

Back to Basics Horticultural Practices

M. Elena Garcia and the
Apple Team



**The University
of Vermont**



Fruit Trees

- ▶ Important factors for successful fruit production
 - ▶ Site selection
 - ▶ Proper planting
 - ▶ Adequate fertility
 - ▶ Variety and rootstock
 - ▶ Pruning and training

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Site Selection

- ▶ Survey
 - ▶ Soil conditions
 - ▶ Sun exposure
 - ▶ Available space
 - ▶ Frost pockets



Make a Map!!

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Site selection

- ▶ Soil conditions
 - ▶ Ideal soil for apples
 - ▶ slightly acidic
 - ▶ well drained
 - ▶ medium loam



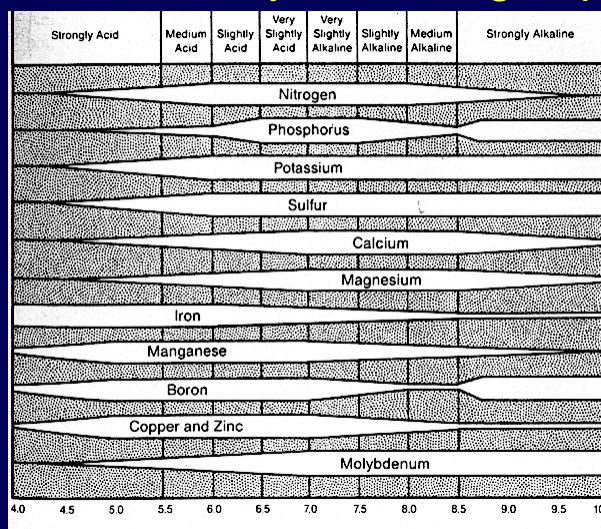
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Site selection

- ▶ Soil Conditions
 - ▶ pH
 - ▶ Range 6.0-6.5
 - ▶ Availability of elements
 - ▶ **Test your soil pH before planting**
 - ▶ Follow up recommendations for soil amendments

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Element availability according to pH



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Soil Conditions

- ▶ Problems:
- ▶ < 5.3
 - ▶ Bark measles due to excess Mn
 - ▶ Ca and Mg deficiencies become more acute
 - ▶ N and K become less available
 - ▶ Al can build up to become toxic

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Soil Conditions

- ▶ Problems:
- ▶ >6.5
 - ▶ B, Cu, Mn, Zn, and Fe uptake seriously reduced

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Site selection

- ▶ Soil fertility
 - ▶ Soil amendments
 - ▶ peat moss
 - ▶ lime
 - ▶ organic matter
 - ▶ mineral elements



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Site selection

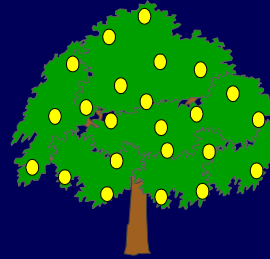
- ▶ Soil conditions
 - ▶ Drainage
 - ▶ Soil type
 - ▶ clay
 - ▶ sandy
 - ▶ hardpan
 - ▶ Best soil: Sandy loam



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Planting Site

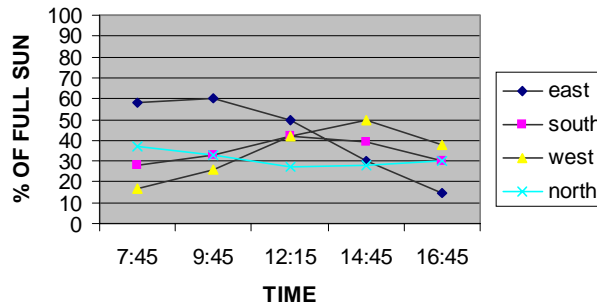
- ▶ Sun exposure
- ▶ Row orientation
 - ▶ North-south best



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Light Penetration

LIGHT PENETRATION FOR FOUR SIDES OF A MATURE APPLE CANOPY (SPUR TYPE 'DELICIOUS'/MM.111)



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Light Penetration

% of full radiation needed for various quality factors in apples

Character	Satisfactory development	Unsatisfactory development
Fruit size	>50%	<50%
Red color	>70%	<40%
Spur development	>30%	<25%

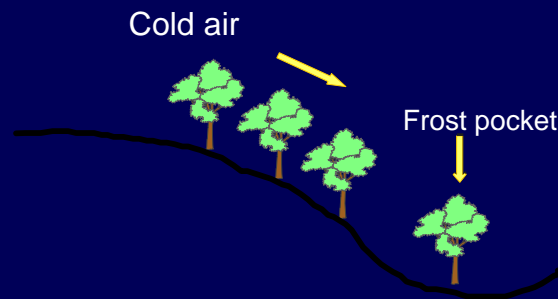
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Planting Site

- ▶ Slope
 - ▶ A 4 to 8% slope is ideal.
 - ▶ A steeper than 10% slope may make it difficult to operate machinery.
 - ▶ Avoid areas at the bottom of the hill where cold air settles and frost pockets form.

