



# DESIGN & ESTABLISHMENT OF A HARD CIDER ORCHARD

Greg Peck, Ph.D.

Assistant Professor of Pomology



VirginiaTech



Virginia Tech • Virginia State University



# Virginia Agricultural Experiment Station and its Agricultural Research and Extension Centers

★ Virginia Agricultural Experiment Station - Blacksburg

■ Alson H. Smith, Jr. AREC - Winchester

● Eastern Shore AREC - Painter

▲ Eastern Virginia AREC - Warsaw

◆ Hampton Roads AREC - Virginia Beach

▼ Middleburg AREC - Middleburg

■ Reynolds Homestead Forestry Resources Research Center - Critz

● Shenandoah Valley AREC - Steeles Tavern

▲ Southern Piedmont AREC - Blackstone

◆ Southwest Virginia AREC - Glade Spring

▼ Tidewater AREC - Suffolk

● Virginia Seafood AREC - Hampton



Land Preparation and Planting	Per Acre
Land clearing	\$1,875
Trees (581 trees/A @ \$6.50/tree)	\$3,777
Fertilizer	\$123
Lime	\$88
Other planting	\$213
Permanent groundcover	\$37
Sprays (Pesticides, herbicides, PGRs, etc.)	\$466
Trellis hardware	\$4928
Irrigation	\$845
Labor	\$1176
Misc. (Tree guards, deer repellent, etc.)	\$893
<b>TOTAL</b>	<b>\$14,421</b>

Assumptions! No equipment purchases, water is already present, existing farm already established, planting >5 acres, mostly H1A visa labor.

Once orchard is in production **\$3,500-5,000/acre** in operating costs.

# Site selection

- **Right plant for the right place!**

- Slope/Aspect/Elevation
- Prevailing winds
- Drainage (air and water)
- Sun exposure
- Organic growers: proximity to conventional farms
- Equipment access
- Bodies of water
- Access to markets & labor
- Water availability



# Climate

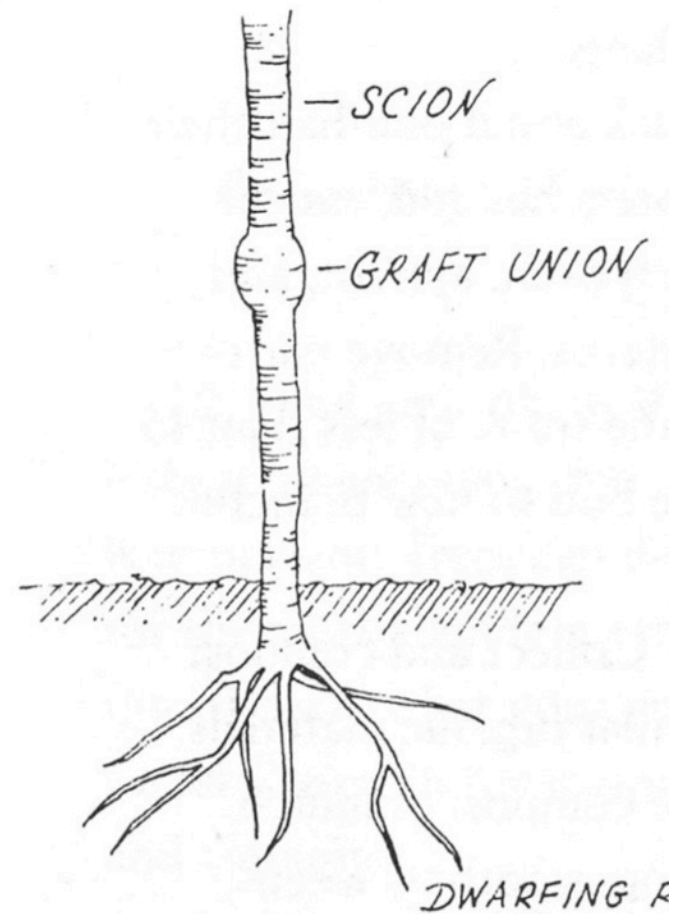
- Late spring frosts
- Early fall frosts
- Days in growing season
- Humidity
- Rainfall
- Hail
- Degree days
- Summer temps
- Winter chill
- Winter low temps
- Sunlight intensity

# Soil requirements

- Apple rootstocks are suitable to a wide range of soil types
- Generally heavier clay soils are more difficult to manage than those with more sand and silt
  - drainage
- Slightly acidic pH (6.0 - 6.8)
- High CEC, SOM, Mineral nutrients

# Anatomy of a fruit tree

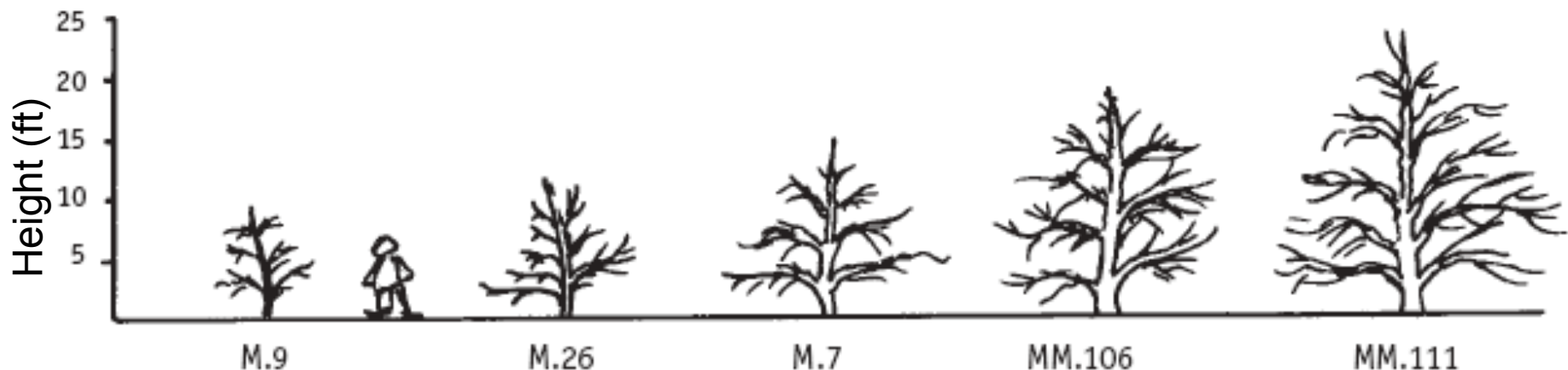
- Rootstock & Scion
  - interstem
- Buds
  - Leaf
  - Flower (fruit)



