Cornell University Cooperative Extension

Eastern NY Commercial Horticulture Program

Tree Fruit News

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The newsletter this spring will be edited by Steve Hoying until the tree fruit specialists of the ENYCHP team are on board. Questions and comments should be directed to sah19@cornell.edu. Although I welcome phone calls with increased responsibilities I will not be able to answer them in as timely a manner as I want. Messages can be left with Donna Clark at 845-691-6787. I welcome your comments and suggestions although the content is solely the responsibility of the authors. The Tree Fruit News will again be sent to enrolled members of the Eastern NY Commercial Horticulture program every other week throughout the growing season. If you have not yet received enrollment information, don't worry, it is on the way. Thank you for your continued support. We look forward to working with you in 2014. - *Steve Hoying and the ENYCHP*

Region	Station Location	Current Degree Day Accumulation Base 43DD 4/11/14	Current Degree Day Accumulation Base 50DD 4/11/14
Capital District	Albany	19.6	3.1
	Castleton	26.7	2.3
	Clifton Park	9.3	0
Long Island	Northport	63.4	5.6
	Riverhead	61.3	4.1
	Watermill	47.1	1
Mid-Hudson Valley	Clintondale	50.2	2.7
	Highland	44.9	2.1
	Hudson	34.8	2.6
	Modena	30.7	3.2
North Country	Chazy	1.7	0
	Peru	9.8	0

UPCOMING PEST EVENTS		
Phenology/Pest	**Degree Day Range Base 43**	**Degree Day Range Base 50**
Pear Psylla Active Adults	30-99	8-34
Pear Psylla Egg Laying	40-126	11-53
Silver Tip McIntosh	60-110	18-42
Green Tip McIntosh	95-147	36-62
Green Fruitworm 1st Catch	52-154	13-71

Effect of pH on Pesticide Activity

There are times when a pesticide application does not give the results expected even though the grower feels that the correct concentration of the recommended material was used, and that it was applied in the same way that has given acceptable control at other times.

Although the grower may suspect a bad batch of chemical or a buildup of pesticide resistance, the poor results may in fact be due to alkaline water – that is water with a pH above 7.0 A close inspection of the pesticide label will usually reveal a caution against mixing the chemical with alkaline materials such as calcium chloride. The reason is that many pesticides, particularly the OP's undergo a chemical reaction in the presence of alkaline materials that destroys their effectiveness. This reaction is called alkaline hydrolysis and can even occur when the pesticide is mixed with alkaline water.

Hydrolysis is the splitting of a compound by water in the presence of ions. Water that is alkaline has a larger concentration of hydroxide ions than water that is neutral; therefore the rate of alkaline hydrolysis increases as the pH increases. Insecticides are generally more susceptible to alkaline hydrolysis than are fungicides and herbicides, and of these organophosphates and carbamates are more susceptible than pyrethroids. A survey of fruit-growing areas in New York showed that a 30-40% of water sources used for spraying in western NY had pH values above 8.

Compounds that undergo hydrolysis at a moderate rate in this pH, such as Imidan, should be applied soon after mixing to minimize this process in the spray tank. In the survey, a smaller number of sites (9-22%) had pH levels greater than 8.5. Above 8.5, the rate of hydrolysis is rapid enough to cause breakdown of compounds if there is any delay at all in spraying the tank once it is mixed. Above pH 9 even a stable compound such as malathion may breakdown. It is important to note that ground water sources change pH through the season so should be checked regularly thorough the spray season.

In order to prevent alkaline hydrolysis, you must first determine the pH of water used for mixing your chemicals. The most accurate method is an electronic pH meter; however pool chemical kits are an adequate substitute. It is best to apply sprays immediately after the tank is mixed. If a delay in spraying is unavoidable, a buffering agent may be added to the tank when the pH is high and the chemical you are using is susceptible to alkaline hydrolysis. A pH range of 4-6 is recommended for most pesticide sprays. Buffering agents are available from many distributors.

Finally, there are a few pesticide materials that should not be acidified under any circumstances. Sprays containing fixed copper fungicides and lime or lime sulfur should not be acidified.

Evaluating the Soil in the Potential Orchard

Mario Sazo LOFT. Carol MacNeil, Cornell Vegetable Program (this information presented at 2014 LOF Winter Schools).

