

Horticultural Challenges and Opportunities in Two Organic Apple Orchard Systems with Ginger Gold, Honeycrisp, Liberty, Macoun, and Zestar! Cultivars

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Opportunities for Organic Apples

- Significant Crop in Vermont
 - \$12 mil farmgate
 - 2800 acres (1133 ha)
- Suited to Multiple Markets
 - On-farm sales
 - Agritourism/Agri-entertainment
 - Farmers' Markets
 - Local Retail
 - Wholesale



Significance of Organic Apples in Vermont

- 2006: 5 orchards certified organic
- 2011: 11 certified organic
 - Low acreage (~100 ac./ 40 ha)
- Consumer/retailer demand high



Big Challenges for Organic Apple Production

Horticultural Challenges

1. Tree Vigor
2. Yield
3. Nutrition Management
4. Weed Management

Pest Management

1. Insects
2. Diseases

Organic Apple Opportunities in New England

- In New England there has been a recent shift away from the historically predominant cultivar 'McIntosh' to 'newer' cultivars
 - very susceptible to apple scab
- Consumer preference
- Interest from NE Apple Industry
- Shift in market focus from wholesale to more profitable retail and niche markets.
 - Feasibility of smaller-scale, higher value cropping systems

What Research is Needed?

- Growers want to expand organic production to capture market opportunities
- They want local research, demonstration, information
- Needs
 - ***Appropriate cultivars for organic and sustainable production***
 - Weed and groundcover management
 - Fertilizers and nutrition management
 - Crop load management
 - Pest management
 - Economics

UVM OrganicA Research Orchards

Two major orchard systems growers are using to change to new cultivars established in South Burlington, VT in 2006

- Orchard 1
 - High density (580 trees/acre, 1427 trees/ha)
 - Trellised vertical axe
 - New planting in prepped ground
 - B.9 rootstock (Honeycrisp on M.26)
 - 1.5 x 4.5 m
 - Mulched or cultivated tree row

UVM OrganicA Research Orchards

- Orchard 2
 - Top-grafted 18 year-old M26 planting (2006)
 - Liberty and McIntosh
 - 3 x 4.5 M
 - Mowed sod tree row



UVM OrganicA Research Orchards

- Phase 1: 2006 with the 'orchard establishment' phase completed in 2009.
- Phase 2: 2009- now the 'early bearing' phase, is complete.



Cultivar Selection

Criteria for selection: cultivars that growers identified as important to the future of the industry.

- 'Ginger Gold', 'Honeycrisp', 'Liberty', 'Macoun', 'Zestar!'



Kelp Extract Biostimulants Experiment

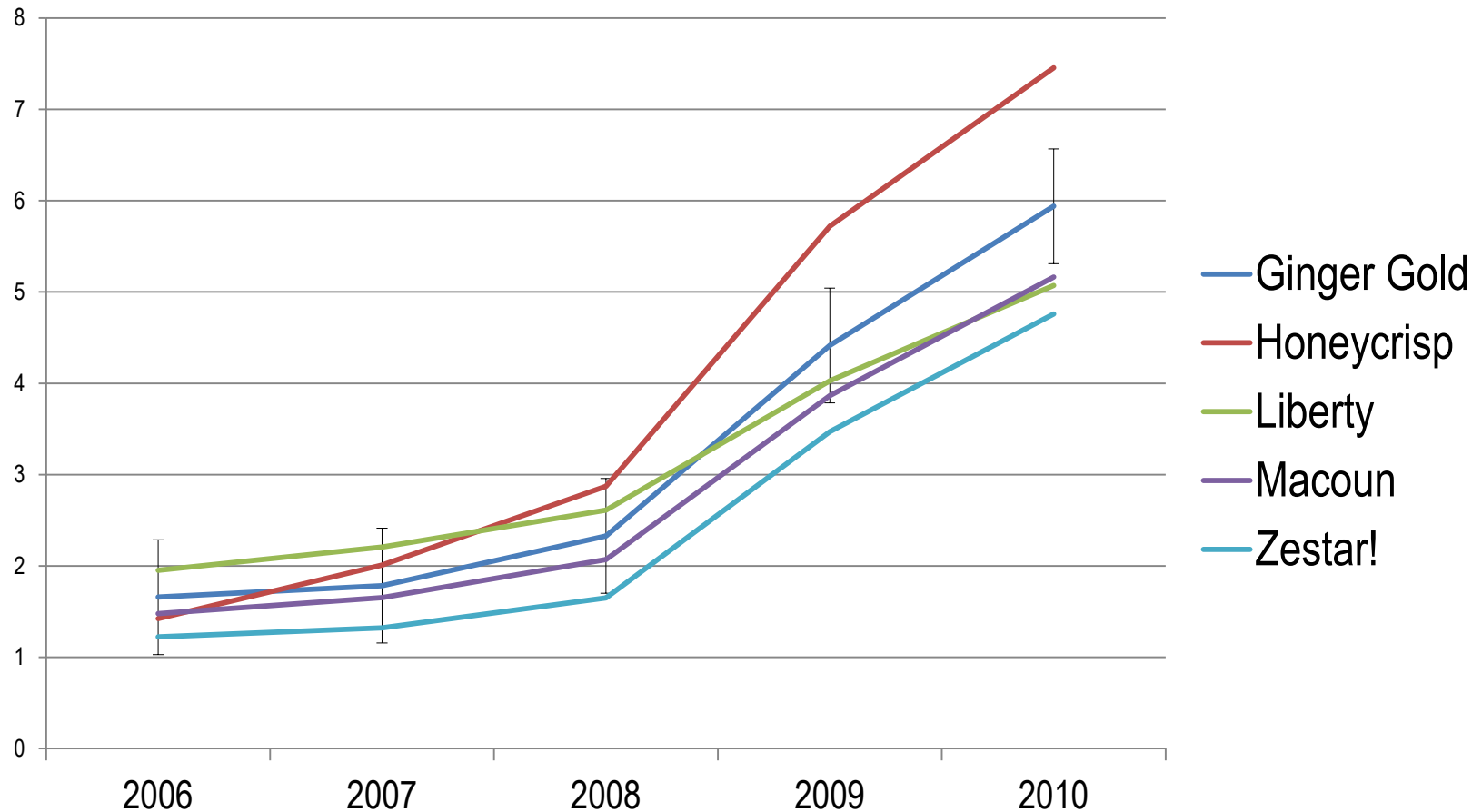
- Reduced tree vigor and fruit yield are frequent challenges experienced in organic apple production.
- To address these issues organic farmers commonly use natural biostimulants in their fertility program to supplement mineral nutrition
- In 2009 and 2010, two Biostimulants materials extracted from the kelp *Ascophyllum nodosum*, Stimplex and Seacrop16, were assessed on Orchard 1.

