

Horticultural Options When Starting an Organic Apple Orchard

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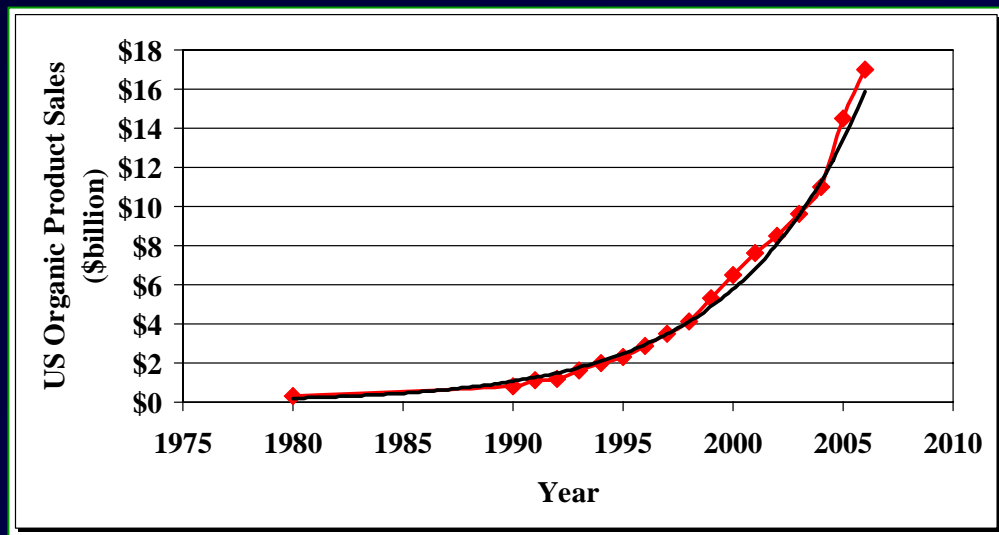


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Why Organic Production?

- ▶ Consumer consumption of organic produce has grown 10-15% every year
 - ▶ The National Organic Program, implemented in 2002, has further stimulated consumption and unified production

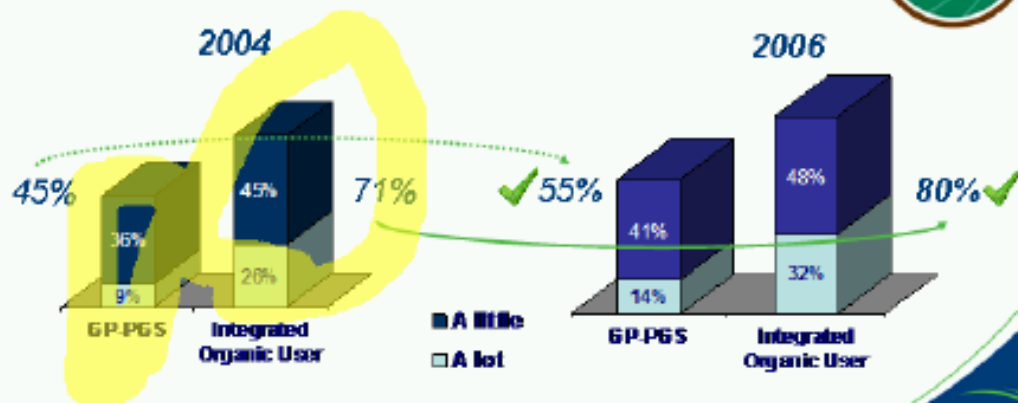


USDA Organic Label Has Growing Influence

(Q60 - % GP/PGS, Integrated Organic Users)

The influence of the "USDA Certified Organic" seal on foods and beverages increased 22% compared to 2004 among Primary Grocery Shoppers.

USDA Certified Organic seal influence on purchase decision...



Source: The Health & Wellness Trade Database™
© The National Marketing Institute, 2005

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USDA Organic Label Has Growing Influence

Can we grow apples organically in the North East?



Yes, it can be done

But, experience tells us organic apple
production is limited and difficult because.....

Organic Production in the NE

Organic apple production in the eastern United States is significantly influenced by cultivar susceptibility to apple diseases because of the weather conditions during the growing season.



photo 2-9 - J. W. Travis

New England

- ▶ In New England there has been a recent shift, away from 'McIntosh', which is the historically predominant cultivar and is very susceptible to apple scab, to 'newer' cultivars
- ▶ Consumer preference
- ▶ Shift in market focus from wholesale to more profitable retail and niche markets.