Fields with heavier soils need to have tile drainage installed at 30-40 feet intervals. Almost every site will require spot drainage somewhere in the field. Field notes on wet spots will be very helpful. Many NY orchards have glacially formed fragipans which prevent drainage and root penetration. They can be ripped through but will reform. In addition, almost all agricultural soils have compaction layers which greatly reduce drainage and root penetration. Wet soils for 2-4 days during active growth can suffocate and kill roots, effectively pruning them off. Such conditions also promote infection and spread of Phytopthora.

A penetrometer measures the depth and severity of soil compaction when it is pushed into soil that has just fully drained. **Spring is the best time to check** (wetter soil appears less compact while drier soil appears more compact). A reading over 300 lbs. /sq. in. (psi) indicates that plant roots will not penetrate and excess water will not promptly drain away. A number of vegetable growers have made their own, uncalibrated penetrometers and use them for determining the depth of compaction, so they will know how deep to rip.

Sometimes soils appear to have compaction, but they may function well, and ponding and plant stress do not occur. This can be clarified by digging a soil pit. If there are ample plant roots all the way down to 18 inches then those root channels will allow deeper root growth and adequate drainage. If you see gray sub-soil it is a good indication of water saturation at some time of the year. Are there earthworms or their channels in the soil? If so, it is a sign of good soil health. In addition to cycling organic matter their channels can be used for root growth and for drainage.

Spring work in the field for the new orchard: Do a soil ball test from a sample as deep as you will rip, plow, till, or plant. Make a soil ball by rolling the soil in the palms of your hands. Press your thumb into the soil ball. If the print of your thumb remains it is too wet. If the soil ball crumbles it is dry enough to work the soil. If needed, deep rip again, plow deep and fit the soil. Add lime and fertilizer as needed and till into the soil. Plant the orchard.

Managing Apple Tree Vigor

By Steve Hoying, Cornell University Dept. of Horticulture

Abstract

Balanced tree growth is essential for the production of maximum crops of high quality fruit. The causes of unbalanced vigor are numerous and mostly under the control of the orchardist. This paper examines the causes of unbalanced vigor in the orchard and suggests methods for bringing an unbalanced orchard into the proper balance. Choice of orchard site, rootstock, planting system, pruning and training scheme, crop load management, tree nutrition, growth regulators, girdling, and rootpruning, are all examined.

Introduction

Vigor is a subjective measure of growth when used in respect to apples trees. Trees that are not growing well are considered ones with poor vigor. Trees with good vigor are ones growing properly. Excessively vigorous trees grow more strongly than we want and contribute to detrimental fruit quality. We must manage the factors that influence "vigor" to produce a marketable and profitable crop (Swensen, 2006).

There really is no one "right" vigor level. Proper vigor levels depend on the specific situation including the age of the planting, apple variety, market, and climate. For example, young trees in medium density orchards are encouraged to grow vigorously to help fill their space as quickly as possible so that they can quickly produce a crop. Older trees that are growing just as vigorously require much more pruning, produce inferior quality fruit, produce smaller crops, and tend toward biennial bearing. There are some apple varieties (McIntosh) that color better at lower vigor levels. Most green or yellow varieties such as Mutsu can attain suitable color even at higher vigor levels. Fruit size is generally better in more vigorous trees but is often at the expense of fruit color and other quality attributes. Apples produced specifically for the processing market are more profitable when larger and aren't required to meet color standards whereas fruit destined for the fresh market must meet a minimum color standard even if at the expense of fruit size. Vigorous varieties in northern climates must be kept at lower vigor levels to prevent winter injury. Early varieties that harden off sooner can be kept at higher vigor levels than later varieties whose harvests do not allow early hardening off.

Factors That Determine Tree Vigor

There are many factors that combine to determine tree vigor (Perry et. al., 2000, Hoying and Robinson, 2000). Perhaps the most important choice in determining potential vigor is the choice of rootstock. The choice of rootstock determines all other orchard system components. Arguably only the variety and site should be chosen prior to the rootstock selection. Local experience often determines which rootstocks are suitable.

The scion also influences vigor but to a lesser degree than rootstock. There are sites in New York where fresh fruit McIntosh cannot be grown no matter the rootstock because of the varieties inherent vigor and poor coloring characteristics combine to produce fruit with lower quality than the market desires.