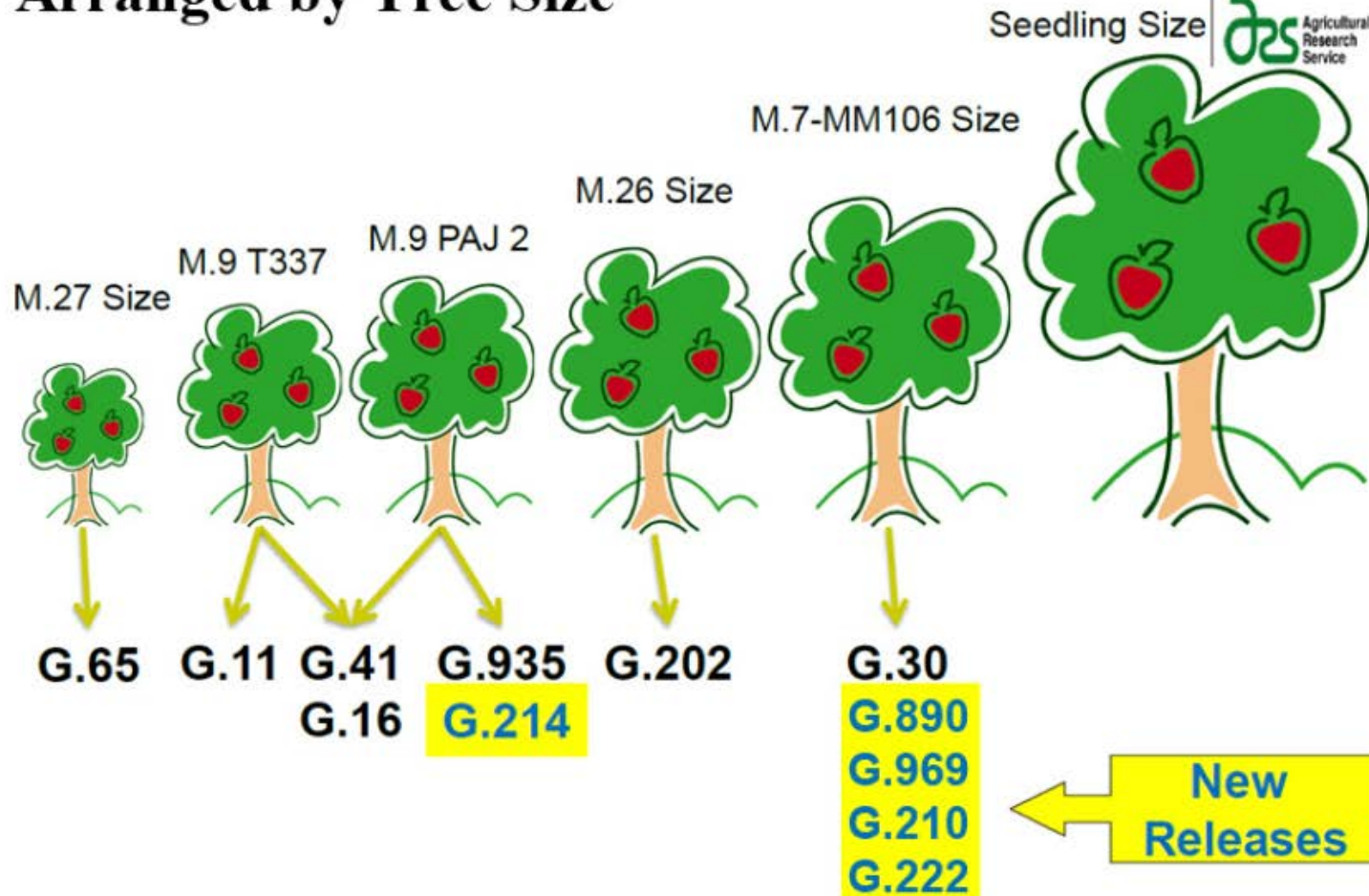


# Rootstock selection

- Controls tree size
  - From 30 ft tall to 6 ft “pedestrian” trees
  - Allows for better spray coverage
- Disease and pest resistance
- Soil adaptability
- Scion compatibility
- How many trees/acre?
  - Long-term decision
  - Change cultivar, but not spacing



## Released GENEVA® Apple Rootstocks Arranged by Tree Size



Contact:  
Jessica Lyga,  
Plant Varieties &  
Germplasm  
Licensing Associate

Office: 607-255-0270

E-mail:  
jml73@cornell.edu



# Apple Rootstock Genotype Trials



M.7



M.9



# Rising Sun Fuji Rootstock Trial, 2014

Rootstock	2014 TCSA (cm <sup>2</sup> )	Yield (Fruit no. per tree)	Crop Density (Fruit no. per TCSA)	Yield Efficiency (Fruit wt., kg per TCSA)	Firmness (lbs.)	Red Color (0-100%)	Starch Index (1-8)	SSC (°Brix)
Bud.9	14.0	67 b	4.67 ab	1.01 ab	15.4 b	82.2a	5.5 a	15.1 ab
G.41	22.9	103 b	4.51 abc	1.00 ab	15.7 b	75.1 abc	4.7 ab	15.3 a
G.16	24.7	111 b	4.56 abc	0.97 ab	15.9 b	78.1 ab	4.3 b	14.6 abc
M.9 Nic29	29.5	93 b	2.86 bc	0.71 bc	15.6 b	72.8 abcd	4.7 ab	14.2 bc
G.30	31.5	92 b	4.03 abc	0.81 abc	16.9 a	65.2 cd	3.3 c	14.0 c
G.935	32.6	193 a	6.46 a	1.18 a	15.4 b	68.7 bcd	4.5 b	14.5 abc
M.26	39.9	101 b	2.88 bc	0.68 bc	15.7 b	63.3 d	4.7 ab	14.5 abc
MM.111	43.2	80 b	2.01 c	0.43 c	15.0 b	70.5 bcd	4.7 ab	13.7 c

Peck et al. Unpublished

# Cultivar Selection

- Market demand and/or cider style
- Flavors, colors, tannins, acidity, sugar content
- Spread out harvest season
- Disease resistance
- Cross-pollination



# Hard Cider Cultivars: Planting I (2013)

Cultivar	Rootstock
Harrison	M.9 nic 29
Hewe's Crab	M.9 nic 29
Coxs Orange Pippin	B.9
Liberty	G.41
Ashmeads Kernel	G.11
Golden Russet	G.30
Newtown Pippin	G.16
Bramleys Seedling	B.9
Puget Spice (WSU AxP Crab)	G.11/MM.111
Roxbury Russet	G.11
Ashmeads Kernel	G.16
Chestnut Crab	B.9
Kingston Black	G.16
Winesap	G.935
Hudsons Golden Gem	G.11
Spitzenburg Esopus	G.202
GoldRush	G.11
Ellis Bitter	B.9



# Hard Cider Cultivars: Planting II (2015)


Cultivar	Classification
Binet Rouge	Bittersweet
Brown Snout	Bittersweet
Brown's Apple	Sharp
Chisel Jersey	Bittersweet
Dabinet	Bittersweet
Ellis Bitter	Sweet or bittersweet
Harry Master's Jersey	Bittersweet
Porter's Perfection	Bittersharp
Stoke Red	Bittersharp
Tremlet's Bitter	Sharp
Vilberie	Bittersweet
Yarlington Mill	Bittersweet

1 **Characterization of the Polyphenol Composition of 20 Cultivars of**  
2 **Cider, Processing, and Dessert Apples (*Malus × domestica* Borkh.)**  
3 **Grown in Virginia**

4 Katherine A. Thompson-Witrick,<sup>†,§</sup> Katheryn M. Goodrich,<sup>†</sup> Andrew P. Neilson,<sup>†</sup> E. Kenneth Hurley,<sup>†</sup>  
5 Gregory M. Peck,<sup>‡</sup> and Amanda C. Stewart<sup>\*,†</sup>

6 <sup>†</sup>Department of Food Science and Technology, Virginia Polytechnic Institute and State University, 360 Duck Pond Drive, Blacksburg,  
7 Virginia 24061, United States

8 <sup>‡</sup>Department of Horticulture, Alson H. Smith, Jr. Agricultural Research and Extension Center, Virginia Polytechnic Institute and State  
9 University, 595 Laurel Grove Road, Winchester, Virginia 22602, United States

10  *Supporting Information*



A large pile of red and green apples, likely a mix of cultivars, filling the background of the slide. The apples are in various stages of ripeness, with some showing more red and others more green. They are piled together, creating a textured, colorful background.

# Experimental Design and Purpose

- Selected 21 apple cultivars from AREC plantings and from Albemarle Ciderworks
- Determined concentration of 23 polyphenols in the peel and in flesh
- Understand differences in fruit chemistry across varieties
- Use this information to inform variety selection for cider production