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Planting Site



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Weed Management

- ▶ Weed:
 - ▶ Non-harvested plant that significantly reduces crop yield and or quality by competing for essential resources such as nutrients, water, or sunlight without providing for compensatory benefits

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Weed Management

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Weed Management

- ▶ Integrated weed management
- 1. Preventing resistance
 - ▶ Repeated use of same herbicide
 - ▶ Repeated mechanical weed control

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Weed Management

- ▶ IPM
- ▶ Pre-plant eradication and exclusion
 - ▶ Herbicides
 - ▶ Pre-plant cover crops
 - ▶ Selection of rootstocks

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Weed Management

- ▶ Ground covers
- ▶ Care in choosing
 - ▶ Beneficial: Sudan grass and marigold may control some parasitic nematodes
 - ▶ Problems: Some ground covers may aggravate pests problem
 - ▶ Legumes may increase tarnish plant bug damage

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Weed Management

- ▶ Weed control area

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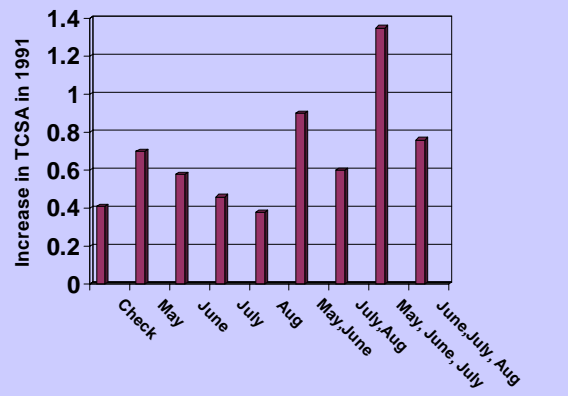
Weed Management

Total shoot growth of apple trees during first year in the orchard in relation to % of weed control within a 6 foot wide row strip (Merwin and Stiles, Ext. Bull 242)

Weed-free area (%)	Shoot growth per tree (ft)	Growth reduction (%)
100	9.28	0
75	8.40	10
50	7.40	20
25	6.63	29
0	5.77	38

Weed Management

Effect of different timing and duration of weed control

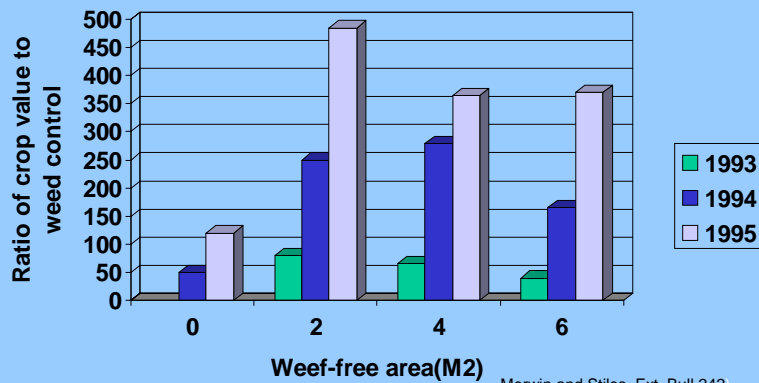


(Merwin and Stiles, Ext. Bull 242)

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Weed Management

Ratio of harvested crop value to yearly weed control cost



(Merwin and Stiles, Ext. Bull 242)

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Weed Management

- ▶ Ground cover management systems
- ▶ Weed control strips with ground covers between rows
- ▶ Permanent ground covers
- ▶ Pre-plant cover crops
- ▶ Natural ground covers

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Weed Management

Weed Management Practices		
TOOL	ADVANTAGES	DISADVANTAGES
Cultivation	Effective Non-selective Equipment readily available Considered "Green"	May damage soil structure Spreads perennial weeds May damage tree /roots Short term control
Mulching	Effective Non-selective Holds moisture Considered "Green" Long-term control	Availability of mulch Cost of mulch/application Attractive to rodents Must be free of seeds
Mowing	Rescue treatment Quick suppression Equipment available Reduce seed spread	Weeds may still compete Quick regrowth Several mowing required May damage young trees
Herbicides	Effective Easy to apply Can be selective Timely	Requires at least 2% OM Directed spray equipment Effects on pest complex Cost varies

