Cider Apple Research in Vermont

Terence Bradshaw, Tree Fruit and Viticulture Specialist, University of Vermont
63 Carrigan Dr, Burlington, VT 05405. tbradsha@uvm.edu. http://pss.uvm.edu/grape/

(Hard) cider production has increased rapidly in the U.S., with an annualized growth rate of about 50% between 2009 and 2014. This growth has been experienced at all scales, from the large national and international brands to smaller regional and local products. In order to meet growing demand for their products, cideries are thirsty for fruit, which represents a significant market expansion opportunity for New England apple growers. The diversity of scales and product offerings from cideries has translated into demand for several different categories of fruit. Until recently, growers and technical support providers have worked diligently to *avoid* growing cider apples, because the traditional outlet for lower-grade fruit was to (non-fermented) juice processors and relatively low prices paid for those fruit did not support growing specifically for that market. Given changes in the marketplace for hard cider apples, research supporting cider apple production recently began in Vermont and other cooperating states. Given the long-term nature of apple production, this field of study is expected to yield results over the years and decades to come. The information contained herein represents early findings and directions for current and future research.

Apple cultivars

Cider may be made from a wide variety of apple cultivars with finished products presented at differing price points. Three main categories of apple cultivars are purchased by cideries:

1) Traditional dessert cultivars (e.g. 'McIntosh', 'Cortland') from packing house culls, orchard-run hail or otherwise damaged fruit, or intentionally managed (reduced-input) cider orchards. These fruit are widely available but prices are the lowest at $4.00-7.50 per bushel as reported in a 2014 survey of Vermont orchards and cideries.
2) Specialty cider apples, often of European descent (e.g. 'Dabinett', 'Yarlington Mill') or North American crabapple types (e.g. 'Wickson', 'Hewes'), that have unique flavor, acid, and phenolic characteristics suited for making high-quality ciders. These fruit command the highest price of $15-25 per bushel but are planted in limited quantities. Horticultural management and cultivar adaptation to the local soils and climate are not fully understood for these cultivars, which presents an area for long-term evaluation. Because these fruit typically have low eating, storing, and/or processing (other than cider) qualities, there may be market risk in planting them if a suitable cider market cannot be found or if local supply begins to outpace demand.
3) Dual-purpose cultivars that have suitable juice quality characteristics (e.g. 'Northern Spy', 'Golden Russet') and which may be sold to both fresh and cider markets depending on quality and market access. Local markets for these fruit may be saturated or require development in many areas, and horticultural parameters such as low precocity, biennialism, and low yield may limit their suitability in New England orchards.

Planting systems

Much debate has occurred in Europe over decades on the topic of large (standard) vs small (semidwarf) rootstocks and training intensity for cider apples. The concept of planting at lower tree densities is at odds with the direction of the New England dessert apple market toward high density, intensively managed orchards. Some New England growers are planting high-value European cider apples in high density planting systems in order to achieve early production and capture strong fruit prices; others are planting lower-density cider orchards to reduce installation costs and potentially improve juice quality. The prospect of mechanical harvest is important to consider when planting cider orchards. At present, essentially no mechanical harvest systems are used in the U.S. as they are in Europe, and differing training systems would require different harvest machines, each at considerable cost to the grower. Questions remain about what planting systems are ideal for cider production in New England. Because of the lack of replicated trees represented in each orchard in New England, research will continue for a decade or more to answer those questions.

Pest management

If apples are being grown for processing into cider, the cosmetic quality of the fruit is of less concern, which presents opportunities to reduce pest management inputs and production costs. We have begun to evaluate pest management programs on scab-resistant cultivars in order to produce fruit with desired cider qualities that may be grown at in low-input systems.

Reduction of pest sprays may be an important management tool to reduce production costs and meet lower price points for dessert cultivars grown in cider orchards compared to the fresh market. This may be a tempting strategy for growers, but purchase agreements should be in-hand at the beginning of the season to prevent growing unmarketable fruit in the event that a cider buyer is not found or prices paid are too low to justify change in management.

Economics

Evaluating the costs and returns for producing cider apples is critical to frame production methods, management, cultivar and rootstock choices. Results from a 2014 survey of Vermont apple growers and cideries include:

•Vermont growers see opportunity in the growth in popularity of hard cider; but receiving adequate prices was identified as a key threat. On average, the prices they receive are below target prices for all markets.

•Cideries see opportunity in the growth of hard cider's popularity, and increase in quality. Maintaining adequate fruit supply was identified as a major risk. Cideries pay an average price above the growers' mean target price for specialty cider apples but lower than the growers' target price for dessert apples.

•Cideries and apples growers have both expressed interest in dual purpose cultivars for cider making. Apple growers have expressed limited interest in growing specialty cider cultivars even while cider makers have expressed strong interest in purchasing those fruit. Planting new apple

cultivars is a long-term investment and commitment that apple growers most likely will not do unless they have the assurance that cideries will buy the apples when the trees start producing. This might imply entering into more formal agreements such as long-term contracts that are not commonly used at present.

Cost of production assessments will be completed this winter with participating growers and data used to model market opportunities and potential profitability.

Juice quality

All cider apple research within our program is correlated to juice quality, and each cultivar, planting system, and pest management program is being evaluated for effects on potential cider making characteristics. A database of cultivar juice characteristics is being developed in order to evaluate those parameters and their effects on cider quality over multiple seasons. In addition, sample fermentations are being conducted of select cultivars each year in order to evaluate final effects on cider quality.

Sample 2014 juice lab data

Cultivar	Soluble solids (°brix)	pH	Malic acid (mg/l)	Total polyphenols (%)	YAN
Ashmead's Kernel	17.6	3.25	10.40	0.075	262.4
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

Values represent sample data collected from multiple Vermont Orchards in 2014. YAN = yeast assimilable nitrogen.

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