The potential orchard sites also strongly influence inherent vigor in an orchard. "Soil strength", a combined measure of fertility, soil texture, water holding capacity, depth, cropping history, soil preparation, and Pest abundance all influence tree vigor. The microclimate within a site or region can also influence tree vigor directly or indirectly. For example, sites with the potential for frost can prevent cropping and stimulate growth. Conversely, sites with the potential for deep winter cold can winter injure tissue preventing vigorous growth.

Regional climate has a strong influence on vigor. Generally warm to moderate climates with long growing season produce the most vigorous orchards provided winter chilling requirements are met. New York averages approximately a 170-day growing season, just enough time to mature the crop but not enough time to allow for more tree growth as in other states such as Texas and California.

Why Manage Vigor?

We must manage vigor carefully for many important reasons. The most important reason is to create uniform light distribution throughout the tree. Light is the most important resource necessary for tree growth and fruiting (Palmer and Warrington. 2000.) Excess vigor produces shade that limits photosynthesis and upsets the balance of naturally occurring growth regulators within the tree. This imbalance prevents the production of carbohydrates and other substances that prevents growth and fruiting. Good vigor management also optimizes the use of all other resources available to the tree such as water and nutrients.

Non-uniform light distribution caused by excess vigor ruins fruit quality. In the short term, shade prevents fruit coloring, diminishes fruit firmness, and limits soluble solid accumulation. In the longer term, shade weakens fruiting wood causing poor fruit set, small fruit, and eventually wood death.

Excess vigor is expressed as vigorous vegetative shoot growth. This shoot growth develops at the expense of fruiting sites. There is severe competition between vigorous shoot growth and fruit set in mature trees with excess vigor.

As mentioned earlier, robust vigor early in a trees life is important. We need to fill the trees allotted space as quickly

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Managing Apple Tree Vigor, continued from p. 3

as possible so that we can take advantage of early cropping to help control subsequent vigor as well as pay the bills. There is a rule of thumb that states that trees in the orchard should fill their space within the first three years for maximum efficiency. This is easily possible with dwarfing rootstocks and in many cases where full dwarf fully feathered trees are planted spaces are filled in the second. leaf.

In northern climates excess vigor can lead to winter damage caused by a failure of the tree to harden off before winter cold snaps. This is particularly important in young trees in which we are pushing trees to fill their spaces as quickly as possible. Managing vigor can be important keeping a uniform orchard stand.

Managing excess vigor is also important in maintaining labor efficiency and keeping pruning and training costs down. It can be expensive managing vigor early in the life of an orchard planting but not nearly as costly as later when fruit quality and returns suffers. Field workers, particularly harvest labor, are much more efficient when trees are not excessively vigorous. Excess tree vigor slows down harvest and can result in a poor picking performance with missed or bruised fruit. Spot picking is virtually impossible.

Methods for Managing Vigor

Improper levels of vigor are often the result of mistakes made in the planning or early training and pruning of the orchard. It can often be as important to encourage vigor in a young planting as to control it. Methods for improving vigor include increasing or supplying limiting nutrients through changes in fertilization, better water management by irrigating (and the removal of excess water through drainage), severe dormant pruning to better balance root and top growth or to remove inhibiting natural growth regulators, excessive fruit thinning to temporarily remove competition to growth, and complete weed control to remove competition for essential nutrients and water.

Methods for the reduction of excess vigor includes regular heavy cropping, various pruning and scoring techniques, tree training, nutrient and water management, and the application of growth regulators. Methods used to reduce vigor must be accurately based on the reasons for the excess vigor to begin with.

Crop Control

Annual cropping is the most effective method for controlling tree vigor. Trees annually carrying a full crop of quality fruit are being managed at the proper vigor level. There is no better method of containing excess vigor than carrying a full crop every year. Trees must be carefully managed for annual cropping.

To maintain annual cropping, growers must keep an appropriate balance of fruiting and vegetative wood through proper pruning practices. Removal of too much fruiting wood can further induce vegetative growth at the expense of fruiting.

Nutritional levels important for bloom, fruit set, and wood growth must be appropriate. In New York, we know that we have achieved that balance if we have approximately 8-12 inches of new growth per season depending of the varieties growth habit. More than twelve inches of growth indicates excess vigor, less indicates weak vigor. Essential nutrients include Nitrogen for flower bud formation, leaf development, fruit set, and shoot growth, boron and zinc for pollination, growth regulator synthesis, and root and shoot growth, Potassium, calcium, and magnesium for fruit growth and condition.