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





Organic Apple Research at UVM

- ▶ In spring 2006, two organic research apple orchards were established at the UVM Horticultural Research Center as part of a multi-disciplinary, multi-state long-term research project:

OrganicA Project

(<http://www.uvm.edu/~organica/>).







UVM OrganicA Research Project

One objective the OrganicA Project is to incorporate and evaluate “newer” apple cultivars and research-generated knowledge of apple ecosystem dynamics into organic production systems to determine their long term sustainability and profitability.





Long-term performance differences between two systems growers would utilize to get 'newer' cultivars in their orchards



Research

These plantings represent two methods by which growers would change cultivars on their farms:

- ▶ By planting a new orchard (Orchard 1) where young trees, ordered from a nursery, are planted
- ▶ By using a technique called “top-grafting” or “top-working” (Orchard 2)
- ▶ Five cultivars selected: GingerGold, Honeycrisp, Liberty, Macoun, Zestar
- ▶ These cultivars may offer new opportunities for enhancing organic apple production in the region





UVM OrganicA Research Project

Looking at two main techniques for starting a new orchard

- ▶ New planting
 - ▶ Pulling old trees
 - ▶ Ground preparation
 - ▶ High density and trellising
 - ▶ 5 x 15 spacing (tractor limitations)



Orchard 1 (New Planting)

- ▶ The plot was a former apple orchard. Trees were pulled out in early 2003 and the land was left fallow.
- ▶ The organic orchard was planted in spring of 2006 in a RCB design and three-tree replications of each of five cultivars per block
- ▶ Trees were purchased from a nursery as two-year-old trees with B.9 rootstock.
- ▶ 'Honeycrisp' is on M.26 rootstock.
- ▶ Tree training is as a vertical axis.
- ▶ Pre-planting soil preparations and amendment additions were based on soil analysis results.

Horticultural Challenges in Orchard Establishment

Soil and weed management are areas that can pose serious challenges because of the limitations associated with perennial systems.



- ▶ A permanent vegetative ground cover needs to be established before planting.
- ▶ Perennial grass crops have been recognized as a means of improving soil health because they enhance the level of microbial biomass and activity as well as soil structure and organic matter contents.
- ▶ Practices in agricultural systems that improve soil health have also been shown to reduce plant pests, wind and water erosion and improve water infiltration and soil nutrient release and absorption.





UVM OrganicA Research Project

Looking at two main techniques for starting a new orchard

- ▶ Top-working
 - ▶ Existing block
 - ▶ No fallow ground
 - ▶ Work with present tree spacing and rootstock
 - ▶ Only if spacing, rootstock, and tree condition are acceptable
- 
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UVM Organica Research Project

- ▶ Topworking UVM Organica Orchard 2
- ▶ 1-acre block planted 1988
- ▶ M.26 rootstock, 10x15 ft spacing
- ▶ Originally 'Liberty' and 'Redmax' scion
- ▶ Trees in good health
- ▶ Same varieties grafted as planted in new orchard 1
- ▶ RCB design:
 - ▶ Block 1= Liberty understock, Block 2= Mac understock

Orchard 2 (cont.)

- ▶ There are six two-tree reps of each cultivar per block.
- ▶ Trees are trained with a central leader.
- ▶ The existing herbicide strip (approx. 1.5m wide) was converted to perennial cover in 2005.
- ▶ The row middles remain with the existing permanent cover (orchard grass mix and other native species).

Top- working

- ▶ Top-working is the process of changing a tree from one variety to another by means of grafting.
- ▶ Procedure is done in the spring, shortly before new growth starts.
- ▶ The exact time depends upon the method to be used.
 - ▶ The cleft graft is performed before the bark is slipping.
 - ▶ The bark graft is done when the bark is slipping, but before the buds of the stock begin to grow

Advantages to Top-working

- ▶ Not leaving the land fallow for at least one year to avoid replant disease and eliminating costs associated with pre-plant land preparation, buying and planting new trees.
- ▶ Trees will have a full crop sooner than a newly planted tree and will generally produce a full crop by the fourth year from grafting (enough time to transition into organic production).
- ▶ Costs include wages for a professional grafter, buying the scion wood, tools, and grafting supplies.
- ▶ No economic analysis of the advantages, disadvantages, or costs and benefits of top-grafting exists.

Basic Grafting Terms

- ▶ **Grafting:** The art of joining parts of plants together in such a manner that they will unite and continue to grow as one plant.
- ▶ **Scion:** The twig or bud that will become the top part of the new plant. It is what is grafted onto the stock.
- ▶ **Stock:** The root, trunk, or branch upon which the scion is inserted. It may be a young seedling plant or a large tree
- ▶ **Graft union:** The place where the scion and stock grow together.

