
Cider Apple Research at UVM (and other U.S. Land Grant Institutions)

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CIDER APPLE PRODUCTION IN VERMONT: MARKET OPPORTUNITIES AND TECHNICAL CHALLENGES
WOODCHUCK CIDERY, MIDDLEBURY, VT

MARCH 30, 2015



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Why cider? Why now?

- Personal interest in cider
- New faculty role at UVM to direct research
- Rapidly expanding cider industry in Vermont & the U.S.
- Critical mass of producers, growers, enthusiasts, and researchers

SEVEN DAYS DEADLY

CIDER WEEK VERMONT

NOVEMBER 14 - NOVEMBER 23, 2014

EVENTS CIDER INFO PRESS ABOUT

JOIN THE HARD CIDER REVIVAL!

SOWING THE APPLE SEEDS PAGE 30
Growers, makers and scientists unite

YEASTIE BOY PAGE 32
Cider making at home

LOST AND REFOUND PAGE 42
The hunt for 19th-century apples



Cider research programs at UVM: Now & later

Long-term research & outreach program

- Baseline data
- Horticultural research
- Pest management
- Economic evaluation
- ...cidermaking...



Two worlds of cider apple production

- Dessert fruit from existing/future plantings
 - Vast majority of apples used for cider
 - Lower-valued from (compared to fresh market)
 - *What are the qualities of dessert fruit from a cidermaking perspective?*
 - *What strategies can be adopted to reduce costs of production/increase supply/improve cider quality?*
- Specialty cider cultivars
 - Unique flavor profile
 - Heirloom
 - Ashmead's Kernel, Golden Russet, Esopus Spitzenburg
 - Low-input scab-resistant cultivars
 - Liberty, Topaz, Winecrisp, etc.
 - Regionally-unique cultivars
 - Bittersweet cultivars
 - Often European origin
 - *How do these cultivars perform in Vermont orchards?*
 - *What management strategies can increase supply/profitability/cider quality?*



Vermont Working Lands Enterprise Initiative

Apple Market Optimization and Expansion through Value-Added Hard Cider Production

- Quantify production costs for apples managed specifically for hard cider production
- Identify fruit quality and yield characteristics of apple cultivars suited for hard cider production
- Coordinate fermentation trials and evaluate finished ciders made from Vermont apple cultivars



Dan Rowell, CEO VT Hard Cider Company (left) and Dr. David Conner, UVM CDAE Dept. Photo: VT Working Lands Enterprise Initiative



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VERMONT HARD CIDER COMI



2014 WLEF

Orchard and cultivar data

- Production by cultivar & orchard system



Cultivar	Bushels / acre	Firmness (psi)	Starch index	Soluble solids (°brix)
Cortland	672	15.9	3.7	10.3
Empire	932	18.8	5.0	12.8
Idared	1221	17.4	4.0	10.6
Jonagold	338	16.0	7.4	12.6
Liberty	282	17.5	6.0	11.0
Macoun	705	15.4	5.0	10.9
McIntosh	1134	15.2	4.6	11.6
Paula Red	435	17.1	3.4	11.3



Cider apple classifications

Barker's Classification of Cider Apples (LARS 1903)

<u>Classification</u>	<u>Acid (%)</u>	<u>Tannin (%)</u>
Sharp	> 0.45	< 0.2
Bittersharp	> 0.45	> 0.2
Bittersweet	< 0.45	> 0.2
Sweet	< 0.45	< 0.2



2014 WLEF

Orchard and cultivar data

- Cultivar juice characteristics
 - *Single year, single orchard dataset*



Cultivar	Soluble solids (°brix)	pH	Malic acid (mg/l)	Total polyphenols (%)	YAN (mg/l)
Ashmead's Kernel	17.6	3.25	10.40	0.075	262.4
Commercial blend	12.2	3.40	5.91	0.037	58.5
Cortland	11.2	3.43	4.74	0.047	45.1
Dabinet	13.1	4.13	1.88	0.109	60.6
Esopus Spitzenburg	15.3	3.48	7.10	0.035	113.4
Honeycrisp	12.6	3.52	4.97	0.027	85.0
Idared	10.8	3.29	5.98	0.017	15.5
Jonagold	12.3	3.40	5.12	0.021	38.6
Liberty	11.5	3.45	5.72	0.018	56.7
Macoun	11.7	3.47	4.17	0.021	65.1
McIntosh	11.7	3.25	5.48	0.036	30.1
PaulaRed	11.0	3.40	4.45	0.050	30.4
Topaz	12.4	3.35	9.86	0.056	16.1
Wickson	13.9	3.40	11.94	0.018	53.3