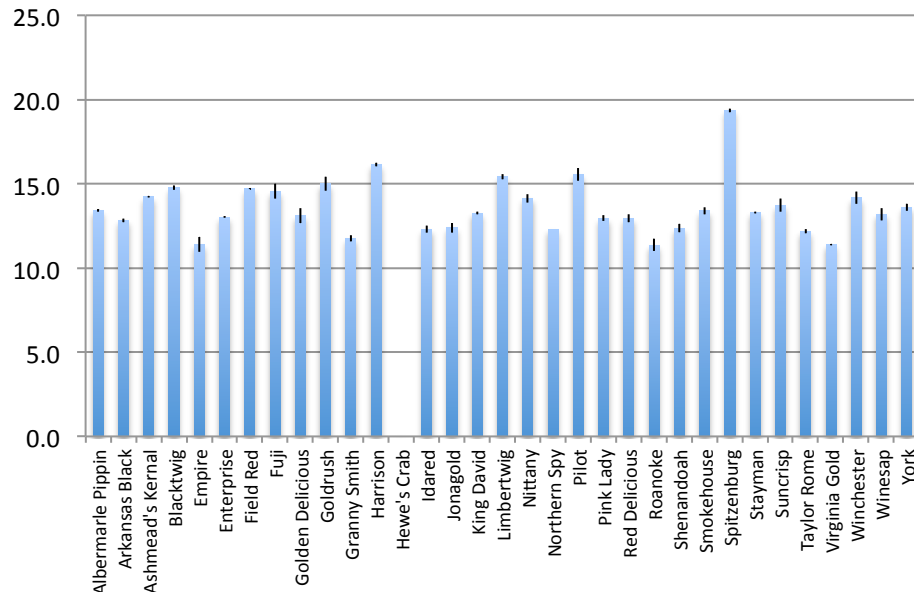


# Cider Apple Varieties Investigated

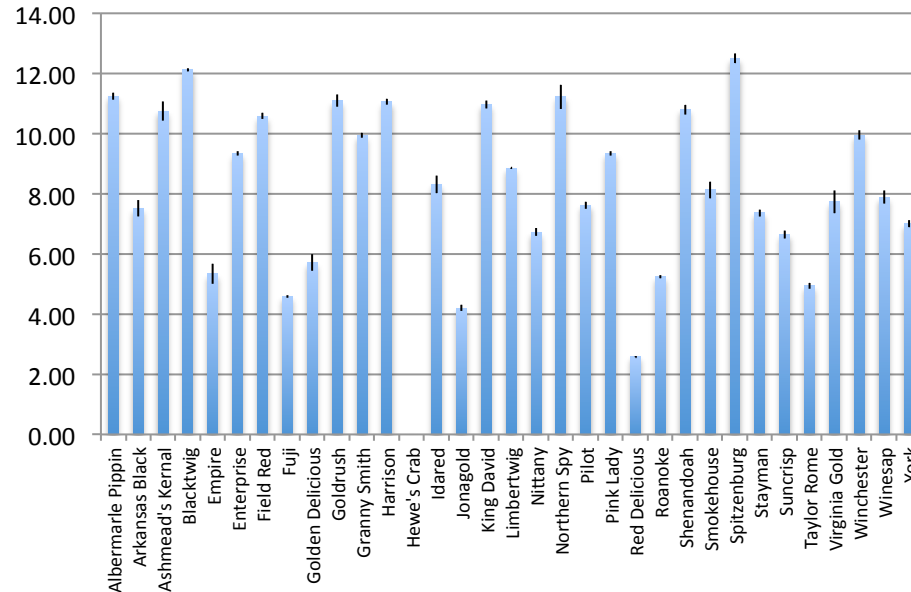
- Arkansas Black\*
- Granny Smith
- Harrison\*
- Fuji
- Idared
- Golden Delicious
- Jonagold
- Newton (Albemarle) Pippin
- Virginia Gold
- Pilot
- Blacktwig
- Pink Lady
- GoldRush
- Red Delicious
- Enterprise
- Rome
- York
- Staymen
- Suncrisp
- Winesap