Basic Grafting Terms

- ▶ ***Cambium:*** A thin layer of living cells between the bark and the wood from which bark and wood tissues are formed.
- ▶ Source of all girth growth in woody plants.
- ▶ As the cambium cells divide bark is produced to the outside and wood towards the inside.



cambium

Block preparation: Topping



Stock preparation: Making the Split



- Clean 'cleft'
made with
axe and
hammer

Scion preparation: Scion Trimming



- Wedge-shaped cut
- Tapered in two dimensions
- Pie-slice

Making the Graft: Scion Insertion



- Line Up Cambium!
- Tapped in with mallet for good contact

Making the Graft: Finished, before waxing



- Tight fit
- Cambium lined up
- First bud on scion lined up with edge of graft

The Final Graft:



Grafting Aftercare

- ▶ Grower must follow up to see that wax covering is intact
- ▶ Shoots arising below graft must be removed
- ▶ Nurse limbs likely will need trimming back
- ▶ Growing scion shoots should be supported

Grafting Aftercare: Buds pushing



- Bud push may take awhile-
PATIENCE

- Pinch out any flowering buds

Grafting Aftercare: Shoot Pinching



Grafting Aftercare: Summer Pruning



- Nurse limb trimmed back
- Shoots below graft removed

Grafting Aftercare: Shoot Support

- Vigorously growing shoots tied to existing support pole





Grafting Aftercare: Training

- ▶ Dormant year after grafting
- ▶ Re-graft failed takes
- ▶ Remove nurse limb
- ▶ Select main leader, remove others
- ▶ Select permanent scaffolds
- ▶ Train central leader, spreading scaffolds during growing season

Crop Load Management

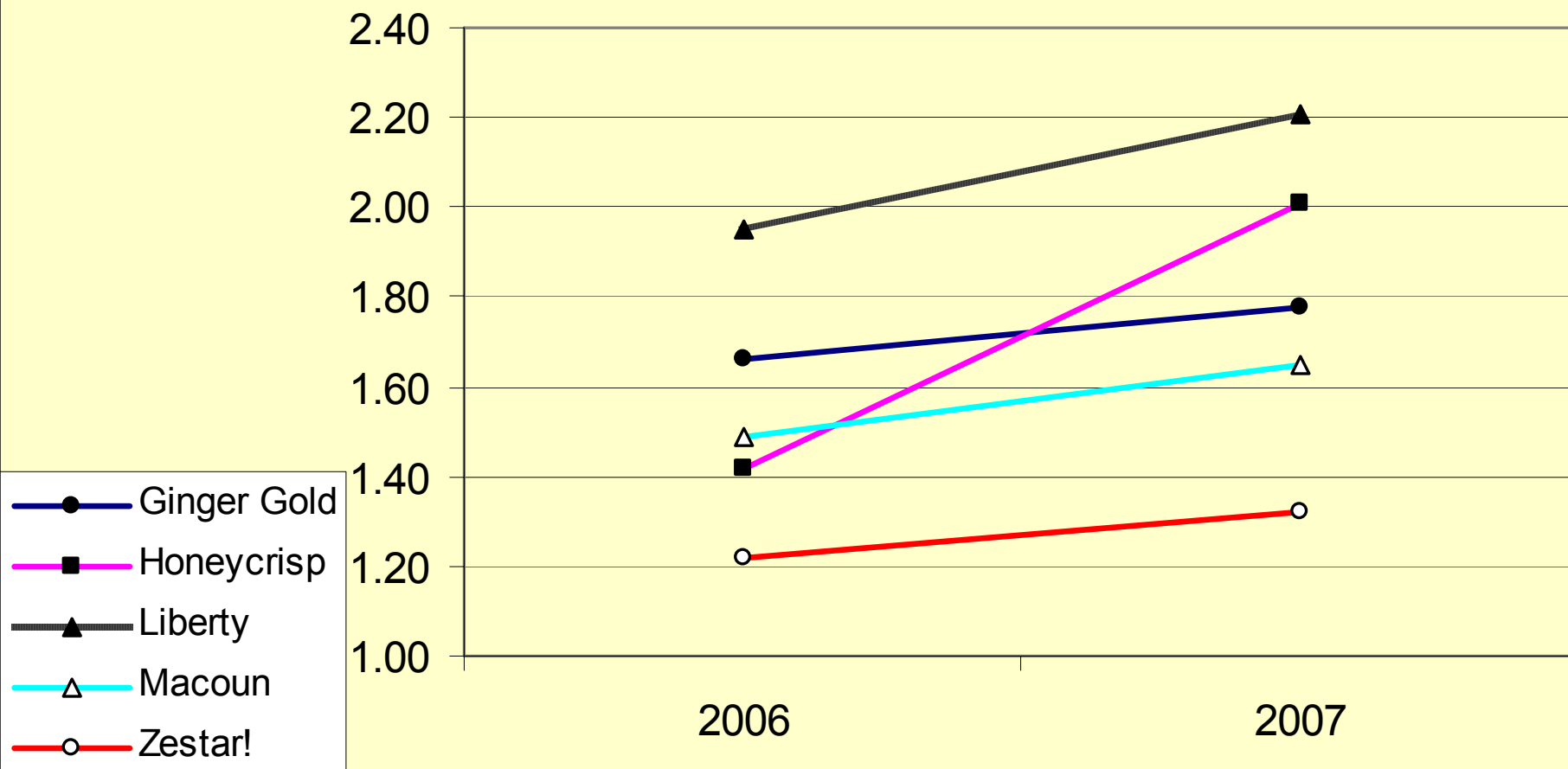
Hand thinning has been conducted in both orchards because the response to chemical thinners is unpredictable in young trees.