Pollinating insects and pollinizing varieties must be present and active. Under New York's generally poor pollinating conditions we recommend at least 1 hive of bees per acre. Hives should be grouped in protected areas out of the wind with hive entrances facing south. All competitive bloom on the orchard floor should be removed before bees are placed in the orchard. Cross pollination is ensured by either using 3 different crab apple varieties mixed throughout the orchard or by alternating compatible varieties with overlapping bloom within the orchard block with no row being more than two rows away from the cross pollinating cultivar.

Weather conditions during bloom and fruit set must also be appropriate, i.e. warm enough to prevent freezing and to foster pollination and fruit set. Where frost is a problem, wind machines (where inversion layers are present), irrigation, or heating is sometimes practiced. This is not a common practice in Western New York because the temperature moderating effects of Lake Ontario limit frost. Site selection before the orchard planting is really the key.

Proper fruit thinning prevents alternate cropping. We use a variety of materials and techniques to properly thin an apple crop (Agnello et al. 2006). Naphthalene acetic acid (NAA), accel and carbaryl (Sevin) are our primary thinning chemicals. The timing of chemical fruit thinning is from late bloom until 2 weeks after bloom depending on weather conditions and variety. The rate of chemical depends on the variety and is modified by temperature, humidity, pollination, and amount of frost. Hand thinning to prevent alternate cropping can also be done but is risky since it must occur soon after actual crop set and before June drop. It is also expensive and difficult requiring labor during a difficult time of the year. Most hand thinning in New York is done not for crop control of tree vigor but to enhance fruit quality (size and color).

Secondary pest control practices must minimize harsh tree stresses such as leaf bronzing and defoliation so that sufficient carbohydrate accumulation to the roots and fruit buds can occur. This is especially important in our climate to prevent winter damage. Too heavy a crop combined with impaired foliage can cause severe winter damage by

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preventing fruit buds from hardening off to the degree necessary to survive winter cold.

Pruning

Pruning techniques are very important managing vigor (Forshey, 1971.) Trees must be regularly pruned to maintain the proper light environment throughout the tree. Light is essential for fruit bud initiation and for the production of quality fruit. It is important to realize that light can be limiting within the tree even in apparent high light environments.

Improper pruning can result in excessive shoot growth that will shade fruit and fruit buds. Dormant thinning cuts (removal of entire branches) as opposed to heading back cuts (removal of part of a shoot or branch) induce less vigor managing auxin levels within the tree. Removal of whole branches improves the light environment throughout the tree without inducing the vigorous vegetative regrowth that heading cuts do. There are special circumstances such as sunburn sensitivity where heading cuts are appropriate but must be done cautiously to minimize an imbalance in vigor.

Late dormant pruning (after growth starts but before leaves start to export materials back to the tree) can be used to reduce vegetative growth in overly vigorous trees. This type of pruning removes carbohydrate and nitrogenous reserves that have already moved to the growing points reducing the total energy available for growth. This type of pruning should only be done in overly vigorous situations.

Summer pruning is widely used in Western New York to keep trees within their allotted space and to improve fruit quality. This practice will reduce tree vigor when overdone. Excessive summer pruning will also reduce yield, fruit size, fruit quality, winter hardiness and increase sunburning. Our rule of thumb is to cut only to expose fruit to sunlight or to keep a tree within its allotted space.

Complete "scoring" at bloom using a knife to make a thin cut around the entire trunk of the tree can improve fruit set that in turn reduces shoot growth by setting additional fruit. It is not effective on trees with no bloom. Wounds heal quickly and scoring need be done annually.

In contrast "gridling" is a semi-permanent restriction of water and carbohydrate to the tree. We use a chainsaw to make half circle cuts on opposite sides of the tree spaced 5 inches apart and overlapped 2-4 inches. This technique is easy to perform and is specific to the tree as one can assess individual tree vigor and make adjustments on a tree by tree basis. Girdling need only be done when cuts completely heal (1-3 years). Fruit size is not reduced and the tendency to alternate bearing is reduced. Wood rotting fungi, herbicide applications, and fireblight infection in the cuts may be a problem.

There are legal agricultural chemicals available which can also help to control vigor. Naphthalene Acetic Acid (NAA) for thinning ensures free flower buds to set an adequate return crop. Annual cropping through thinning helps to control vigor. Multiple summer applications of NAA or ethephon applied after the trees are past sensitivity to thinning response will also help to differentiae buds for the following year and ensure consistent cropping. NAA is also registered for prevention of root suckering and water sprout growth preventing vigorous growth response. In high density situations, the Europeans use high concentrations of NAA as chemical girdlers, this prevents localized excessive growth. Multiple applications of relatively low concentrations of NAA to growing foliage can also slow growth. All growth regulator sprays for vigor control must be understood and used precisely to be effective.