\*donated by Albemarle Ciderworks

### SSC (Brix)

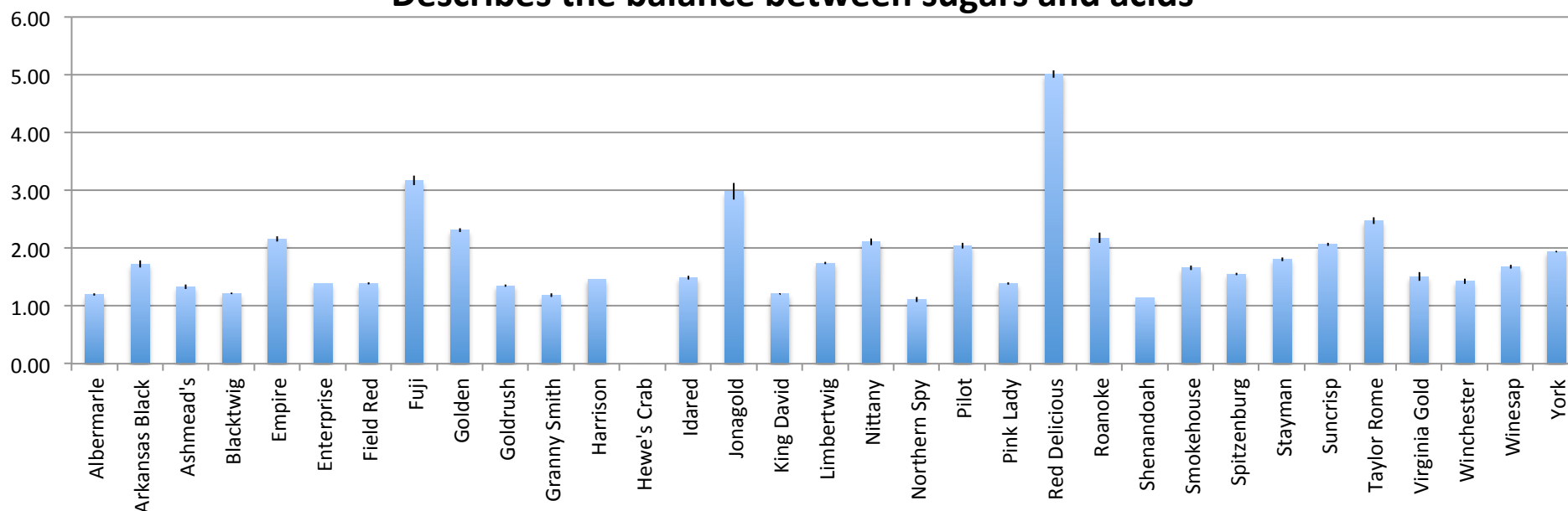


### TA (g/L; malic acid equivalents)



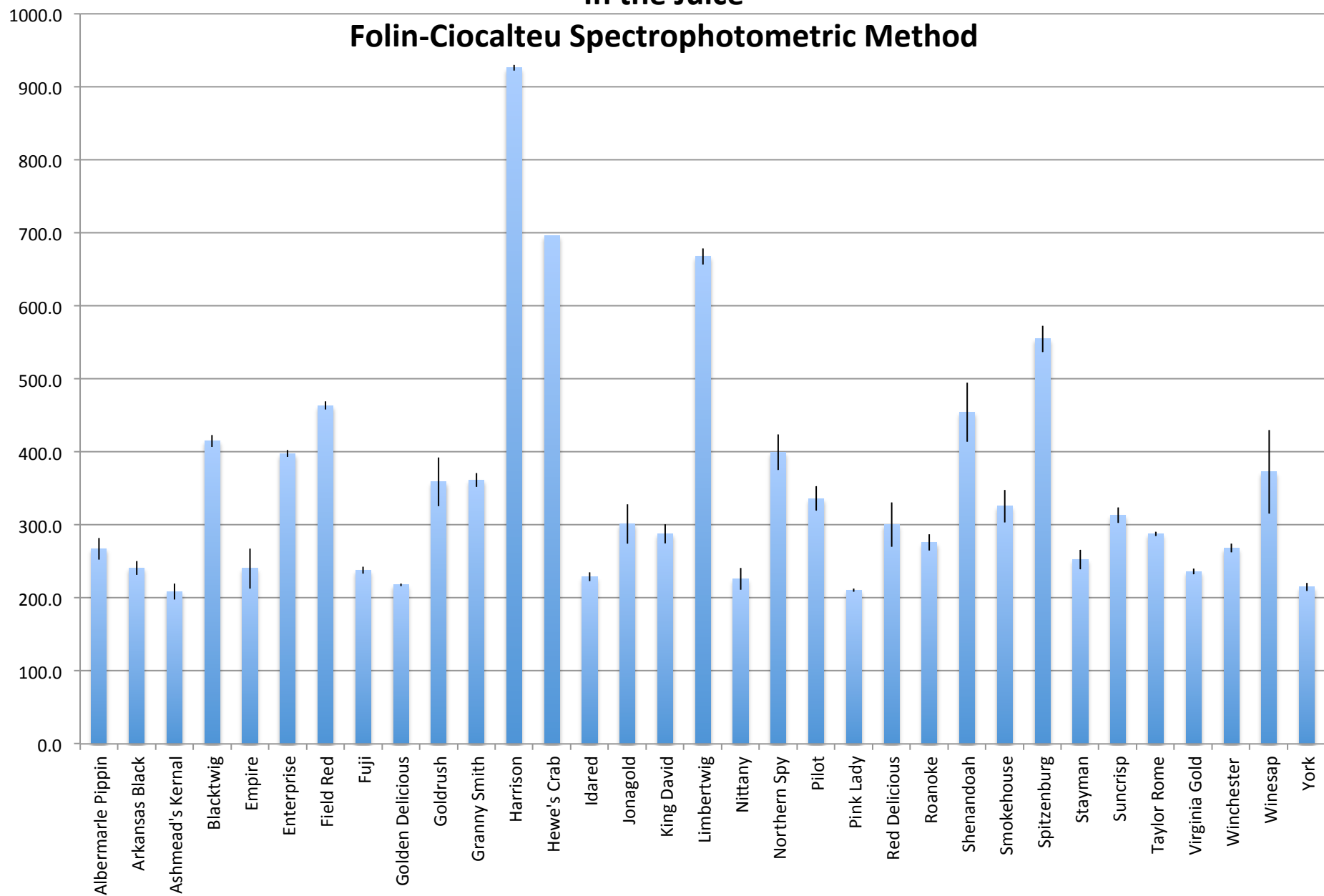
### SSC:TA

Describes the balance between sugars and acids



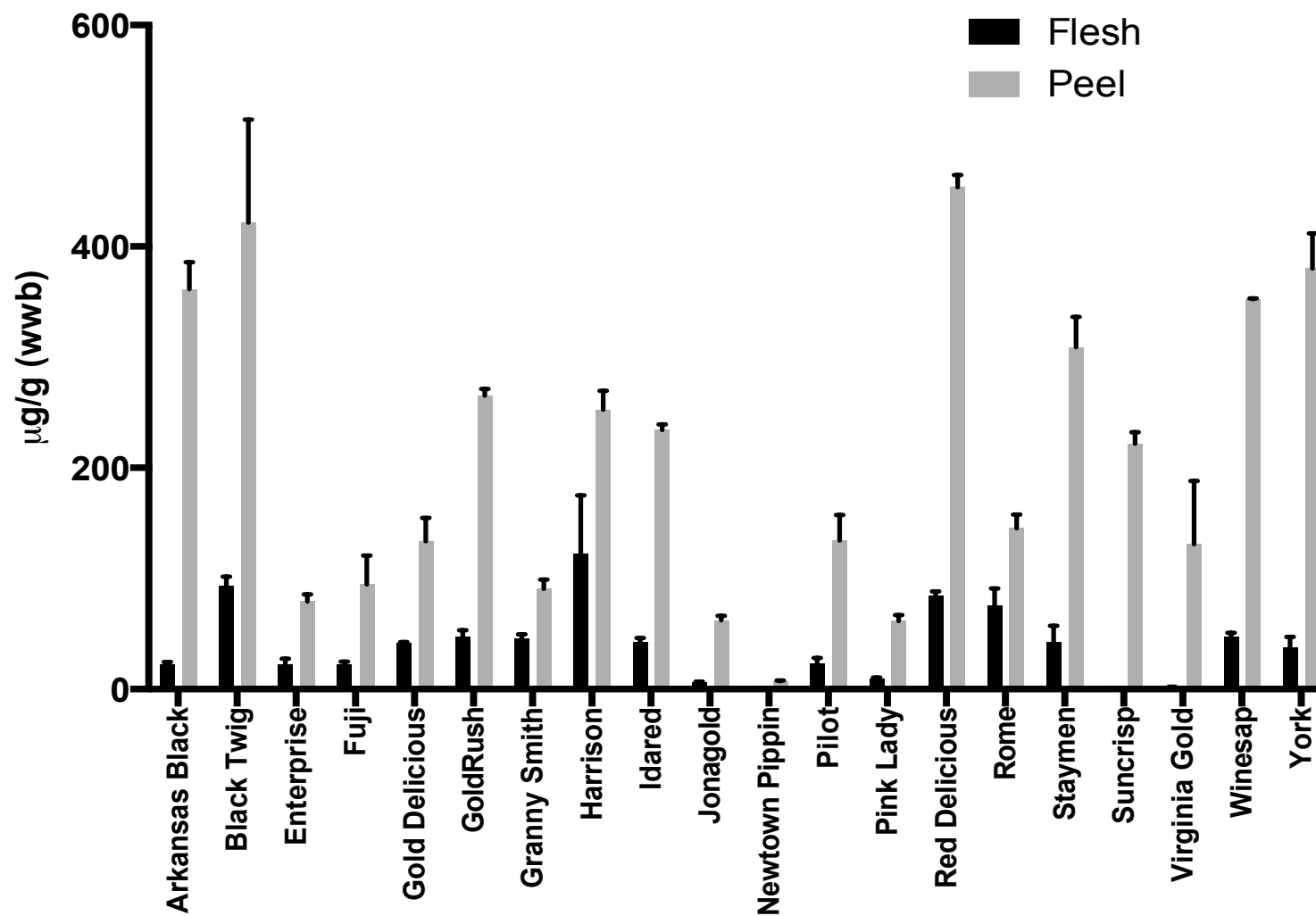
# Total Polyphenolics (mg G.A.E./L) In the Juice

Folin-Ciocalteu Spectrophotometric Method

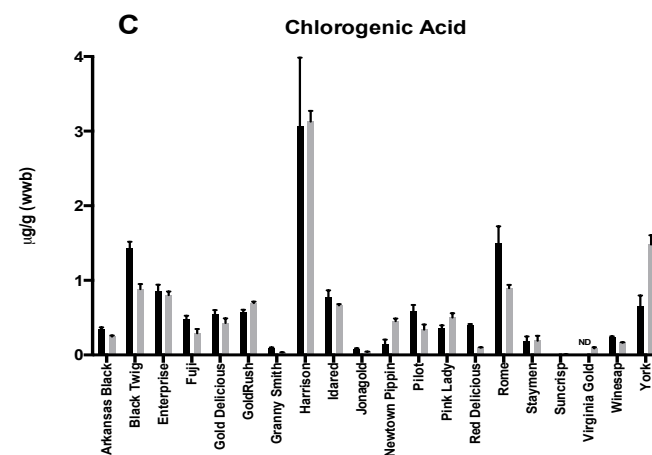
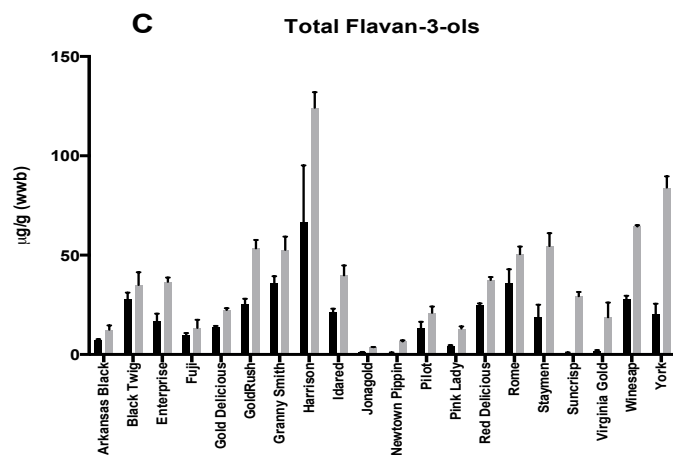
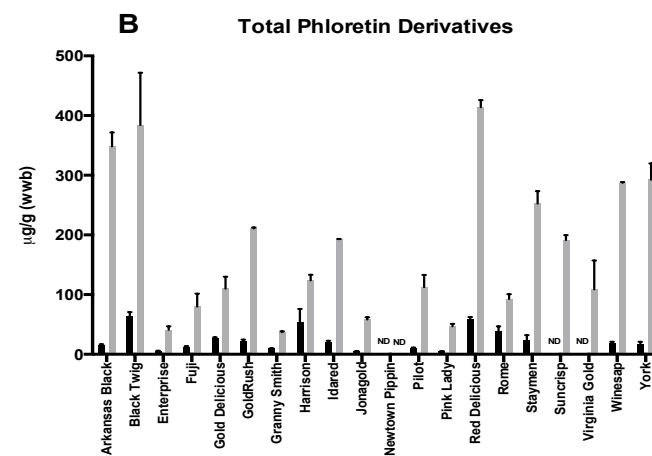
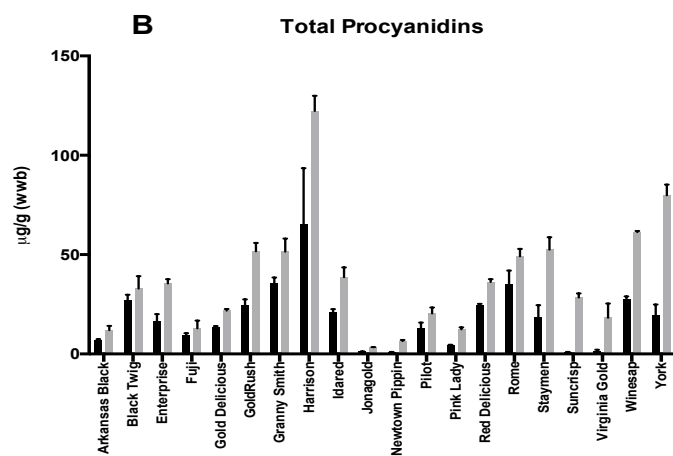
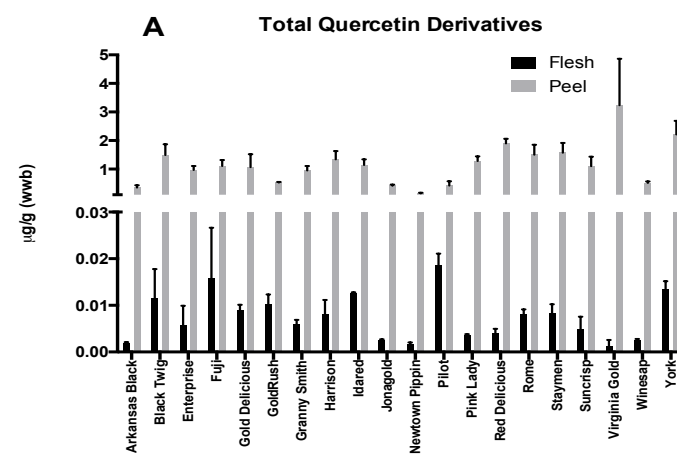
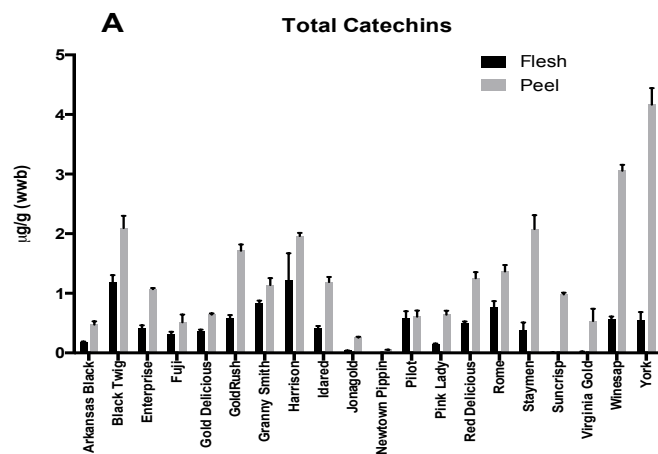