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Table 2. Estimated cost per acre of orchard to establish and maintain natural and synthetic mulches, herbicides, grasses or cultivation in a 6-foot wide strip in a NY orchard Integrated weed and soil management in fruit plantings CCE-242)

System	Material(\$/acre)	Labor (\$/acre)	Total (\$/acre/year)
Hay-straw	150-400	145	300-550
Woodchip	70	295	130-315(1-3yr)
1.2 mil poly	150	35	185
Herbicide	10-50	5	15-55
Mowed sodgrass	30	40	70-100
Clean cultivation	15	35	59

Weed Management

- ▶ Herbicides
- ▶ Types
 - ▶ Herbicides labeled for orchards
 - ▶ Herbicide efficacy on various annual weed species

Orchard Nutrition

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Generic Fertilizer Schedule for Apple Tree. (For general purposes only. To be used only when no leaf and soil analysis are available)

Element	Form	Time of application	Ground	Foliar
N	Urea	Pink and first cover		9#/ Ac (1X-3X)
	or			
	Calcium nitrate	Before bloom	2-4#/tree	
		+ 6 weeks	2-4#/tree	
	or			
	Ammonium nitrate	Before bloom	1-2# /tree	
		+ 6weeks	1-2# /tree	
Ca	Calcium chloride	7 to 10 days APF		4- 14# actual Ca /season
		4-6 sprays 14 days apart		
Mg	Dolomitic limestone	In the fall or Spring		
Mg, K	Sul-Po-Mag	Before bloom	2# /tree	
	or			
	Epson Salt	PF, 1st and 2nd cover		10-15# /Ac
B	Solubor	Prebloom, PF, 1st, or 3rd cover		4-8# / Ac
	or			
	Granular	Before bloom		7-8#/Acre
Mn	Manganese sulfate	First cover		5#/ Ac
		or 3 sprays of Mn containing fungicide		
Zn	Zinc sulfate	Dormant or post-harvest		5-11 # / Ac
Cu	Bordeaux or	Dormant		4-6# / Ac
	Copper sulfide			

Mineral nutrition

- ▶ ***Nitrogen***
- ▶ ***Potassium***
- ▶ ***Calcium***
- ▶ ***Magnesium***
- ▶ ***Boron***
- ▶ Phosphorous
- ▶ Manganese
- ▶ Copper
- ▶ Iron
- ▶ Zinc

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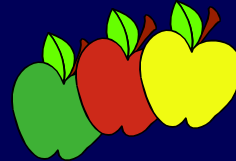
Cultivars

- ▶ <http://orchard.uvm.edu/uvmapple/hort/cultivars/index.htm>

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Variety and Rootstock

- ▶ Large selection
 - ▶ Apples ~10,000 cultivars
- ▶ Questions to consider
 - ▶ Uses
 - ▶ Maturity
 - ▶ Storage



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Cultivar and Rootstock

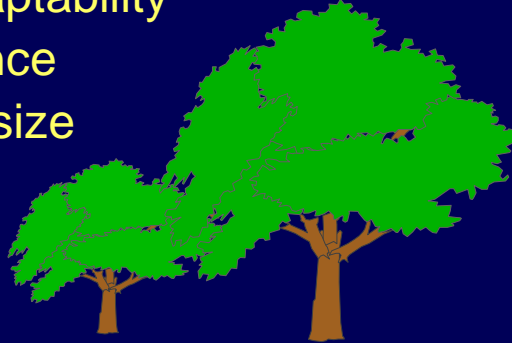
- ▶ What to look for in a cultivar
 - ▶ Type and use for fruit
 - ▶ Disease resistance
 - ▶ Type of tree
 - ▶ Climate adaptability
 - ▶ Market demand
 - ▶ Time of harvest
 - ▶ Pollination



