What's New and Improved in the 2018 – 2019 Penn State Tree Fruit Production Guide

2018 Commercial Tree Fruit School

PennState Extension

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It takes an army…

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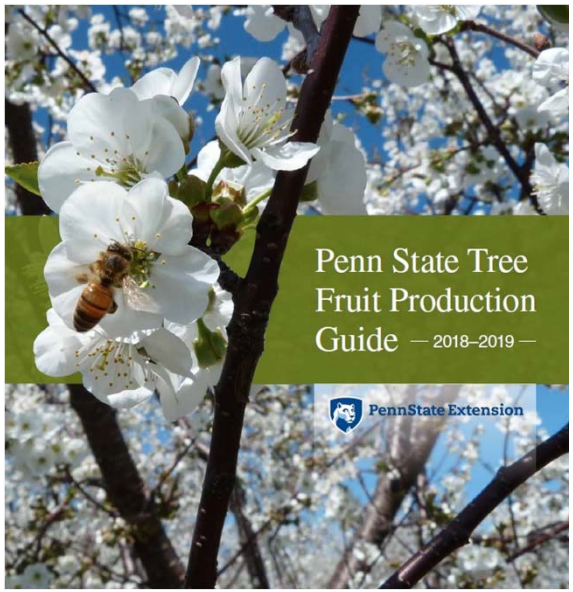

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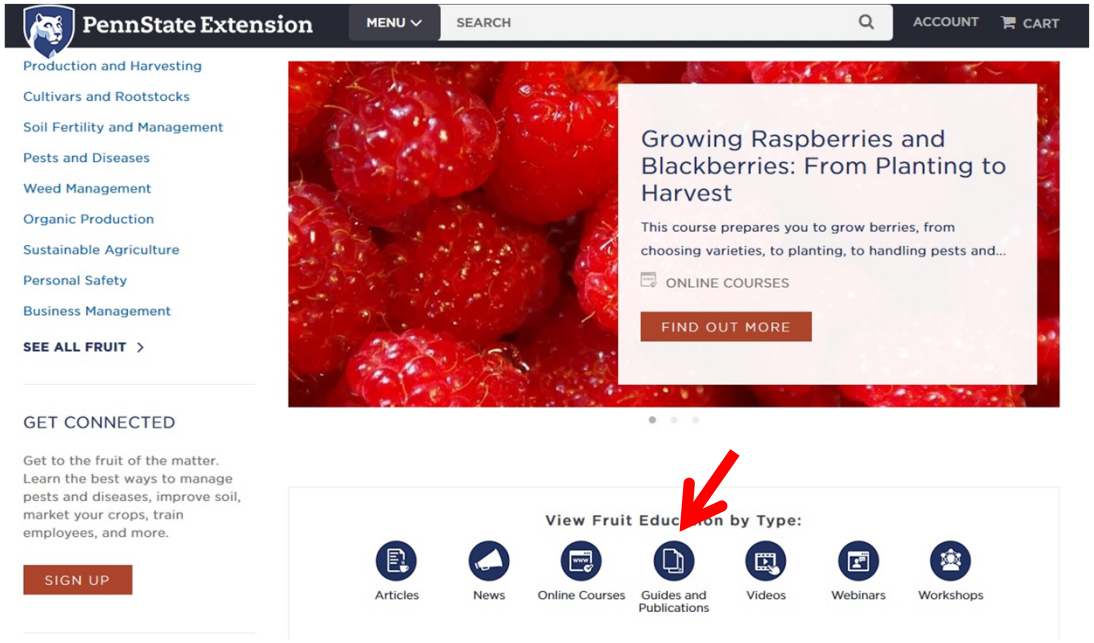

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2018 – 2019 Penn State Tree Fruit Production Guide