Thompson-Witrick, JAFC, 2014

## Total of Measured Polyphenols



Thompson-Witrick, JAFC, 2014





# What do we know about the influence of orchard practices on cider quality?

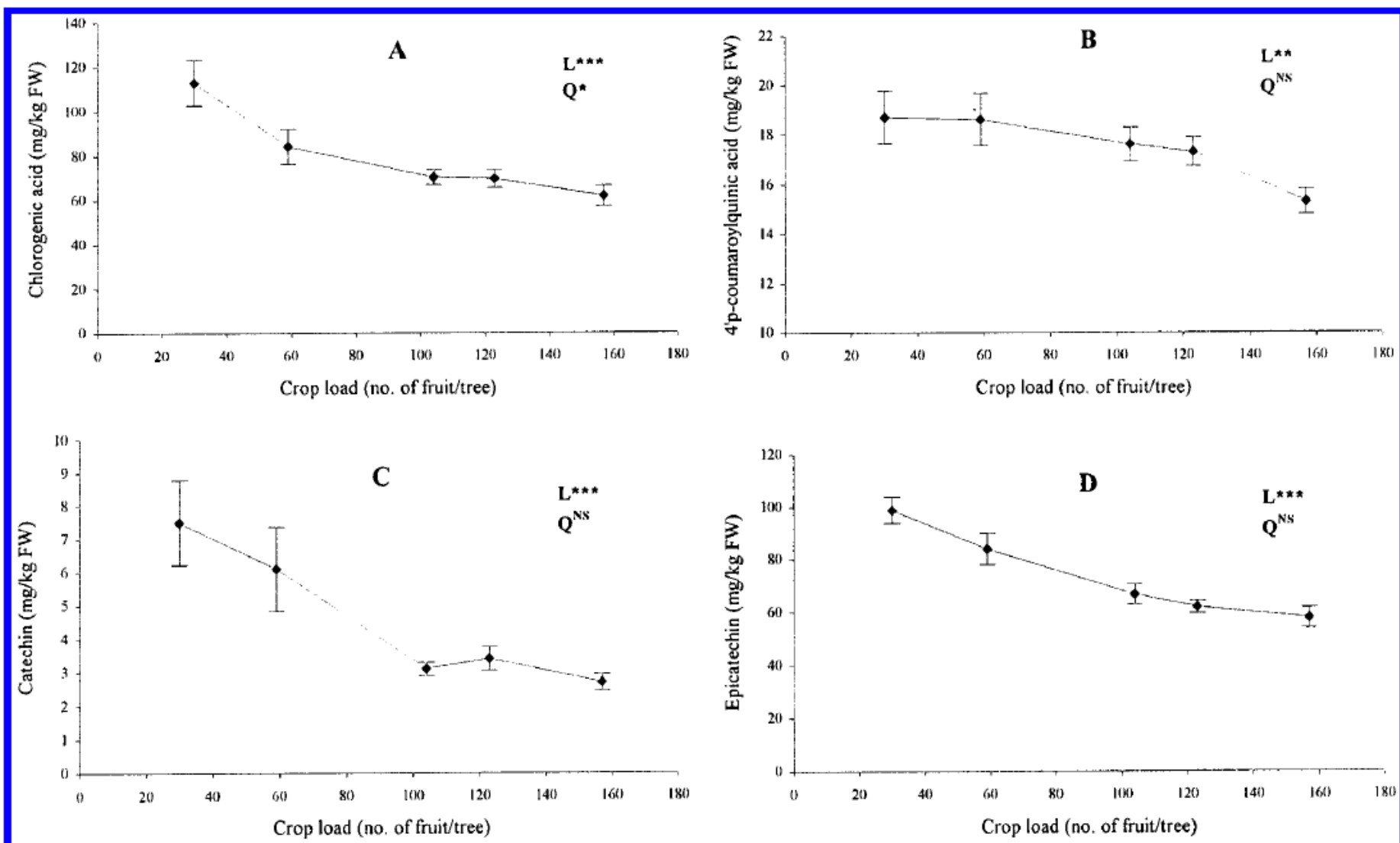
- Rootstocks?
- Training system?
- Crop load?
- Light exposure?
- Nutrient and water management?
- These issues have been worked on in wine grapes, and for dessert apples, but not for cider apples.

# Which fruit quality parameters can be manipulated?

- Yields & fruit size
- Peel color
- Malic acid content
- Sugar content
- Polyphenols/tannins – probably mostly related to sunlight exposure
  - Primary consideration should be cultivar selection

# Effect of Crop Load on York Apples

Treatment	Average Fruit Weight (g)	Starch (1-8)	Red Color (0-100%)	Soluble Solids (°Brix)	TA (g/L)	pH
Low (2 fruit/ TCSA)	209	1.9	97.5	11.1	5.85	3.37
Medium (4 fruit/ TCSA)	159	2.0	96.9	11.0	4.99	3.36
High (6 fruit/ TCSA)	145	3.1	97.5	11.0	4.48	3.38



**Figure 1.** Effect of crop load of cv. Jonagold/M.9 apple trees on chlorogenic acid (A), 4'-p-coumaroylquinic acid (B), catechin (C), and epicatechin (D) content in fresh weight (FW) samples containing fruit cortex plus skin. NS, \*, \*\*, \*\*\*: nonsignificant or significant polyphenol/crop load regression analysis ( $n = 30$ ) with linear (L) or quadratic (Q) trend at  $P < 0.05$ ,  $P < 0.01$ , or  $P < 0.001$ , respectively. Vertical bars indicate standard errors of each mean.

