (Fig.3 and QR code 2) to serve as Michigan's go-to web reference for cider related research. The website currently contains content pages for the following topics; previously conducted variety trials and the resulting recommendations, detail descriptions of red-juice cultivars that have been selected for cider use and a small scale breeding project, description and maps of the GLCAC, directories cider growers, producers, and nurseries, and a resource page linking to industry groups, competitions, and other academic cider research sites. This funded project will help expand our existing site to create a user-friendly trait database. This will allow users to search and filter lists of cider apple cultivars based on documented trait measurements. Ultimately, this will also serve as a portal for the release of results generated from objectives 1 and 2.

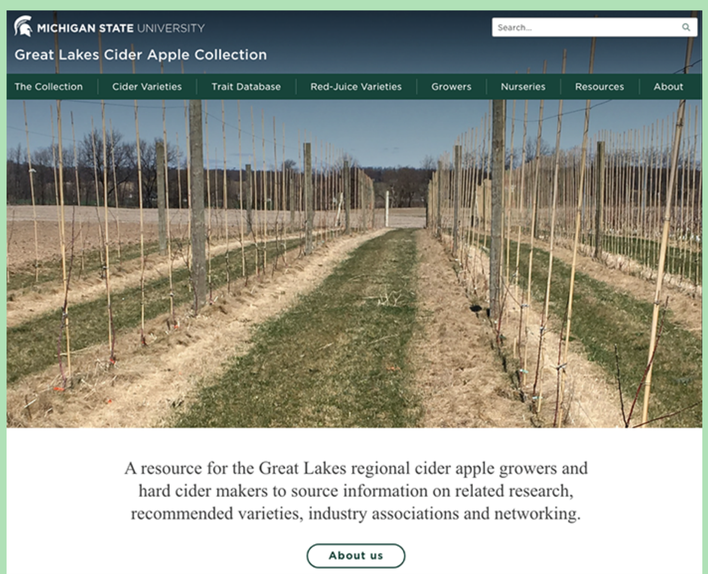

Figure 3. The home page of ciderapples.msu.edu.

QR Code 2. Scan QR code using your smart phone camera to access MSU's cider apples extension website.

Available Cider Apple Extension Resource

In late December of 2017, we released a free extension bulletin (E3364) to serve as an information packet regarding cider apples (Fig. 2 and QR code 1). The bulletin includes information on national and regional industry trends, defining what makes a good cider apple, and detailed descriptions of previously documented cider apples and their respective production traits.

Figure 2. Front cover of extension bulletin E3364.

QR Code 1. Scan QR code using your smart phone camera to download extension bulletin E3364.

Resources provided by:

MAIA 21st Century Apples

Funding provided by:

Michigan State Horticultural Society

Department of Agriculture & Rural Development