Contents

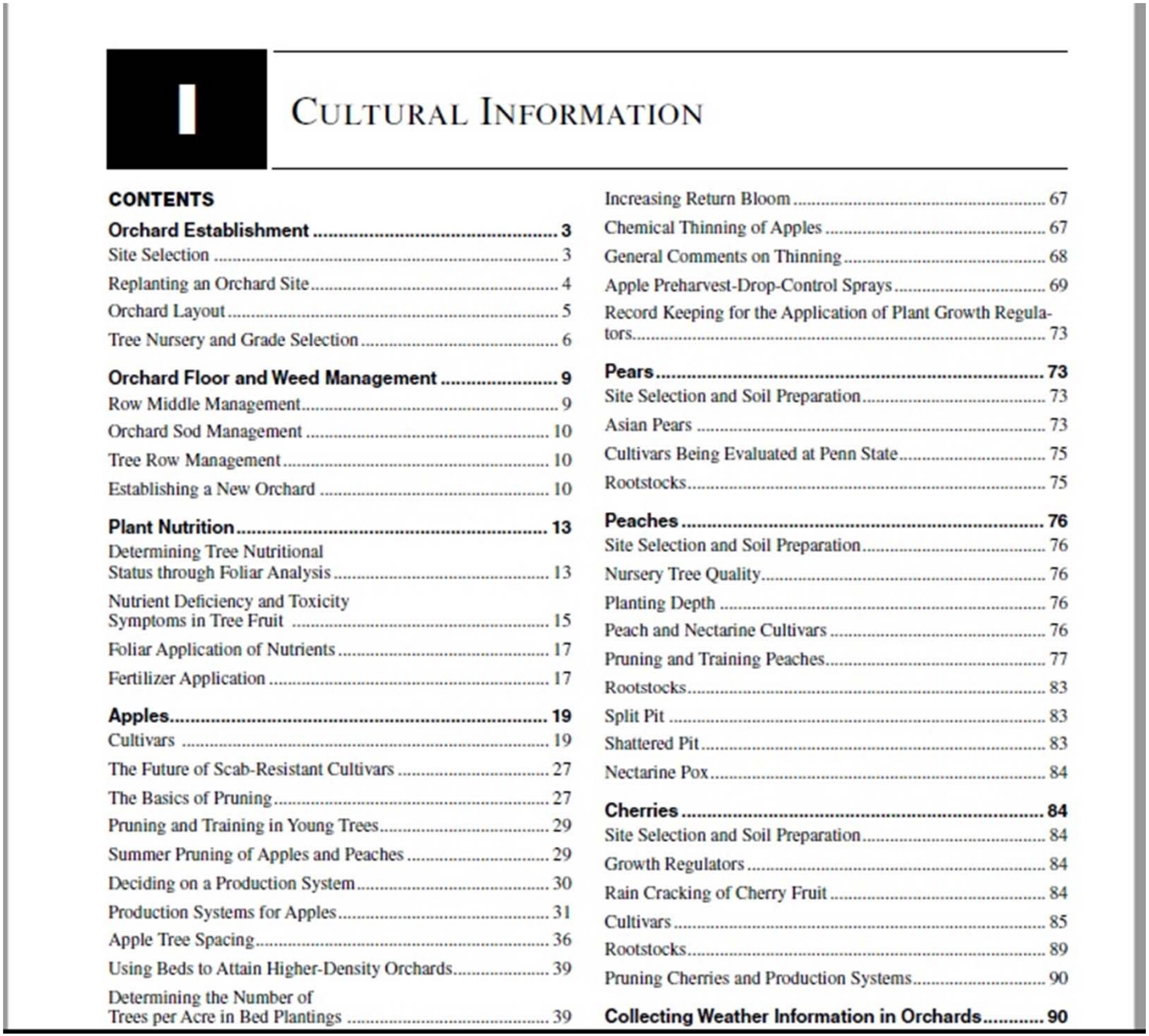
2018 – 2019 Penn State Tree Fruit Production Guide

Instead of an index:

Detailed table of contents at the beginning of each chapter

Websites included/referenced throughout the guide:

Updated (able to click on link with PDF version)



I

Cultural Information

CONTENTS

Part I Cultural Information Updates

- Updated orchard establishment section
- New: Preharvest Assessment of the Potential for Bitter Pit in Honeycrisp
- Updated Tables:
  - Rootstocks (WAA inlcuded)
  - Tree density
  - Toxicity table to bees
  - Thinning recs
  - Plant growth regulators
  - Stop drops
  - Tree fruit varieties
- Updated: Weather information

cium chloride, you need to compare the cost per pound of actual calcium with the amount of the formulation needed to achieve the 4 to 14 pounds of actual calcium per acre per season needed to control problems.

Preharvest Assessment of the Potential for Bitter Pit in Honeycrisp

Bitter pit severity varies with cultivar and season, but Honeycrisp is particularly susceptible. Results from a Penn State study in commercial Honeycrisp orchards led to the development of a model for predicting bitter pit potential.