# Cider Cultivars Worth Trying

## (but not tested in replicated trials)

English	French	American (tend to be dual purpose)
Brown Snout (Bittersweet)	Bedan (Bittersweet or Bittersharp)	Esopus Spitzenberg (Sharp) <fireblight>
Chisel Jersey (Bittersweet)	Binet Rouge	GoldRush (Sharp)
Dabinett (Bittersweet)	Frequin Rouge (Bittersweet)	Harrison (Sharp) <poor yields/ fireblight>
Kingston Black (Bittersharp) <poor yields>	Medaille D'Or (Bittersweet)	Hewe's Virginia Crab (Bittersharp?) <fireblight>
Porter's Perfection (Bittersharp)	Michelin (Bittersweet)	Newton (Albemarle) Pippin (Sharp) <hard to thin>
Tremlett's Bitter (Bittersweet)	St. Aubin	Stayman (Sharp)
Yarlington Mill (Bittersweet)	St. Martin	Winesap (Sharp)

# ORCHARD SYSTEMS



Standard Trees  
Processing Fruit  
Sodus, New York





Semi-Dwarf Trees  
Processing Fruit  
Central Virginia





Modified Vertical Axe  
Dwarf Trees  
Winchester, VA





Tatura Trellis  
Yakima Valley, Washington State





Planting systems  
The Tall-Spindle Orchard  
Winchester, VA





Planting systems  
The Tall-Spindle Orchard  
Winchester, VA





# Some Recommendations

- Plant orchards in horticulturally desirable locations (\$15K+ per acre)
- Use precocious rootstocks that are disease resistant
- Use varieties that are going to produce annually and have some level of disease resistance
- Do your homework, an orchard is a 25-year-long investment

# Fruit Quality Recommendations

- Design an orchard that is manageable for your situation
  - Ability to perform orchard activities, spraying, pruning, harvesting
  - Probably going to be dwarf rootstock at moderate density
- Use maturity indices to make harvest decisions
  - Starch-iodine, firmness, flavor, seed color, etc.



**ADDITIONAL RESOURCES**



---

# Apple Rootstocks and Cultivars

[www.extension.org/apples](http://www.extension.org/apples)

**Facebook:** <https://www.facebook.com/eApples>

Supported by a USDA-SCRI grant

## In This Resource Area

### Apple Rootstocks

- All about understanding and choosing the right rootstock

### Apple Cultivars

- Characteristics, descriptions, and how to choose the best to grow and eat

### Establishing an Apple Orchard

- Buying and planting trees

### Managing Apple Trees and Orchards

- Insects, diseases, wildlife and other challenges

### Propagating Apple Rootstocks and Trees

- Grafting, budding, tissue culture, and all about how rootstocks are developed

### Regional Resources

- Links to apple information specific to your area

UNIVERSITY OF MINNESOTA  
**EXTENSION**

PENNSTATE



College of Agricultural Sciences  
Cooperative Extension

Extension Service  
**West Virginia University**



UMassAmherst Outreach **UMass  
Extension**

UNIVERSITY OF MISSOURI  
**Extension**

Live. And Learn.



**NC** State University  
A&T State University  
**COOPERATIVE  
EXTENSION**  
*Empowering People • Providing Solutions*

 **VirginiaTech**



**Cornell University**  
Cooperative Extension

**PURDUE**  
UNIVERSITY  
PURDUE EXTENSION


1865 THE UNIVERSITY OF  
**MAINE**  
Cooperative Extension

www.extension.org/apples

VirginiaTech VA Farms eApple Prod Guides Bills Sports Read Later Press This Prun

ase Update Apples – eXtension Virginia Tech Tree Fruit... Tree-Fruit Horticulture...

These resources are brought to you by the Cooperative Extension System and your Local Institution

**Virginia Cooperative Extension**  
 **VirginiaTech**  
 Invent the Future


Local Extension offices near you  
 Learn more about this institution

Select a different institution

Home About Resource Areas News Articles Answers Learning Lessons

**Apples**

Here are some of our featured articles and activities...



**Controlling Apple Tree Size by Horticultural Means**

The use of dwarfing rootstocks is the primary means utilized to affect tree size. Apples are the fruit crop that most commonly utilizes dwarfing rootstock. Size...

[More...](#)

2 3 4 5 Next

**In This Resource Area**

**Apple Rootstocks**

- All about understanding and choosing the right rootstock

**Apple Cultivars**

- Characteristics, descriptions, and how to choose the best to grow and eat

**Establishing an Apple Orchard**

- Buying and planting trees

**Managing Apple Trees and Orchards**

**Answers from our Experts**

November 07, 2012

What causes my apple and pear trees to look like they have been burned with a torch?

January 11, 2012

How do I find out what variety my apple tree it is? Can my local Extension office tell me ?

November 28, 2011

I missed pruning a few dead branches in an apple tree. Can I remove them in the

## Apple Rootstocks: Understanding and Choosing the Right Rootstock

Last Updated: November 07, 2012

Have a question?  
 Try asking one of our Experts

 Print

 Share / Save

- Apple Rootstock Characteristics and Descriptions
- Summaries of plantings from the NC-140 Regional Rootstock Research Project
- Understanding Apple Tree Size: Dwarf, Semi-Dwarf and Standard
- Controlling Apple Tree Size by Horticultural Means
- Apple Rootstock Influence on Precocity
- Apple Tree Productivity
- Winter Hardiness of Apple Rootstocks
- Apple Rootstock Testing and NC-140
- Support for Apple Trees on Dwarfing Rootstocks
- Apple Rootstocks and Suckering
- Apple Rootstocks and Virus Status
- Interstem Apple Trees
- Parts of an Apple Tree
- Table of Apple Rootstock Susceptibility to Phytophthora spp.

Browse related Articles by tag: virus, apples, standard, dwarf, interstem, apple rootstock, seedling, semi dwarf, suckering

www.extension.org/apples



# Apple Rootstock Characteristics and Description

Last Updated: September 19, 2011

Last Updated: September 19, 2011

Print

Share / Save

Click on a rootstock to access characteristics and descriptions.

Dwarfing Rootstocks	Semi-Dwarfing Rootstocks	Standard Size Rootstocks
B.9	B.118	Alnarp 2
G.16	B.490	Antonovka 313
G.214	G.11	MM.111 EMLA
G.41	G.210	P.18
G.65	G.30	Seedling
G.935	G.890	
M.27	G.969	
M.9	J-TE-H	
Mark	M.4	
Ottawa 3	M.27, M.9 (interstem)/ MM.106 rootstock	
P.2	M.27,M.9(interstem)/ MM.111 rootstock	
P.22	M.26	
Supporter 1	M.7 EMLA	
Supporter 4	MM.106 EMLA	

Characteristic	Detail	Description
<a href="#">Rootstock</a>	G.30	Resulted from a cross between M.9 and Robusta 5 and introduced by the New York State Agricultural Experiment Station, Geneva, NY. G.30 produces a fairly vigorous dwarf tree, similar in size to M.26. Precocity and productivity are also similar to M.26. G.30 is highly resistant to fireblight and quite resistant to crown and root rots, but susceptible to woolly apple aphid. G.30 was tested at 20 locations in the NC-140 1994 semi-dwarf rootstock trial with 'Gala' as the scion cultivar. Compared to M.26 EMLA, the trees were similar in size and in yield efficiency, but produced more rootsuckers. Some of the trees on G.30 broke at the graft union during wind storms. Further testing at Geneva indicated that G.30 has brittle wood and when brittle scions are budded or grafted onto it, trees may break at the union. Therefore, trees on G.30 should be supported better than for most other rootstocks: tying branches to two or more wires has helped prevent tree breakage.
<a href="#">Synonyms</a>	Geneva 30	
<a href="#">Origin</a>	Robusta 5 X M9	
<a href="#">Availability</a>	Trial	
<a href="#">Tree Size</a>	60-65%	
<a href="#">Precocity</a>	Early	
<a href="#">Winter Hardiness</a>	Hardy	
<a href="#">Suckering</a>	Little	
<a href="#">Tree Support Needed</a>	Yes	
<a href="#">Where tested within NC-140 or other research plantings</a>	BC, IA, IL, ME, MI, NC	

G.30 Tree



Image used with permission.

G.30 Blossom



Image used with permission.