Cultivar Selection

How are the
selected cultivars
performing in each
orchard?



Orchard 1: Changes in TCSA



Tree Growth: Canopy Size and Shoot Length

Orchard 1. 2011 Tree Height (m), spread (m), and shoot length (cm)			
Cultivar	Tree height (m)	Tree spread (m)	Shoot length (cm ²)
Ginger Gold	2.5a ^z	1.8a ^z	20.9a ^z
Honeycrisp	2.2b	1.5b	17.7ab
Liberty	1.9c	1.4bc	16.2b
Macoun	2.3b	1.3cd	17.6ab
Zestar!	2.4ab	1.2d	17.7ab
^z Different letters within columns indicate significant differences at $P \leq 0.05$ (Tukey's test)			

Bloom Rate

Orchard 1. Bloom rating of trees in Orchard 1 (2009-11) ^y			
	Year		
Cultivar	2009	2010	2011
Ginger Gold	4.9a ^z	2.9b ^z	4.2a ^z
Honeycrisp	3.1c	0.8d	2.7b
Liberty	4.6a	2.2c	4.3a
Macoun	4.2b	2.7bc	3.2b
Zestar!	4.5ab	4.0a	4.6a
^y Bloom rating ; 0=no blossoms, 5=>90% spurs with blossoms ^z Different letters within columns indicate significant differences at $P \leq 0.05$ (Tukey's test)			

Yield

Orchard 1. 2011 fruit yield, drop, yield efficiency , and bushels per acre

Cultivar	# of fruit/ tree	Net wt fruit on tree (kg)/ tree	Net wt drop (kg) fruit per tree	Marketable fruit YE (kg/cm ²)	2011 Orchard 1 bu/ac	2011 Orchard 1 bu/ha
Ginger Gold	52.1a ^z	6.1a ^z	0.57b ^z	1.0a ^z	185.7	459
Honeycrisp	65.9a	7.3a	0.71b	0.97a	222.3	549
Liberty	32.25b	3.4b	2.54a	0.67b	103.5	256
Macoun	31.9b	3.7b	0.62b	0.71b	112.7	278
Zestar!	18.1b	3.0b	0.56b	0.64b	91.4	226

^zDifferent letters within columns indicate significant differences at $P \leq 0.05$ (Tukey's test)

Yield

Orchard 1. Marketable fruit YE (kg/cm²) in 2009, 2010, and 2011

Cultivar	2009- Marketable fruit YE (kg/cm ²)	2010- Marketable fruit YE (kg/cm ²)	2011- Marketable fruit YE (kg/cm ²)	2009-2011 Cumulative Yield (kg/tree)
Ginger Gold	0.13a ^z	0.36a ^z	1.0a ^z	11.1b
Honeycrisp	0.11b	0.11c	0.97a	13.4a
Liberty	0.13ab	0.12bc	0.67b	7.9c
Macoun	0.03d	0.19bc	0.71b	6.6cd
Zestar!	0.07c	0.24ab	0.64b	5.6d

^zDifferent letters within columns indicate significant differences at $P \leq 0.05$ (Tukey's test)

Orchard 1: Conclusions

- Small tree size
- Poor tree health
- Poor yield



‘Ginger Gold’, ‘Honeycrisp’, are performing better than ‘Liberty’, ‘Macoun’, ‘Zestar!’