In the three-year study in six orchards, the percentage of fruit on a tree that developed bitter pit ranged from 0 to 74 percent. When the percentage of fruit with bitter pit was correlated with concentrations of various mineral nutrients measured in the fruit peel three weeks before harvest, bitter pit was negatively correlated with calcium (Ca) and consistently positively correlated with potassium (K), phosphorus (P), and ratios of magnesium to calcium (Mg/Ca), potassium to calcium (K/Ca), and nitrogen to calcium (N/Ca). Bitter pit also increased as average shoot length increased, and decreased as crop load (number of fruit per square centimeter of trunk cross-sectional area) increased. The best combination of variables for predicting bitter pit was average shoot length plus the N/Ca ratio in the fruit peel.

The table below shows the percentage of fruit that may be expected to develop bitter pit from trees with varying combinations of average shoot lengths and N/Ca ratios in the fruit peel. For example, trees with a N/Ca ratio of 10 would be expected to have no bitter pit if average shoot length is less than 5 inches, but 36 percent of the fruit may develop bitter pit if average shoot length is 15 inches. If a tree has an average shoot length of 25 inches or more, we would expect 59 percent of the fruit to develop bitter pit even when the N/Ca is only 2.

	Average shoot length (inches)		
N/Ca	5	15	25
2	0	20	59
6	0	28	67
10	0	36	75
14	5	44	83
18	13	52	91
22	21	60	99

Estimating average shoot length

Select 20 typical trees per block and record the length of five typical terminal shoots around the tree. For best results, select current-season shoots with moderate branch angles (avoiding strong vertical shoots or weak shoots hanging below a horizontal orientation). Sum the lengths of the five shoots from the 20 trees and divide by 100 to obtain the average shoot length for the block.

Estimating N/Ca ratio of fruit peel

Three weeks before anticipated harvest select three typical fruit from each of the same 20 trees per block. (Shoot length measurements and collection of fruit samples can be done simultaneously if that is more practical for you.) Within a block, select fruit of similar size. Scrub the apples in tap water to remove any residues. Use a potato peeler to remove 1-centimeter-wide (about 3/8-inch) strips of peel from around the circumference at the calyx end of the fruit (Figure 1-9). Be careful to avoid removing flesh with the peel because it is difficult to grind for analysis. If there is flesh attached to the peel, use a dull knife or spoon to scrape the flesh off the peel. Combine the peel tissue from the 60 apples and place them on a cookie sheet on parchment paper and dry in an oven at 180 degrees overnight. Submit the samples to the Penn State Agricultural Analytical Services Lab with a Standard Plant Analysis Kit (see **agsci.psu.edu/aasl/plant-analysis/plant-tissue-total-analysis**). When filling out the information form, include the average shoot length. Results sent to the person submitting the sample will be limited to values for mineral elements and there will be no interpretation. Results will also be sent to a fruit specialist, who will send the grower an interpretation.

Sometimes a block of trees will contain trees with varying crop loads, or tree vigor may vary across a block. In those cases it may be preferable to submit samples from different sections of the block or from trees with light or heavy crops.

Figure 1-9. How to sample peel tissue. The peel already on the plate shows the size of the sample needed from one apple. Peel from the second apple is being removed from the calyx end of the fruit, exercising care to not cut into the flesh.

Implications for best management of Honeycrisp in orchards

The predictive model also has implications for Honeycrisp management in the orchard. Growers have long understood the importance of a multifaceted approach for controlling calcium-related disorders in bitter-pit-prone cultivars, but in the case of Honeycrisp it has been difficult to ascertain which practices are most important relative to its high susceptibility to the disorder. The two-variable model suggests the focus should be on managing terminal shoot growth and increasing the ratio of calcium to nitrogen in the fruit.