G.30 Flower cluster



G.30 Fruit



## Managing Apple Trees and Orchards: Insects, Diseases, Wildlife and Other Challenges

Last Updated: November 07, 2011

Have a question?  
Try asking one of  
our Experts

Print

Share / Save

- Diseases of Apple Trees and Fruit
- Insect Pests of Apple Trees and Fruit
- Wildlife Problems of Apple Trees and Fruit
- Other Challenges of Growing Apples

Browse related Articles by tag: [wildlife](#), [tree](#), [fruit](#), [disease](#), [problems](#), [insect](#), [orchard](#), [apples](#), [apple orchard](#), [apple trees](#), [orchard management](#), [abiotic](#)

## Other Challenges of Growing Apples

Last Updated: December 06, 2012

Have a question?  
Try asking one of  
our Experts

Print

Share / Save

- Effect of Temperature on Apple Trees
- Effect of Water on Apple Trees: Not Enough or Too Much?
- Hail Injury on Apple Trees and Fruit
- Effect of Wind on Apple Trees
- Sunburn of Apple
- Pre-harvest Drop
- Sunscald of Apple
- Sunscorch of Apple
- Fruit Cracking of Apple
- Bitter Pit and Calcium Deficiencies in Apple Fruit
- Apple Skin Russetting

## Pre-harvest Drop

Last Updated: December 06, 2012

Have a question?  
Try asking one of  
our Experts

Print

Share / Save

Apples sometimes drop to the ground before they reach the desired harvest maturity. This pre-harvest fruit drop can cause significant losses in apple orchards. As apples mature, an abscission layer of specialized cells naturally forms between the apple stem and the fruit spur to which it is attached. The abscission layer allows the apple to be released from the tree without causing damage to the tree. However, apples may fall off the tree before the ideal harvest maturity has been obtained.

There are many potential reasons why apples may drop prematurely, and some cultivars are more prone to drop than others. McIntosh apples are prone to falling off the tree before harvest. Apples with short stems may physically "push" themselves off of the branch they are attached to, or other apples that share the same fruiting spur as fruit size increases towards harvest. Both biotic and abiotic stressors can cause fruit to drop prematurely. Drought stress and strong winds are common causes of pre-harvest drop, as well as heavily cropped trees. Apples with severe disease or insect damage will also be more prone to fall off the tree before harvest.

Two plant growth regulators are commonly applied to apple orchards to minimize pre-harvest drop, aminoaminoethoxyvinylglycine (AVG, ReTain®) and 1-naphthaleneacetic acid (NAA). AVG retards maturity and thus fruit drop by inhibiting ethylene production, while NAA decreases abscission of the fruit stem from the bud but can advance maturity after repeated applications.



**Feasibility Study**  
**For**  
**A Small Farm Cidery in Nelson County, VA**

**Prepared by:**

**Matson Consulting**  
PO Box 661  
Aiken SC 29802  
Phone: 803-233-7134  
Fax: 803-233-7938  
[www.Matsonconsult.com](http://www.Matsonconsult.com)



**In Coordination with:**

**VAFAIRS**  
P.O. Box 27552  
Richmond VA 23261  
Phone: 804-290-1160  
[www.vafairs.org](http://www.vafairs.org)



**October, 2012**

This document contains privileged and confidential information intended only for the use of Nelson County. You are hereby notified that any use, dissemination, distribution or reproduction of this document, either in its entirety or in part, without the express written permission of Nelson County or VAFAIRS is prohibited.

- Matson Consulting
- 154 pages
- Market analyses
- Feasibility study
- Sensitivity analyses

# Main Assumptions

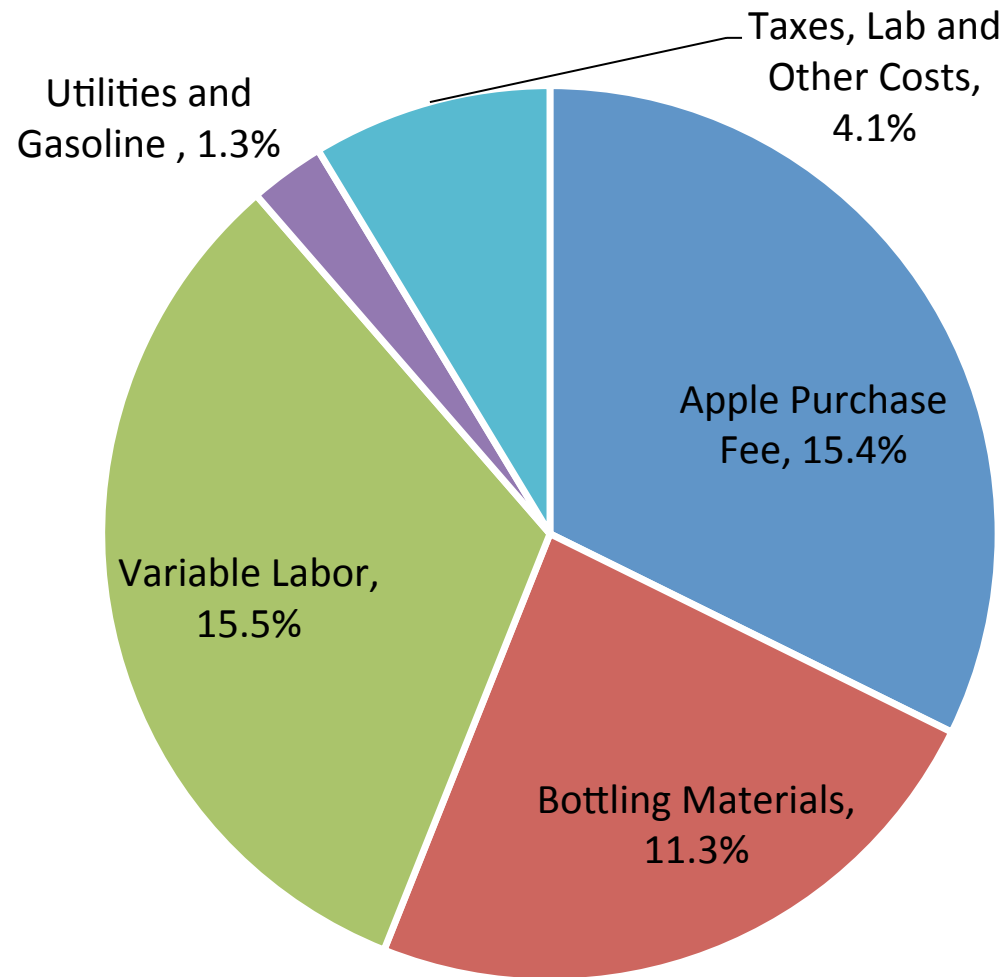
## Prototypical Cidery Model

Balanced approach

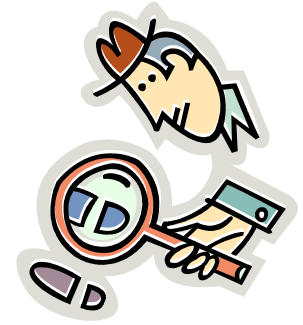
- Small Farm Cidery
  - Producing between 4,500 and 8,400 gallons
- On-Going Snapshot
  - Focus on the break even point
- Majority of Sales Onsite
  - Tasting room, events, wholesale



# Variable Costs Breakdown



# Cidery Feasibility Study: Key Observations



- The region is poised for expansion.
  - Industry is growing nationally.
  - A receptive consumer market exists.
- This project is technologically and economically feasible.
  - The operational break even point when selling is approximately 4,800 gallons of cider per year.
  - At 8,400 gallons the prototypical cidery will generate a net income of approximately \$46,000, or that of an average annual salary.
- Apple prices remain a small percentage of overall costs.
  - If apple prices doubled the operational break even point for profitability only increases by 400 gallons sold annually.

# New National Cider Association & National Conference: [ciderconference.com](http://ciderconference.com)

[Home](#) [Board](#) [Join](#) [Cider Act](#) [Association News](#) [Cider Conference 2014](#) >

Home

## Welcome to the United States Association of Cider Makers

The USACM is an organization of cider and perry producers in the United States. It gathers and shares information about cider production, cider regulations, and cider apple growing, to help members improve their operations, raise awareness, and advance cider in the market.

Upcoming events

The organization was founded in February, 2013 at "CiderCon," the third annual gathering of Cider Makers from across the US. Board members are: Michael Beck from Uncle John's Cider Mill (President), James Kohn from Wandering Aengus Ciderworks, Brad Page from Colorado Cider Company (Vice President), Dan Rowell from Vermont Cider Company (Treasurer), Charlotte Shelton from Albemarle Cider Works (Secretary), Robert Vail from Angry Orchard, and Stephen Wood from Farnum Hill Ciders.