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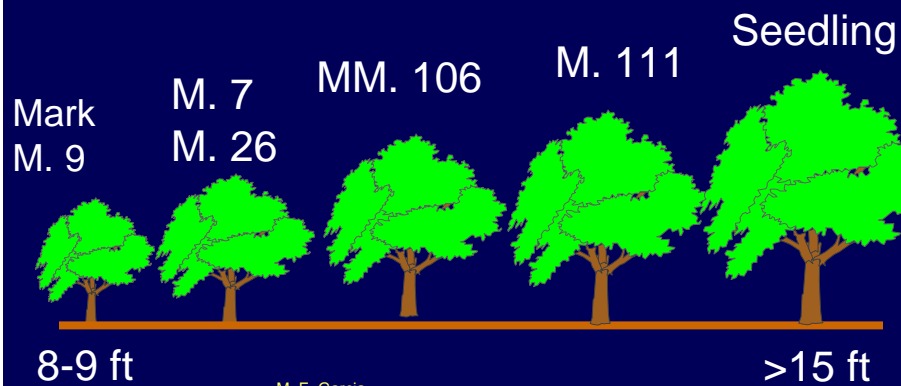
Cultivars and rootstocks

- ▶ What to look for in a rootstock
 - ▶ Hardiness
 - ▶ Soil type adaptability
 - ▶ Pest resistance
 - ▶ Overall tree size
 - ▶ standard
 - ▶ semidwarf
 - ▶ dwarf



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Rootstocks



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Rootstocks

- ▶ <http://orchard.uvm.edu/uvmaple/hort/rootstocks/index1.htm>

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Proper planting

- ▶ When to plant?
 - ▶ Spring
 - ▶ If trees are bare- root
 - ▶ Late April or May
 - ▶ Fall
 - ▶ If trees are in containers



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Proper planting

- ▶ Never let the roots dry out
 - ▶ Soak roots of bare-root trees 1-3 hrs before planting
- ▶ Hole should be twice as large as the root system
- ▶ If putting any soil amendment, mix with soil that will be used to refill the hole

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Proper planting

- ▶ Prune roots
- ▶ Graft union should be 2"-3" above the soil line
- ▶ Pack the soil gently, but firmly
- ▶ Stake dwarf trees
- ▶ Place mouse guard at base of tree
- ▶ "Head back" to about 36" tall

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Adequate Fertility

- ▶ Major nutrients for growth are nitrogen, phosphorous, and potassium (N-P-K)
- ▶ As a rule, no fertilizer at planting time
- ▶ Soil preparation should be done in Fall before planting



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Adequate Fertility

- ▶ After growth begins
 - ▶ 1/2lb of a 16% or 20% nitrate fertilizer
 - ▶ 8-10 inches from tree trunk
- ▶ **AVOID OVER FERTILIZATION!!**



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Adequate Fertility

- ▶ For one year old and older trees
 - ▶ When growth begins, 1/2lb of 10-10-10/ age of tree
 - ▶ In a band or a circle at least 18 inches from the trunk
 - ▶ No fertilizers after June

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Fertility

- ▶ Nutrient disorders

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Fertility

▶ Calcium deficiency



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Fertility

▶ Mg deficiencies



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Fertility

▶ Boron deficiency



▶ Boron toxicity



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Fertility

▶ Zn deficiency



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Fruiting Trees



- ▶ Pollination
- ▶ Most fruit trees are not self-fertile
 - ▶ cross-pollination
- ▶ Cultivars' bloom period should coincide
- ▶ Tetraploid apple cultivars such as Mutsu produce sterile pollen
- ▶ Honey bees are the primary pollinators



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Fruit Thinning

- ▶ Removing some of the developing fruit
 - ▶ To provide top quality, full-sized fruit
 - ▶ To ensure good return bloom the following year
- ▶ Time of thinning depends on the time of flower initiation according to the species

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Time of flower initiation of apples

Fruit	Initiation	Flowers borne on
Apple	Mid-June- mid-July	Terminal buds. 2yr.spurs

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FRUIT	TYPE OF BUDS	FLOWER BUD LOC. AND TYPE	INFLORESCENCE	FLOWER NUMBER	TIME OF FLOWER INITIATION	CHARC. 1ST YEAR WOOD	CHARC. 2ND YEAR WOOD	CHARC. 3RD YEAR WOOD	WOOD PRODUCTIVITY
Apple	Vegetative and mixed	Terminal epicynous	Determinate	5	Early summer	Where buds are attached	Will initiate flower buds for next season	Where fruit is found	Youngest wood most productive
Pear	Vegetative and mixed	Terminal epicynous	Indeterminate	7-8	60 days past full bloom	Similar to apple	Similar to apple	Similar to apple	Similar to apple
Peach	Unmixed	Lateral pericynous	Solitary	1	Midsummer	Where fruit is located	Inferior flower buds		
Cherry	Unmixed clusters	Lateral pericynous	Cluster	2-4	July, after crop is harvested	Sweet Cherry-spurs Sour cherry-long shoots	Sweet Cherry- best spurs Sour cherry-		Long productivity 10-15 years in sweet cherry
Plum	Unmixed	Lateral pericynous	1-3 flowers/bud	1-3	Mid to late summer		Most vigorous spurs Fruit production		Similar to apple, spurs older than 4 years may die