GROWTH REGULATORS IN APPLE AND PEAR PRODUCTION

Plant growth regulators (PGRs) are chemicals used to modify tree growth and structure, remove excess fruit, or alter fruit maturity. In order to be effective, PGRs must be applied with adequate coverage, and then be absorbed by the plant and translocated to the site of activity in sufficient concentration to give the desired response. Consequently, numerous factors affect PGR performance. Weather conditions before, during, and after

Part II Diseases, Disorders, Pests, and Natural Enemies

- Disorders added = including pictures
  - 2, 4 Damage
  - Bitter Pit and Cork Spot
  - Frost Damage
  - Glyphosate Herbicide Damage
  - Hail Damage
  - Nectarine Pox
  - Southwest Injury
  - Sunburn

- Updated info for disease and insects

- More pictures added for diseases

- Mammal control = updated

Part II Diseases, Disorders, Pests, and Natural Enemies

September 2017: Marssonina Blotch (fungal disease, newly described for PA)

- **Overwinters in fallen leaves (like scab)**
- **Can defoliate a tree**
- **Easily controlled with conventional fungicides**
- **Sulfur = weak**

Part III Chemical Management

Worker Protection Standard for Agricultural Pesticides: Updated

- NEW: Application Exclusion Zone (AEZ)

New table: Courtesy of Cornell University – EPA, REI, PPE for insecticides, fungicides/bactericides, herbicides

Table 3-1. EPA numbers and Worker Protection Standard reentry and personal protective equipment guidelines.

Worker notification: Under most circumstances, worker employers must make sure that workers are notified about areas where pesticide applications are taking place or where restricted-entry intervals are in effect. For details on notification requirements both for these products and those not represented below, refer to the product label and the Worker Protection Standard, 40 CFR part 170.

Product	EPA reg. no.	Common name	REI (hours)	Applicator PPE	Early entry PPE
Insecticides and Acaricides					
Acramite 50WS	400-503	**bifenazate	12	ac	cfk
*Actara 25WDG	100-938	**thiamethoxam	12	acf	cfk
*Admire Pro 4.6SC	264-827	**imidacloprid	12	acf	cfk
§Agree 3.8WS	70051-47	Bt	4	abcl	bck

Not 100% = some chemicals are missing

Part III Chemical Management

- **Ground spraying updates**
  - **Surface temperature inversion**
  - **Shielded sprays**
  - **Sensitive areas**

- **New fungicides/bactericides added (mentioned over the last 2 years)**
  - **New for 2018: FLINT EXTRA**
    - **For use on pome and stone fruit**
    - **Will replace Flint and Gem**

- **Updated tables for IRAC, FRAC, HRAC, Adjuvants**

Part III Chemical Management

New table: Copper products available for tree fruit

Table 3-10 Copper formulations for fruit crops.

Product	Copper form	Amount of active ingredient	Metallic copper equivalent	Unit type	Metallic copper per unit	OMRI listed*
Dry formulations						
Badge X2	copper oxychloride copper hydroxide	23.82% 21.49%	28%	1 lb	0.28 lb	yes
Basic Copper 53	basic copper sulfate	98%	53%	1 lb	0.53 lb	yes
Basic Copper Sulfate	copper sulfate	98%	53%	1 lb	0.53 lb	no
Champ WG	copper hydroxide	77%	50%	1 lb	0.50 lb	yes
Champ Dry Prill	copper hydroxide	57.6%	37.5%	1 lb	0.375 lb	no
C-O-C-S WDG	copper oxychloride copper sulfate	74.8% 14.2%	50%	1 lb	0.50 lb	no
Copper sulfate = bluestone = blue vitriol	copper sulfate pentahydrate	99%	25%	1 lb	0.25 lb	yes
Cuprofix Ultra 40 Disperss**	basic copper sulfate	71.1%	40%	1 lb	0.40 lb	no
Kentan DF	copper hydroxide	61.3%	40%	1 lb	0.40 lb	no
Kocide 2000	copper hydroxide	53.8%	35%	1 lb	0.35 lb	no
Kocide 3000	copper hydroxide	46.1%	30%	1 lb	0.30 lb	no
Nordox	cuprous hydroxide	56.4%	50%	1 lb	0.50 lb	yes
Nordox 30/30 WG	cuprous oxide	33.8%	30%	1 lb	0.30 lb	yes

Part III Chemical Management

Fungicide resistance management:

Management strategy outlined

→ **During the 2017 winter meetings**

FAQ

- They often have a very specific mode of action against fungi.
- Some systemic fungicides are Elite, Flint, Indar, Rally, Merivon, Orbit, Pristine, Procure, Rubigan, and Sovran.