2014 WLEF

Working Lands Enterprise Fund

Fermentation characteristics

- Ciders fermented at three commercial cideries
- *Today*: evaluation of finished ciders to characterize cider quality



USDA Federal State Marketing Improvement Program

Orchard Economic Assessment to Support Vermont Hard Cider Production

- Assist in the development of more efficient marketing methods, practices and facilities to bring about more efficient and orderly marketing of cider apples, and reduce the price spread between growers and cideries
- Quantify the economic impact of hard cider and cider apple production on rural Vermont economies.



Terence Bradshaw collects orchard yield data at Sunrise Orchards, Cornwall, VT. Photo: T. Bradshaw



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VERMONT HARD CIDER COMPANY
LLC



Other topics of research interest

- Cultivar evaluation
 - Unique, cider-specific cultivars *presently planted*
 - Regionally-developed cultivars
- Systems
 - Long-term evaluation of planting systems
 - 2015-2017 plantings? Call me!
- Pest management
 - Low-input production systems for cider apples, including dessert cultivars
- Research requires grower & researcher cooperation, plan ahead



Washington State University

Carol Miles, Suzette Galinato,
Peter Tozer

- Cider cultivar trials
- Mechanical cider apple harvest
- Enterprise budgets & economic analysis of cider apple production

WSU Extension
Western Washington Tree Fruit & Alternative Fruits

Hard Cider



The cider room at Mount Vernon contains cider being fermented and samples for ongoing evaluation.

Cider Research at WSU NWREC

Variety Trials

The cider apple research program was started at WSU Mount Vernon NWREC in 1979 with the planting of 2-4 trees each of 6 cider apple varieties. Additional plantings were added over the years, and today we are planting 6 trees each of 64 cider apple varieties.

Hard Cider Navigation

- [Cider Associations & Groups](#)
- [Cider Information](#)
- [Cider Research in the U.S.](#)
- [Hard Cider Home](#)
- [History of Cider](#)
- [Mechanical Harvest](#)
- [Perry](#)



Michigan State University

Nikki Rothwell

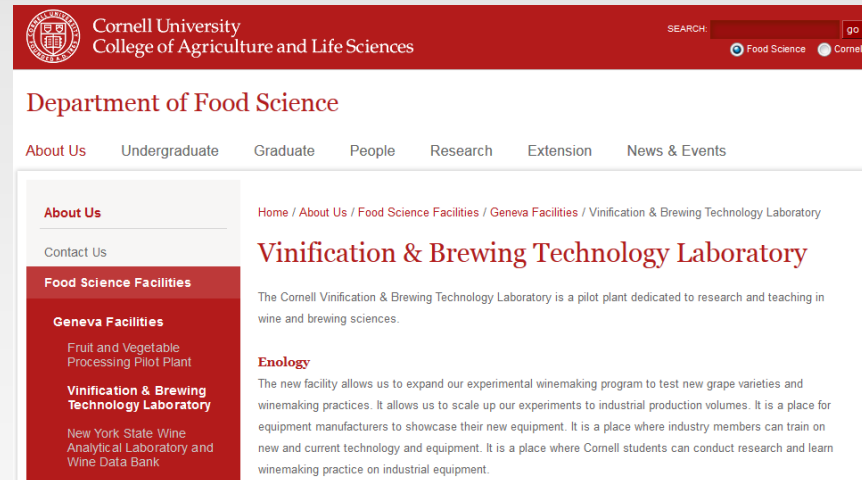
- Cider cultivar evaluation
- Integrated pest management systems for cider apple production



Cornell University

Olga Padilla-Zakour, Chris Gerling

- Extensive enology program and winemaking facilities



The screenshot shows the Cornell University Department of Food Science website. The header includes the Cornell University logo and the text "Cornell University College of Agriculture and Life Sciences". A search bar is visible with the text "SEARCH:" and a "go" button. Below the header, the page title is "Department of Food Science". A navigation menu includes "About Us", "Undergraduate", "Graduate", "People", "Research", "Extension", and "News & Events". The main content area features a sidebar with "About Us" and "Contact Us" links, and a "Food Science Facilities" section with sub-links for "Geneva Facilities" and "Vinification & Brewing Technology Laboratory". The main content area displays the "Vinification & Brewing Technology Laboratory" page, which includes a breadcrumb trail: "Home / About Us / Food Science Facilities / Geneva Facilities / Vinification & Brewing Technology Laboratory". The page title is "Vinification & Brewing Technology Laboratory". The text describes the laboratory as a pilot plant dedicated to research and teaching in wine and brewing sciences. It also mentions an "Enology" program that allows for expanding experimental winemaking to industrial production volumes.