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Fruit Thinning

- ▶ How to thin apples by hand
 - ▶ As early as possible after bloom
 - ▶ Use small hand pruners
 - ▶ Cut off the young fruit by their stems
 - ▶ Leave the largest fruit
 - ▶ Fruit should be 4-6 inches
- ▶ Goal: Keep the “king” fruit
- ▶ June drop



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Fruit thinning

- ▶ Fruit thinners

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Thinning

Table 9. Thinning Windows (Apple Thinning Guide)

Thinning Window	Bloom	Petal Fall	Early Fruit Set	Late Fruit Set	Closing
DAFB		5 to 10	11 to 15	16 to 20	20+
Fruit Size (mm)		PF to 8	8 to 12	16 to 20	20+
Stage (mm)	Full Bloom	Petal Fall	6 8 10 15	20 25	
General Thinning Success	Fair	Best	Good	Good	OK
Past Thinning			<i>Traditional Window</i>		Rescue thinning

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Thinning recommendations

Table 10. Specific thinning recommendations

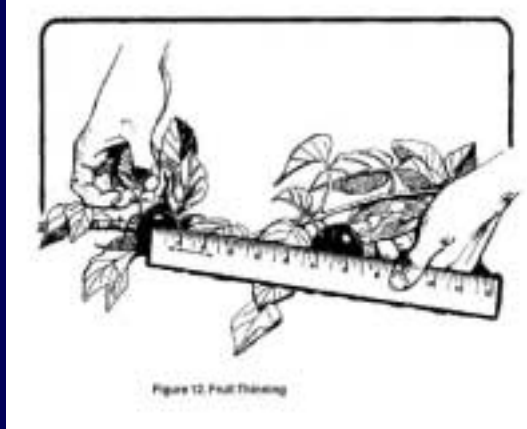
Cultivar	Stage of fruit development		
	Petal fall to 3 mm	7 to 12 mm	15+ mm
McIntosh	Sevin	Sevin+2.5-7.5 NAA or Sevin+50-75 Accel	Sevin
Cortland	Sevin	Sevin	Sevin
Delicious (Promalin at bloom)	Sevin	Sevin (+75 Accel if needed)	Sevin
Empire	Sevin	Sevin+7.5-10 NAA or Sevin+50-75 Accel	Sevin
Macoun*	Sevin+5-7.5NAA	Sevin+5-7.5 NAA	Sevin
Macoun (alternative)	Sevin	Sevin+75-100 Accel	Sevin
Golden Delicious	Sevin	Sevin+10-15 NAA or Sevin+75-100 Accel	Sevin
Mutsu	Sevin	Sevin+5-7.5 NAA	Sevin
Fuji	Sevin	Sevin+75-100 Accel	Sevin
Gala	Sevin	Sevin+5-7.5NAA	Sevin

In all cases, Sevin is recommended to be applied at 1 qt Sevin XLR per acre, and NAA and Accel recommendations are in ppm.
* According to Jim Schupp (U. Maine), NAA at 10 -15 PPM as close to petal fall as possible + Sevin followed by a second application of NAA without Sevin is very effective.

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Fruit Thinning

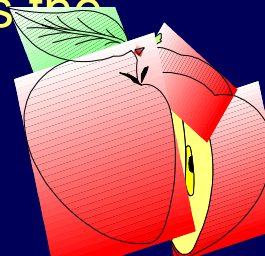
As a general rule for apples, 18 leaves are necessary for one apple to develop satisfactorily



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Harvesting

- ▶ Apples are matured
 - ▶ Stems separate easily from spur
 - ▶ Seeds are brown
 - ▶ One of the best test is the starch index



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Apple bud stages

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Dormant (D)

Apple Bud Stages



Silver Tip (TP)



Green Tip (GT)

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Apple bud Stages (Cont.)



Half inch Green (HIG)



Tight Cluster (TC)



Pink (P)

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Apple bud stages



Full Bloom (FB)



Petal Fall (PF)



Fruit Set (FS)

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Pruning and Training

See Presentation on
Pruning and Training

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Thank You



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