Cultural Control and Fungicide Use Patterns

Due to environmental conditions, disease is inevitable in the Mid-Atlantic growing region and use of chemical controls is a necessity; however, following cultural practices that favor decreasing disease pressure will help decrease the opportunity for resistance. Using resistant varieties, minimizing tree stress, and maintaining proper soil fertility reduces disease incidence since pathogens do not reproduce well on trees that are less susceptible to disease. As a result, the chance of resistance decreases. Avoid selecting sites with high disease pressure since this increases the chance of selecting for resistant fungi. Using dormant copper sprays and removing inoculum sources such as leaves (using urea or a flail mower), mummified fruit, and dead twigs/branches reduces the initial pathogen population. It is important to be sure sprayers are appropriately calibrated and covering trees effectively. Achieving good spray coverage, tank-mixing with protectants, and alternating fungicides with different modes of action (FRAC Group) reduces populations exposed to selection.

Fungicide Resistance Issues and Mitigation Strategies for Specific Diseases

Apple scab and brown rot

Fungicides in FRAC Groups 3, 7, 9, and 11 are highly effective against scab infection on apples and brown rot on stone fruit. However, apple scab and brown rot fungi can become resistant to these fungicides, especially if any of them are continually applied alone. Growers using one of these fungicides to control apple scab or brown rot must be certain to not only alternate it with an unrelated fungicide but also use it in combination with a broad-specturm fungicide, like captan, metiram (Polyram), mancozeb, Ziram, thiram, sulfur, or ferbam. Another strategy to prevent resistance is to alternate the use of these materials throughout the season. The less any one of them is used in an orchard during a given season, the lower the chances that resistance will develop. At the present time, we know fungi causing apple scab and brown rot have shown high tolerance to fungicides in FRAC Group 11. As a result, growers are cautioned when using fungicides in this class,

From green tip through tigh cluster. Scab spores will begin to be dispersed from overwintering leaves starting at green tip; however, the spore numbers will be low, gradually increasing over time. If conditions are dry, focus on managing powdery mildew by using products such as Indar, Rally, Topguard/Rhyme, or sulfur tank-mixed with a broad-spectrum fungicide (EBDC, ferbam, metiram, ziram). Dry weather plus low scab spore numbers equals low disease pressure. Although some strong powdery mildew products are not as effective against scab, a broad-spectrum fungicide will keep the disease in check. If disease conditions are favorable for scab (warm and wet), then consider using other fungicides from FRAC Groups 3 or 9, such as Indar, Inspire Super, Procure/Trionic, Scala, or Vangard, during this period. Be sure to rotate FRAC Groups. Growers are highly encouraged not to use the FRAC Group 7 fungicides during this time period; these fungicides are best saved for peak apple scab pressure, which is from pink through petal fall.

From pink through petal fall. Scab spores will start to peak (the maximum number of available spores dispersing from the overwintering leaves) beginning late pink and will remain high through approximately late petal fall. In our experience with monitoring scab spore dispersal from overwintering leaves, available scab spores remain high (more than 10,000) for approximately two weeks (from pink through petal fall). During this time, it is best to use FRAC Group 7 (SDHI) fungicides, such as Aprovia, Fontelis, Luna Sensation, Luna Tranquility, Merivon, Pristine, or Sercadis, and tank-mix with a broad-spectrum fungicide. Limit FRAC Group 7 fungicides to two applications during this period of high disease pressure. A maximum of four complete applications are allowed per year for FRAC Group 7 fungicides. Save two FRAC Group 7 fungicide sprays (if possible) for the end of the season when Luna Sensation, Merivon, or Pristine should be applied in order to mitigate late season and storage fruit rots.

From post petal fall through second cover. Although the number of overwintering scab spores drastically decreases after petal fall, spores are still available and can wreak havoc, especially if conditions favorable for disease are present. During this time, use products from FRAC Group 3 and 9, such as Inspire Super, Indar, Rally, Procure/Trionic, Scala, or Vangard, plus a

Part IV Chemical Management Tables

IV CHEMICAL MANAGEMENT TABLES

UPDATED

CONTENTS

TABLES

Part V Integrated Pest Management Spray Programs

Pesticide recommendations for apples, tight cluster to open cluster.