Prohexadione calcium (Apogee) blocks the synthesis of gibberellins; the naturally occurring plant growth substances that promote shoot elongation. When Apogee is applied, the actively growing shoots on the apple tree slow down over the following 10-14 days, then stop elongating altogether. The result is shorter shoots with fewer leaves. This arrested growth lasts for three to six weeks, depending upon the dose used, and the natural vigor of the tree. By making one or two repeat applications of Apogee, you can control growth for the entire season, under New York growing conditions. Reducing shoot growth increases the penetration of sunlight to the interior of the tree canopy, improving fruit color and fruit quality. Dormant pruning time is reduced by 40-50%. and the need for summer pruning may be eliminated.

Experience is the most important method for controlling tree vigor. Only experience with your climate, choice of rootstocks, varieties, soils, and training and pruning methods will make you an effective manager of tree vigor.

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MICHIGAN STATE UNIVERSITY EXTENSION VAN BUREN COUNTY HORTICULTURE

Critical Spring Temperatures for Fruit Bud Development Stages

Apples									
Apples	**Silver tip**	**Green Tip**	**½ inch green**	**Tight Cluster**	**First Pink**	**Full Pink**	**First Bloom**	**Full Bloom**	**Post Bloom**
Old temp	16	16	22	27	27	28	28	29	29
10% kill	15	18	23	27	28	28	28	28	28
90% kill	2	10	16	21	24	25	25	25	26
Pears									
Pears	**Bud scales separating**	**Blossom buds exposed**		**Tight cluster**	**First White**	**Full White**	**First Bloom**	**Full Bloom**	**Post Bloom**
Old temp	18	23		24	28	29	29	29	30
10% kill	15	20		24	25	26	27	28	28
90% kill	0	6		15	19	22	23	24	24
Apricots									
Apricots	**Swollen Bud**	**Tips separate**	**Calyx red**	**First White**	**First Bloom**	**Full Bloom**	**In the shuck**	**Green Fruit**	
Old temp	--	23	--	25	--	28	--	31	
10% kill	15	20	22	24	25	27	27	28	
90% kill	--	8	9	14	19	22	24	25	

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Critical Spring Temperatures for Fruit Bud Development Stages, continued from p. 6

Peaches									
Peaches	Swollen Bud	Calyx Green	Calyx Red	First Pink	First Bloom	Full Bloom	Post Bloom		
Old temp 10% kill 90% kill	23 18 1	-- 21 5	-- 23 9	25 25 15	-- 26 21	27 27 24	30 28 25		
European Plums									
European Plums	First Swelling	Side White	Tip Green	Tight Cluster	First White	First Bloom	Full Bloom	Post Bloom	
Old temp 10% kill 90% kill	-- 14 0	-- 17 3	-- 20 7	-- 24 16	23 26 22	27 27 23	27 28 23	30 28 23	
Sweet Cherries									
Sweet Cherries	Swollen Bud	Side Green	Green Tip	Tight Cluster	Open Cluster	First White	First Bloom	Full Bloom	Post Bloom
Old temp 10% kill 90% kill	23 17 5	23 22 9	25 25 14	28 26 17	28 27 21	29 27 24	29 28 25	29 28 25	30 28 25