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Virginia Tech

Greg Peck, Gustavo Ferreira,
Andrew Neilsen, Amanda Stewart

- Cider orchard economic feasibility
- Cidermaking Extension workshops
- Orchard management for cider apples
- Cropload effects on juice quality
- Fermentation trials
- Characterization of phenolics in cider apples



The screenshot shows the website for the Alton H. Smith Jr. Agricultural Research and Extension Center. The header includes the Virginia Tech logo and the text "Virginia Agricultural Experiment Station". A search bar is located in the top right corner. The main navigation menu on the left includes "QUICKLINKS", "About the Center", "People", "Tree Fruit", "Pathology", "Entomology", "Horticulture", "Grapes", "Impacts", "Calendar", and "Contact Us". The main content area features a title "Alton H. Smith Jr. Agricultural Research and Extension Center" and a sub-header "Hard Cider Production in Virginia". The "Background" section discusses the exponential expansion of commercial hard cider production in the United States, mentioning over 100 licensed commercial cideries (wineries) that specialize in hard cider production across the country. A photograph shows a man, identified as Chuck Shelton, co-owner of Albemarle Ciderworks, taking a sip from a glass through a filter. The "Contacts" section lists Greg Peck, Ph.D., Assistant Professor of Horticulture, and Gordon Groover, Ph.D., Extension Economist & Associate Professor, both at Virginia Tech.



USDA Specialty Crops Research Initiative

CIDER: Redeveloping the North American Hard Cider Industry

- Coordinate a stakeholder-driven national research & outreach agenda to support cideries and cider apple producers in the U.S.
- Planning grant awarded & project initiated to develop & submit \$5 million+ project to USDA Specialty Crops Research Initiative, July 2015
- 3-5 year coordinated research & outreach program



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United States Association of Cider Makers



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USDA CIDER SCRI Proposal: Fruit Production

1. Determine impact of horticultural practices on juice quality.
 - a) Crop load, light interception, cultivar evaluation
2. Initiate trials to determine disease and insect susceptibility and management of cider varieties
 - a) In-vitro & field-based trials
3. Test and develop mechanized pruning and harvesting for cider apples
4. Identify cultivars and genetic markers in the USDA *Malus* collection that interest cider producers and apple breeders.



USDA CIDER SCRI Proposal: Cider Production

1. Assess processing techniques to optimize tannin extraction from apples and retention in cider
 - a) Compare existing technologies for maceration, pressing, and extraction for their ability to increase and retain tannin content of cider juice
2. Develop cider production lab manual using research-based analytical techniques validated specifically for cideries
3. Characterize cider quality based on apple cultivar and blending strategies.



USDA CIDER SCRI Proposal: Economics & Marketing

1. Determine scale of U.S. cider market and impact on the apple industry
2. Increase profit for cider apple growers by modeling cost-benefit scenarios.
 - a) Compare production systems and harvest methods from existing budget models in key apple production regions
3. Determine consumers' preference for key cider profiles
 - a) Conduct sensory evaluation panels and consumer surveys



USDA CIDER SCRI Proposal: Transdisciplinary activities

1. Assess the U.S. cider industry through online surveys
 - a) Survey nurseries, apple growers, and cider producers for current and projected cider production
2. Coordinate case studies of key apple growers and cideries
3. Develop online database of apple cultivar information for growers and cidermakers
 - a) Replicated field trials, research observations, grower experiences
 - b) Regionally and systems-sortable



2015 Undergraduate & Continuing Education Courses



PSS 209 Sustainable (Vegetable) Farm Practicum

- Instructors: Susie Walsh Daloz and Terry Bradshaw
- Dates: May 18-August 5, 2015 (On-line coursework is from May 18-27 and August 3 - 5; On-farm practicum is MW from June 1-July 29)

PSS 195 Sustainable Orchard and Vineyard Management

- Instructor: Terry Bradshaw
- Dates: TR, June 15 - July 10, 2015