Orchard 1: Conclusions

Poor tree performance

- Rootstock
 - B.9 has been reported no negative attributes to this rootstock in 20 years of research in New England.
 - Sandy soils
- Lime Sulfur applications
 - Since 1930's –negative impact on apple Pn have been reported.
 - Also reported, decrease in fruit set.

Kelp Experiment

- The majority of the horticultural parameters measured showed no significant effect from kelp extracts on tree growth, crop yield, and fruit quality.

Orchard 2: Grafted trees- Tree Survival

Rating of grafted trees in Orchard 2		
Cultivar	2009 Proportion of all trees rating greater than '2'	2011 proportion of all trees rating greater than '2'
Ginger Gold	0.95	0.95
Honeycrisp	0.95	0.92
Liberty	0.84	0.76
Macoun	0.63	0.63
Zestar!	0.61	0.63
^z Tree ratings: 0 = dead, 1 = too small of a tree to be an appropriate research tree, 2 = borderline to keep as a tree in research, 3 = OK for research; growing well		

Yield in 2011

Orchard 2. 2011 fruit yield, drop, and yield efficiency

Cultivar	# of fruit/ tree	Net wt fruit on tree (kg)/ tree	Net wt drop fruit on tree (kg)/ tree	Marketable fruit YE (kg/cm ²)	bu/ac	bu/ha
Ginger Gold	216.7a ^z	35.0a ^z	9.8b ^z	0.24a ^z	504	1246
Honeycris p	123.8bc	24.2abc	5.3b	0.18ab	348	861
Liberty	92.5c	13.1c	21.0a	0.09c	173	428
Macoun	118.9bc	17.2bc	8.7b	0.12bc	172	425
Zestar!	178.2ab	27.4ab	9.1b	0.19ab	263	651

^zDifferent letters within columns indicate significant differences at $P \leq 0.05$ (Tukey's test)

Orchard 2: Fruit Yield 2009-2011

Net yield (kg) of harvested fruit per tree, Orchard 2^a

cultivar	2009		2010		2011		Cumulative 09-11
Ginger Gold	18.1	a	16.3	a	35.0	a	70.1 a
Honeycrisp	13.9	b	8.2	bc	24.2	abc	45.0 b
Liberty	18.9	a	10.6	b	13.1	c	44.2 b
Macoun	3.2	d	3.5	c	17.2	bc	25.4 c
Zestar!	9.3	c	14.1	ab	27.4	ab	52.7 b

Orchards 1 and 2: Estimated Bushels per Acre

Comparison of estimated bushels per acre for Orchards 1 and 2 in 2011.		
Cultivar	2011 Orchard 1 bu/ha	2011 Orchard 2 bu/ha
Ginger Gold	459	1246
Honeycrisp	549	861
Liberty	256	428
Macoun	278	425
Zestar!	226	651
NOT A STATISTICAL COMPARISON		

Orchard 2: Yield Efficiency

- The measurement: YE (kg/cm²) does not reflect yield performance.

Comparison of estimated bushels per acre and YE (kg/cm ²) for Orchard 2 in 2011.		
Cultivar	2011 Orchard 2 bu/ac	Marketable fruit YE (kg/cm ²)
Ginger Gold	504.6	0.24a
Honeycrisp	348.5	0.18ab
Liberty	173.3	0.09c
Macoun	172.1	0.12bc
Zestar!	263.6	0.19ab

Conclusions:

- Top-grafting appears to be economical and sustainable technique to change existing apple cultivars is
 - cultivar dependent
 - several years may be necessary to determine its success or failure.
- For most horticultural parameters measured, there is no significant interstock effect.