FRAC Group	Pesticide	Recommended rate per acre
CHOOSE one of the following:		
U12	Syllit FL[a]	1.5 pt
3	Indar 2F[b]	6–8 fl oz
3	Procure 50WS[b]	8–16 oz
3	Rally 40WP[b]	5–10 oz
3	Rhyme[b]	4–6.5 fl oz
3	Topguard[b]	13 fl oz
3	Trionic[b]	8–16 fl oz
3	Vintage SC[b]	8–12 fl oz
3 + 9	Inspire Super[b]	8.5–16 fl oz
M2	Lime sulfur[c]	2.5–3% solution
In combination with one of the following:		
M3	Penncozeb 75DF[d]	3 lb
M3	Polyram 80DF	3 lb
M3	Ziram 76DF	3 lb
M4	Captan 80WDG[e]	2.5–3 lb
OR select one of the following to be applied alone:		
M3	Penncozeb 75DF[d]	6 lb
M3	Polyram 80 DF	6 lb
M3	Ziram 76DF	6 lb
M4	Captan 80DF[e,f]	5 lb
PLUS one or more of the following based on the insect pest complex		

Part VI Harvest and Postharvest Handling

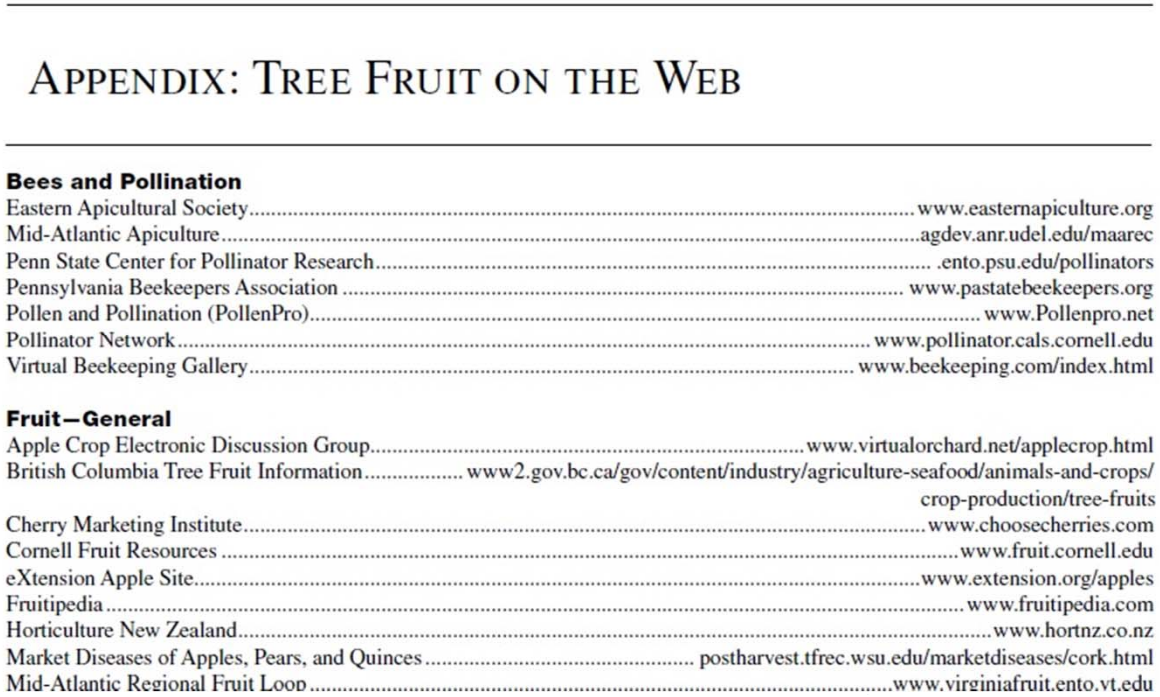
Part VIII Maintaining the Safety of Pennsylvania Apples and Apple Products

Part IX Farm Management - Updated

- Budget tables
- State and Federal Laws that apply to farm labor

Part X Marketing

Appendix



APPENDIX: TREE FRUIT ON THE WEB

Bees and Pollination

Eastern Apicultural Society	www.easternapiculture.org
Mid-Atlantic Apiculture	agdev.anr.udel.edu/maarec
Penn State Center for Pollinator Research	.ento.psu.edu/pollinators
Pennsylvania Beekeepers Association	www.pastatebeekeepers.org
Pollen and Pollination (PollenPro)	www.Pollenpro.net
Pollinator Network	www.pollinator.cals.cornell.edu
Virtual Beekeeping Gallery	www.beekeeping.com/index.html