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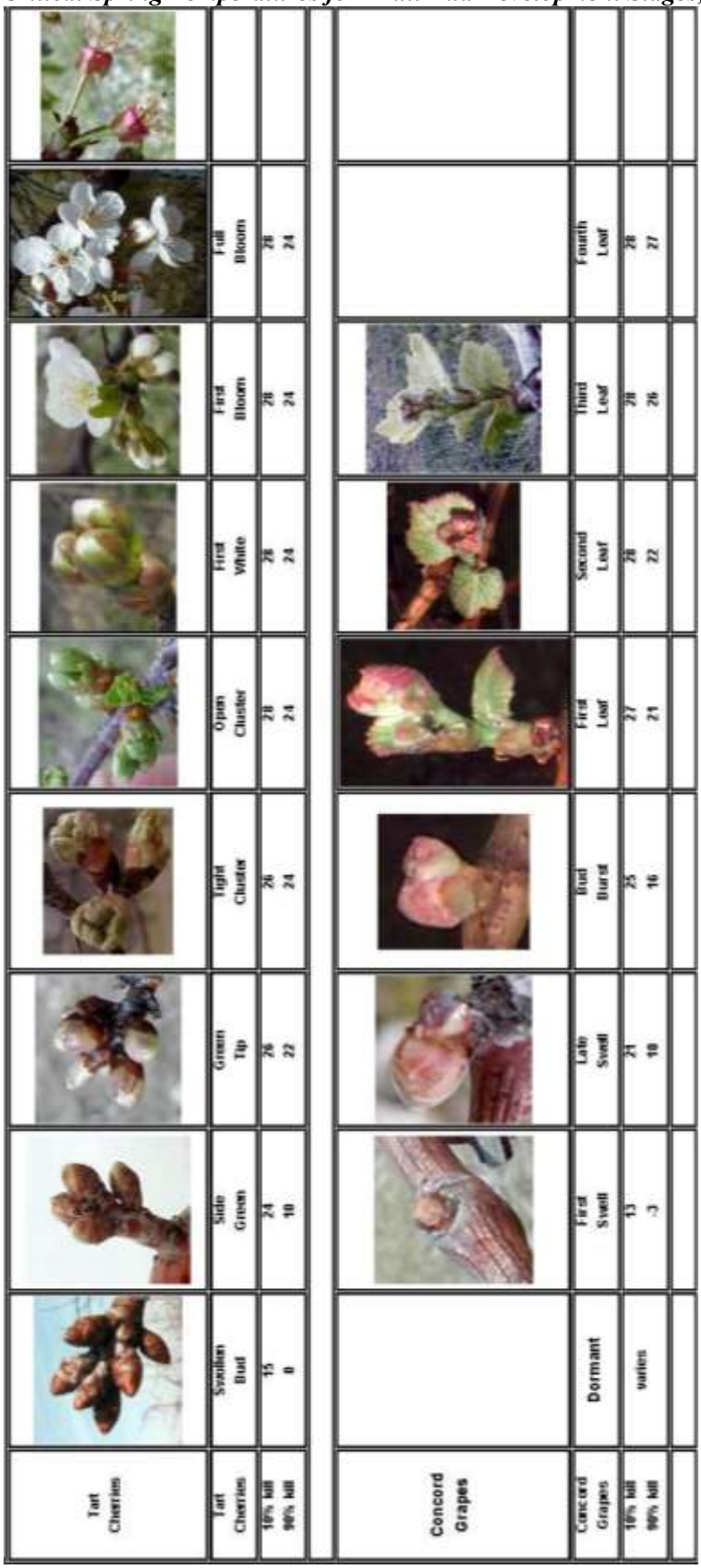
Critical Spring Temperatures for Fruit Bud Development Stages, continued from p. 7



Tart Cherries	Dormant	Side Green	Green Tip	Tight Cluster	Open Cluster	First White	First Bloom	Full Bloom
Tart Cherries	Swollen Bud							
10% kill	15	24	26	26	26	26	26	26
90% kill	0	10	22	24	24	24	24	24

Concord Grapes	Dormant	First Swell	Late Swell	Bud Burst	First Leaf	Second Leaf	Third Leaf	Fourth Leaf
Concord Grapes								
10% kill	varies	13	21	25	27	26	26	26
90% kill		-3	18	16	21	22	26	27

Old standard temperature is the lowest temperature that can be endured for 30 minutes without damage.

This chart also shows the temperature that will kill 10 % and 90 % of normal fruit buds.

These numbers were taken from Washington (WSU), Michigan (MSU) and North Carolina (NCS) Extension Bulletins.
Apple - WSU EB0913, Pears - WSU EB0978, Sweet Cherries - WSU EB1128, Peaches - WSU EB0914, Apricots - WSU EB1240, Tart Cherries - MSU Research. Rpt. 220

Portions of these bulletins are posted at Gregg Lang's Fruit Bud Hardiness Page at the MSU Horticulture Department (go to http://www.hrt.msu.edu/faculty/Langg/Fruit_Bud_Hardiness.html)

This material is based upon work supported by Smith Lever funds from the Cooperative State Research, Education, and Extension. Diversity and Inclusion are a part of Cornell University's heritage. We are a recognized employer and educator valuing AA/EEO, Protected Veterans, and Individuals with Disabilities.