Conclusions:

- In both orchards, 'Liberty' had significantly higher incidence of fruit drop than the other cultivars.
- 'Liberty' and 'Macoun' not performing as well in either orchard

OrganicA

a resource for organic apple production

- Organic Apple Website
<http://www.uvm.edu/organica/>

 OrganicA - a resource for organic apple production

Practical Guide for Organic Apple Production

[Organic Basics](#) - [Horticulture](#) - [Organic IPM](#) - [Economics & Marketing](#) - [Listserves & Blogs](#)

[Case Studies](#) - [The OrganicA Project](#) - [Progress Report](#) - [Additional Links](#) - [OrganicA Home](#)

Please take a moment to send us your input, comments, and suggestions: ["Evaluate OrganicA"](#)



~ [Practical Guide for Organic Apple Production](#) ~

The goal of this publication is to share the authors' experiences and knowledge about organic apple production in New England.
[click here to view the guide](#)



Welcome to OrganicA - a resource for organic apple production

The pages of this site are intended to provide information to New England apple growers who are interested in organic apple production and who want to examine the **opportunities** of organic production given the shift in cultivars and the new research-generated information that is available. This website is a product of [The OrganicA Project](#).

The OrganicA Project is a **collaborative partnership** among three land-grant universities and stakeholders throughout in the region. The project includes both research and a closely integrated organic apple outreach program which is disseminating research findings, information, and insights. **The long-term goal of this multi-state, multidisciplinary project is to enhance adoption of organic apple production in New England** through research that advances the scientific knowledge base and provides practical information to stakeholders.

The OrganicA Project is holistically examining the **opportunities and challenges of organic production** within the two major orchard systems growers are using to change to new cultivars and with five of the top apple cultivars that growers identified as important to the future of the industry. The project was initiated with these two systems in 2006 with the 'orchard establishment' phase completed in 2009. Phase 2, the 'early bearing' phase, is underway. Based on findings from the initial research, an additional orchard was planted in 2011 with eight scab-resistant apple cultivars in a high density orchard system.

Major funding for the project comes from the **USDA Organic Research & Extension Initiative**. Additional funding sources are listed at: [Project Funding Sources](#)



EXTENSION

DIVISION OF AGRICULTURE
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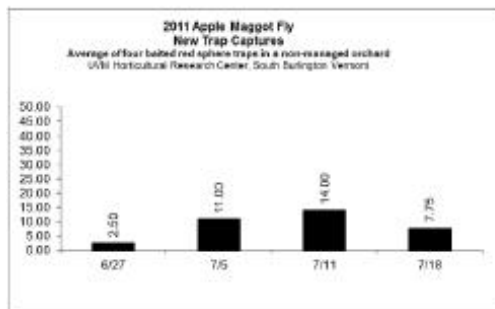
Orchard Observations

<http://www.uvm.edu/~organica/ListserveBlogs/listserveblogs.html>

Organica
a resource for organic apple production

Orchard Observations
Lorraine P. Berkett
July 26, 2011

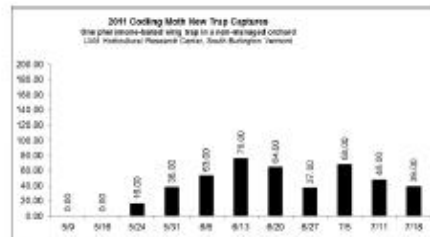
Apple Maggot Flies (AMF) – This part of the growing season is usually a very active time for AMF. Below are the weekly new trap captures in a non-managed orchard at the Hort Farm through last week using baited, sticky red spheres.



We will be checking the traps by tomorrow to determine if intervention is needed in Orchard 1 and 2 this week.



This is a Honeycrisp apple that came from Orchard 1 this morning. It is always not good to see **Codling Moth** (CM) larval damage. Last year we had high fruit damage from this insect; populations seem to have built up at the Hort Farm. As mentioned in the last issue of 'Orchard Observations', trap captures of adult moths have been high again this year (see graph below with updated pheromone trap captures in a non-managed orchard on the farm through last week).



We continue to try to reduce the CM population in the organic orchards through the use of BT and codling moth granulovirus.

I am happy to report that other arthropod 'pests' such as aphids, leafhoppers, and mites are at low levels -- at least presently! The very hot, dry weather we have experienced over the last week is favorable for **European red mite** (ERM) and twospotted spider mite (TSSM) populations and we will be monitoring them closely.

In walking through Orchard 1 and 2, the most prevalent disease symptom is rust lesions -- the wet spring was very favorable for infection -- even on fruit. At harvest, we will be collecting data to see what cultivars had more damage to fruit and foliage.



Rust lesion on Ginger Gold and Honeycrisp.

Rots at the calyx end of an apple can be caused by a number of fungi. The picture below is a Honeycrisp apple with a rot developing. However, as I looked closer at the apple -- that whitish, oblong egg shell at the end of a slender stalk -- that was an egg of an 'aphid lion' which is the immature stage of a green lacewing insect. So, although I did not like seeing the rot, I was happy to see that biological control is occurring in the orchard!!



Honeycrisp apple with rot and an 'aphid lion' eggshell.

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Funding Sources



United States
Department of
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National Institute
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Organic Research & Extension Initiative



Integrated Pest Management (IPM) Program



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Thank You !

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Funding Sources



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