## An Introduction to Hard Cider in the U.S.

Apples

June 16, 2014 | [Print](#)

Like

10

Tweet

4

Pin it

g+1

0

By the simplest definition, hard cider is fermented apple juice. In the U.S., unfermented and usually unfiltered apple juice is referred to as cider or sweet cider. In many other countries, particularly in Europe, the fermented product is called cider and the unfermented product is called apple juice. In this article, we use the term cider to refer to the fermented product.

According to Alcohol and Tobacco Tax and Trade Bureau data, production of hard cider in the U.S. has, on average, increased 73% per year from 2008 to 2012. This is the largest growth in demand since the 1930s when Congress enacted prohibition and ended a more than 300-year tradition of cider production in the U.S. With the increase in cider sales, there is an equal interest in cider apple production, and a need to identify apple cultivars that are suitable for making quality cider.

Apples naturally have a sugar content between 10 and 20%, which produces ciders with a final ABV between 4 and 9%. Federal and state regulations define cider by its alcohol by volume (ABV) content, and specific amounts can differ by state. In most states, the ABV in cider must be below 7% or the cider will be taxed at a higher rate, similar to wine. However, some states, such as Virginia allow ciders to have an ABV of up to 10%. Many commercial cider producers in the U.S. desire an ABV taxation level that more accurately reflects the alcohol level produced naturally from orchard-run fruit.

For marketing and taxation purposes, cider is often categorized with beer, but the process of making cider is much more similar to wine. Briefly, fruit is crushed, the pulp is pressed to extract the juice, and then the juice is fermented by yeast that converts sugar to alcohol. Post-fermentation sugar and acid adjustments might be made to finished ciders in order to maintain flavor profiles and product consistency.

Cider producers make sweet tasting ciders by adding sugar, juice/juice concentrate, or stopping the ferment with high-quality filtration equipment after the fermentation process. If sugar is added to the juice prior to fermentation, the resulting product is higher in alcohol and is often called apple wine. This process of adding sugar prior to fermentation is called Chaptalization and is often used to standardize alcohol levels in ciders and may be used to make higher alcohol products.

Applejack is another cider product with increased alcohol content and is made by freeze concentrating (cryo-distillation) already fermented cider. However, this process also concentrates

### Connect with us



### Your Local Extension:



Local Extension offices near you  
[Learn more about this institution](#)

### Select a different institution

### Donate to Apples

Your donation keeps eXtension growing.

### Recent Webinars

The OrganicA Project Webinar





## Tree Fruit

We are a collective team of Extension specialists and agents who deliver year-round programming for the Commonwealth's tree fruit producers. We provide our stakeholders with the latest research-based information for making sustainable management decisions on their farms. We also develop resources for beginning farmers and home fruit enthusiasts. Our information is disseminated through this website, Extension publications, workshops, on-farm meetings, and one-on-one conversations.

### Tree Fruit Updates

### Facebook Feed

### Home Fruit Production

### Tree Fruit Production in Virginia

### Publications

## Commercial tree fruit production updates

Seasonal updates from Virginia Tech's tree fruit extension specialists and agents. Click on a title to read the full post. Or, visit the blog homepage for [Horticulture](#) (Greg Peck), [Disease Updates](#) (Keith Yoder), or [Pest Management](#) (Chris Bergh) to read previous postings.

- » [Some late season disease pressures](#) Oct 18, 2014
- » [Sold Out: Cider Production Short Course: From Tree To Bottle](#) Oct 17, 2014
- » [Pheromone Trap Catch](#) Sep 25, 2014
- » [Apple Maturity Report for September 16](#) Sep 19, 2014
- » [Cider Production Short Course: From Tree To Bottle](#) Sep 3, 2014
- » [Degree Day Updates – 2014](#) Sep 2, 2014
- » [Summer disease pressures: extended wetting and accumulated wetting hours](#) Jul 29, 2014
- » [Now is the time to sample leaves for nutrient analysis](#) Jul 24, 2014
- » [Predicted 2014 Apple Harvest Dates](#) Jul 24, 2014
- » [Upcoming Tree Fruit Programs](#) Jul 24, 2014

## Subscribe to commercial tree fruit updates

Enter your email address:



Delivered by [FeedBurner](#)

## Featured Publications

- » [Spray Bulletin for Commercial Tree Fruit Growers](#)
- » [Pest Management Guide: Home Grounds and Animals](#)

## Related Topics

- » [Agriculture](#)
- » [Diagnostic and Laboratory Services](#)
- » [Greenhouse, Nursery and Landscape](#)
- » [Master Gardener Program](#)

## Follow VCE



[Social Media Directory](#)

## Need help?

Find your city or county's local office



## Publications and Resources



## Events and Calendars



Explore more Extension resources:



Email subscription service for updates from extension specialists and agents

<http://www.ares.vaes.vt.edu/olson-h-smith/treefruit/horticulture/hard-cider/>

 VirginiaTech  
Invent the Future

Virginia Agricultural Experiment Station

People Pages

Search VAES/ARECs

GO

QUICKLINKS

Alson H. Smith Jr. Agricultural Research and Extension Center

About the Center

People

Tree Fruit

Pathology

Entomology

Horticulture

Grapes

Impacts

Calendar

Contact Us

Virginia Agricultural Experiment Station

Agricultural Research and Extension Centers

College of Agriculture and Life Sciences

Virginia Cooperative Extension

College of Natural Resources and Environment

Virginia-Maryland College of Veterinary Medicine

### Hard Cider Production in Virginia

#### Background

In every major apple-growing region in the United States, there is an exponential expansion of commercial hard cider production. One source lists more than 100 licensed commercial cideries (wineries that specialize in hard cider production) across the country. The majority of these businesses are less than 10 years old, showing the growing popularity of hard cider among consumers. Virginia has at least seven licensed commercial cideries, and several more are slated to open in the next few years. Additionally, individuals who are interested in starting or expanding their orchard, winery, or cidery business are increasingly approaching Virginia Tech, Virginia Cooperative Extension, and Virginia Department of Consumer Services personnel for technical support on growing hard cider apples and making hard cider. Possessing many parallels to the Virginia wine industry, hard cider production can positively impact rural economies by creating a new value-added agricultural opportunity, which promotes tourism, land preservation and Virginia's apple industry.

Similar to wine, there is a large range of hard cider styles available in the marketplace. On the one end of the spectrum are ciders that have high-sugar content and may be made from a mix of fresh apple juice, apple juice concentrate, and/or water. On the other end of the spectrum are ciders that are dry to semi-dry (meaning that there is no or very little residual or added sugar in the final product) fermented from 100 percent apple juice. These ciders are often made from hard cider apple varieties or a blend of apple varieties, which provides a complex flavor profile. Hard cider apple varieties are unique in their chemical composition, having high acid and/or high tannin content. They also have unique names, such as Hewes Crab, Black Twig, and Sheepnose. Many hard cider producers believe that these specialized varieties are essential to the quality and marketability of their products. Hard cider may also be made from varieties commercially grown in Virginia, such as Winesap or Stayman.



Chuck Shelton, co-owner of Albemarle Ciderworks, takes guests on a tour through the facility.

#### Projects

In 2011, a Specialty Crop Block Grant from VDACS was awarded to the Nelson County Economic Development Office to fund economic feasibility studies of hard cider orchards and cideries. The outcomes from this grant were intended to help overcome the limited availability of hard cider apples in Virginia by producing a better

#### Contacts

**Greg Peck, Ph.D.**  
Assistant Professor of Horticulture  
Virginia Tech  
Alson H. Smith, Jr. AREC  
595 Laurel Grove Road  
Winchester, VA 22602  
540-869-2560 ext. 19  
[greg.peck@vt.edu](mailto:greg.peck@vt.edu)

**Gordon Groover, Ph.D.**  
Extension Economist & Associate Professor  
Virginia Tech  
301A Hutcheson Hall  
Blacksburg, VA 24060  
540-231-5850  
[xgrover@vt.edu](mailto:xgrover@vt.edu)

#### Follow Greg Peck

- » Blog: [Tree Fruit Horticulture](#)
- » Facebook: [VTechPomology](#)
- » Twitter: [@VTechPeck](#)

#### Feasibility Study for A Small-Scale Hard Cidery



Dr. Greg Peck  
[greg.peck@vt.edu](mailto:greg.peck@vt.edu)