- ▶ All blossoms were removed from both orchards in 2006 and 2007.
- ▶ Orchard 2 in 2007 trees were thinned to allow one third of the blossoms to remain.



Preliminary Results

Mean TCSA (cm²) difference for Orchard 1

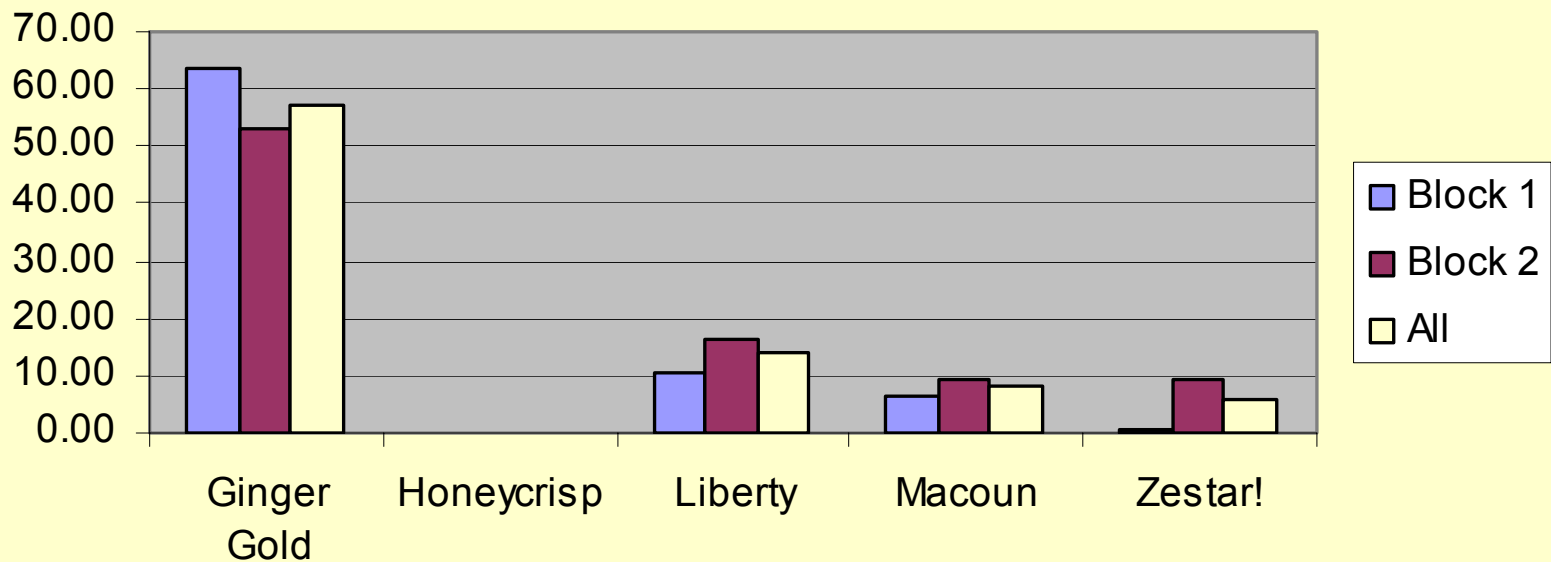


Scion growth assessment in Orchard 2 (2006).