Fruit—General

Apple Crop Electronic Discussion Group	www.virtualorchard.net/applecrop.html
British Columbia Tree Fruit Information	www2.gov.bc.ca/gov/content/industry/agriculture-seafood/animals-and-crops/crop-production/tree-fruits
Cherry Marketing Institute	www.choosecherries.com
Cornell Fruit Resources	www.fruit.cornell.edu
eXtension Apple Site	www.extension.org/apples
Fruitipedia	www.fruitipedia.com
Horticulture New Zealand	www.hortnz.co.nz
Market Diseases of Apples, Pears, and Quinces	postharvest.tfrec.wsu.edu/marketdiseases/cork.html
Mid-Atlantic Regional Fruit Loop	www.virginiafruit.ento.vt.edu

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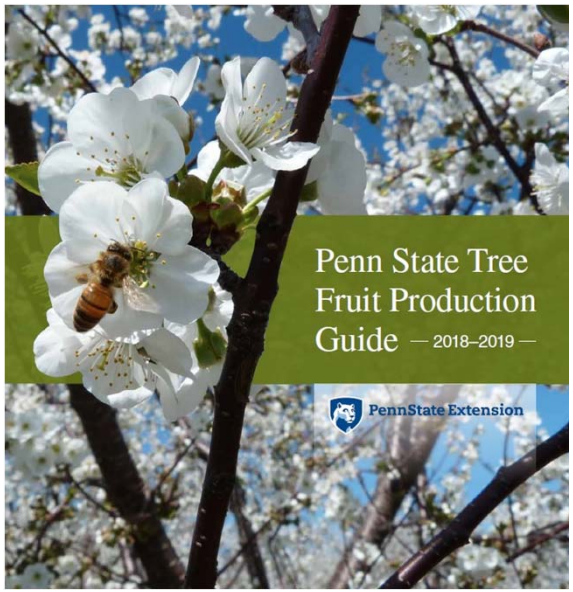

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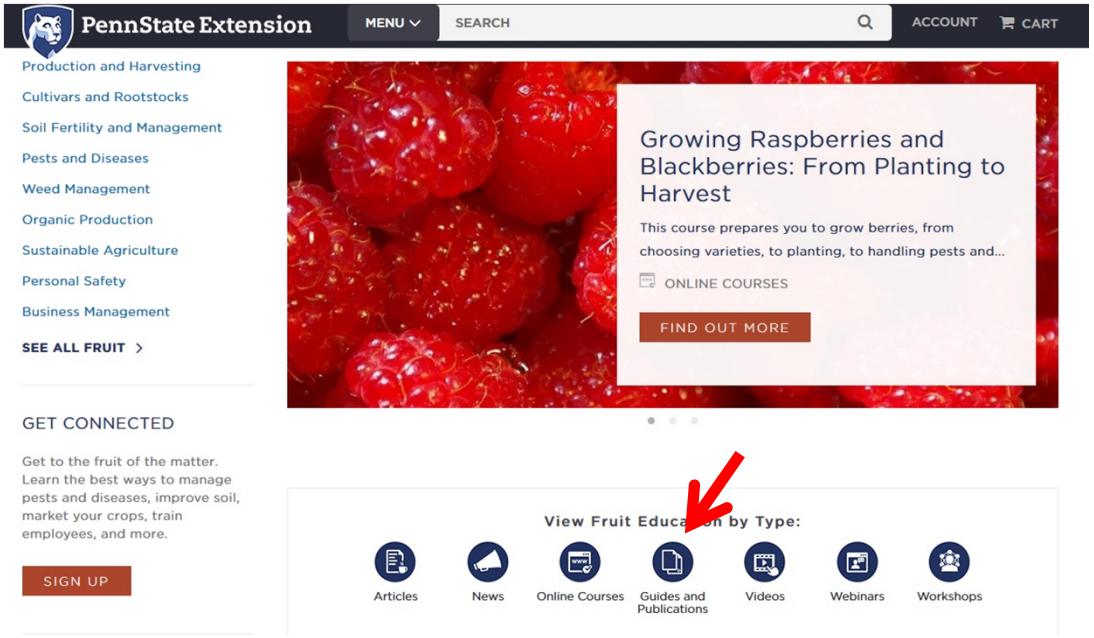

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Tree Fruit Pathology 2018 Season Announcements…

2018 Season: We are in search of collecting fruit with BITTER ROT throughout the state

2018 Season: Identifying additional sites that are experiencing RAPID APPLE DECLINE

Contact:

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