	Ginger Gold	Honeycrisp	Liberty	Macoun	Zestar!
Number of trees grafted	38	38	38	38	38
Total % scions with live Tissue, June 06	99a	97a	100a	99a	60b
Total % scions with flowering tissue, June 06	14ab	0b	0b	1b	34a
Total % of tree with ≥ 1 living scion, Feb 07	97	97	100	100	82

Means within a column with the same letter are not significantly different at $p = 0.05$ (Tukey, SAS 2006)

Scion Flower Cluster Count Orchard 2 (2007)



Take results

- ▶ Warning from R. Allen, Grafter
 - ▶ Zestar! Doesn't graft well, sets too many flowers on 1-year wood
 - ▶ Listen to voice of experience



Orchard 1: Economics

Orchard costs and returns for the actual Block

Year	Calendar Year	Net Income (- harvest)	Labor Cost	Machinery Cost	Input Costs	Growing Costs	Net Cash Flow
1	2003	\$ -	\$ 180.00	\$ 400.00	\$ -	\$ 580.00	\$ (580.00)
2	2004	\$ -	\$ 250.00	\$ 434.00	\$ 183.09	\$ 867.09	\$ (867.09)
3	2005	\$ -	\$ 275.00	\$ 266.00	\$ 520.80	\$ 1,061.80	\$ (1,061.80)
4	2006	\$ -	\$ 2,270.00	\$ 738.21	\$ 6,462.75	\$ 9,470.97	\$ (9,470.97)
5	2007	\$ -	\$ 933.75	\$ 296.11	\$ 298.44	\$ 1,528.30	\$ (1,528.30)

Orchard 1: Costs and returns per acre

Year	Net cash Flow	Accum. Cash flow	Discount Factor	Present Value Net Cash Flow	Present Value of Accum. Cash Flow
2003	\$(1,349)	\$(1,345)	0.94	\$(1,268)	\$(1,268)
2004	\$(2,016)	\$(3,365)	0.88	\$(1,782)	\$(2,974)
2005	\$(2,469)	\$(5,834)	0.83	\$(2,051)	\$(4,846)
2006	\$(22,025))	\$(27,860)	0.78	\$(17,196)	\$(21,752)
2007	\$(3,554)	\$(31,414)	0.73	\$(2,608)	\$(23,055)

Orchard 2: Economics

Orchard costs and returns per **Block**

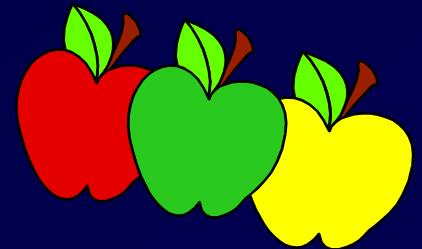
Year	Calendar Year	Net Income (-harvest)	Labor Cost	Machinery Cost	Input Costs	Growing Costs	Net Cash Flow
1	2006	\$ -	\$2,098.30	\$ 289.87	\$ 335.54	\$ 2,723.71	\$ (2,723.71)
2	2007	\$ 313.53	\$1,080.00	\$ 604.80	\$1,044.88	\$ 2,729.68	\$ (2,416.14)

Orchard 2: Costs and returns per acre

Year	Net cash Flow	Accum. Cash flow	Discount Factor	Present Value Net Cash Flow	Present Value of Accum. Cash Flow
2006	\$(4,163)	\$(4,163)	0.94	\$(3,913)	\$(3,913)
2007	\$(3,696)	\$(7,856)	0.88	\$(3,269)	\$(6,941)

Thank you!

Questions?





Pre-plant Preparations

- ▶ Buckwheat was sowed as a cover crop and allowed to go to seed before mowing in early July 2004.
- ▶ A second crop grown from the first crop's seed was flail mowed and the residue disc harrowed in August 2004.
- ▶ The plot was then seeded to a mix of oats and Arlington red clover.
- ▶ This cover crop program was repeated in 2005.
- ▶ In late August, a permanent cover of a mix of creeping fescue (30%), dwarf perennial ryegrass (30%), Kentucky bluegrass (30%), and white clover (10%) was established.
- ▶ Before planting in spring 2006, a strip of finished compost two m wide by 10 cm deep was spread.
- ▶ The trees were planted into this strip.
- ▶ A weed badger cultivating tool has been used to maintain a clean weed-free strip one m wide underneath the trees within the tree row.

Year 2 Percent Scion Survival for Orchard 2

