

ORGANIZATION OF THIS GUIDE.....	VI
1 INTEGRATED CROP AND PEST MANAGEMENT	1
1.1 Introduction.....	1
1.2 Practicing IPM	1
1.3 Components of IPM.....	1
1.4 IPM Tactics.....	2
2 ORGANIC TREE FRUIT PRODUCTION IN NEW ENGLAND.....	3
2.1 Introduction.....	3
2.2 What is Organic Agriculture?	3
2.3 Fungicide/Bactericide Options in Organic Apple Production.....	4
2.4 Insecticide Options in Organic Apple Production.....	5
2.5 New England Organic Apple Production Resources:	7
3 PESTICIDE INFORMATION.....	8
3.1 Pesticide Classification and Certification.....	8
3.2 Use Pesticides Safely	8
3.3 Protect Honey Bees from Insecticides	9
3.4 Verifying Pesticide Registration and Restricted-Use Status	9
3.5 Pesticide Recordkeeping/Reporting	9
3.6 Reduced-Risk Pesticides, Minimum-Risk Pesticides, and Biopesticides.....	9
3.7 FIFRA 2(ee) Recommendations.....	10
3.8 Prepare for Emergencies	10
3.9 Organophosphate Poisoning.....	10
3.10 Your Responsibility as a Pesticide User.....	11
3.11 Field Use and Care of Respirators.....	11
3.12 Acute Toxicity of Pesticide.....	11
3.13 Label Compliance	12
3.14 Protecting Water Quality.....	12
3.15 Restricted Entry Interval	12
3.16 Pesticide Residue Tolerances.....	12
3.17 EPA Worker Protection Standard	13
3.18 OSHA Hazard Communications Standard.....	14
4 SPRAYER INFORMATION	15
4.1 Solutions for Safer Spraying	15
4.2 Minimizing Pesticide Drift in Orchards Part I	16
4.3 Minimizing Pesticide Drift in Orchards Part II	18
4.4 Preparing the Air Blast Sprayer for Work.....	20
4.5 Rate of Output (GPM).....	22
4.6 Tree Row Volume.....	23
4.7 Nozzles on the Net	23
4.8 Selecting Nozzles from the Nozzle Catalogue – Airblast sprayers	24
4.9 Calibrating Airblast Sprayers.....	26
4.10 Selecting Nozzles from the Nozzle Catalogue –Boom Sprayers.....	27
4.11 Boom Sprayer Calibration (Use Clean Water).....	29
4.12 Going Spraying! Mixing Procedures.....	30
4.13 Equipment for Weed Control in Orchards	33
4.14 Decontaminating and Storing Crop Sprayers.....	35
4.15 Homeland Security.....	39
5 CHARACTERISTICS OF CROP PROTECTANTS USED ON TREE FRUITS.....	40
5.1 Cross Reference of Chemical vs. Trade Names of Pesticides.....	40
5.1.1 By Common Name	40
5.1.2 By Trade Name.....	41
5.2 Restricted Highly Toxic Pesticides	43
5.3 Fungicides.....	44
5.4 Bactericides.....	49
5.5 Other Materials	49
5.6 Insecticides.....	50

5 CHARACTERISTICS OF CROP PROTECTANTS USED ON TREE FRUITS (<i>continued</i>)	
5.7 Acaricides	57
5.8 Fumigants and Nematicides for Tree Fruits	59
6 DISEASE MANAGEMENT	61
6.1 Apple Scab Fungicides	61
6.2 Notes on Apple Scab Management	64
7 INSECT AND MITE MANAGEMENT	71
8 WEED MANAGEMENT	93
8.1 Calibration to Ensure Correct Herbicide Rate	93
8.2 Groundcover Management	94
8.3 Herbicides and Their Use	95
8.4 Herbicides for Tree Fruits	98
9 WILDLIFE DAMAGE MANAGEMENT	111
9.1 Deer and Rabbits	111
9.2 Meadow and Pine Voles	111
9.3 Woodchucks	112
9.4 Beavers	112
9.5 Birds	113
10 NUTRIENT MANAGEMENT OF APPLE ORCHARDS	114
10.1 Introduction	114
10.2 Soil Analysis	114
10.3 Preplant Soil Preparation	114
10.4 Fertilization Program for Young Trees	117
10.5 Fertilization Program for Established Orchards	117
10.6 Characteristics of Commonly Available Fertilizers	120
11 GENERAL PEST MANAGEMENT CONSIDERATIONS – APPLES	123
11.1 Diseases	123
Apple Rust Diseases	123
Apple Scab	123
Bitter Rot	125
Black Rot, White Rot (frog-eye leaf spot and fruit infections)	125
Blister Spot	125
Blossom End Rots	125
Crown Rot (Collar Rot)	126
Fire Blight	126
Powdery Mildew	127
Sooty Blotch and Fly Speck	128
11.2 Insects and Mites	128
American Plum Borer refer to <i>Dogwood Borer</i>	128
Apple Aphid, Spirea Aphid	128
Apple Maggot	128
Apple Rust Mite	129
Codling Moth, Lesser Appleworm, and Oriental Fruit Moth	129
Comstock Mealybug	130
Cutworms	130
Dogwood Borer, American Plum Borer	130
European Apple Sawfly	130
European Corn Borer	130
European Red Mite	130
Green Fruitworms	131
Japanese Beetle	131
Mullein Plant Bug	131
Obliquebanded Leafroller	132
Oystershell Scale	132
Plum Curculio	132
Redbanded Leafroller	132

11 GENERAL PEST MANAGEMENT CONSIDERATIONS – APPLES <i>(continued)</i>	
11.2 Insects and Mites <i>(continued)</i>	
Rosy Apple Aphid	133
San Jose Scale.....	133
Spotted Tentiform Leafminer, Apple Blotch Leafminer.....	133
Stinkbugs	134
Tarnished Plant Bug	134
Variegated Leafroller, Sparganothis Fruitworm	134
White Apple Leafhopper, Potato Leafhopper.....	135
Woolly Apple Aphid.....	135
11.3 Storage Disorders.....	135
Storage Rots.....	135
Storage Scald.....	135
Senescent Breakdown (Mcintosh)	136
11.4 Notes on Scald Control	136
11.4.1 Materials	136
11.4.2 Application Equipment.....	136
11.4.3 Variety Requirements	136
11.5 Apple Spray Table	136
11.6 Growth Regulator Use in Apples	161
11.6.1 Chemical Thinning	161
11.6.2 Weather Factors That Affect Thinning Response.....	161
11.6.3 Tree Factors That Affect Thinning Response	162
11.6.4 Chemicals Registered for Thinning.....	162
11.6.5 Chemicals not Registered for Thinning that Influence Cropload.....	163
11.6.6 Spray Timings.....	163
11.6.7 Suggested Strategies for New England Growers	164
11.6.8 Summary.....	165
11.7 Other Growth Regulator Uses in Apples in New England.....	171
12 GENERAL PEST MANAGEMENT CONSIDERATIONS – PEARS	176
12.1 Diseases.....	176
Fabraea Leaf Spot.....	176
Fire Blight.....	176
Pear Scab	176
Sooty Blotch	177
12.2 Insects and Mites.....	177
Aphids, Including Spirea Aphid	177
Codling Moth.....	177
Comstock Mealybug.....	178
European Red Mite, Twospotted Spider Mite	178
Green Fruitworms.....	178
Obliquebanded Leafroller.....	178
Pear Midge.....	179
Pear Psylla	179
Pear Rust Mite	179
Pearleaf Blister Mite	179
Plum Curculio.....	179
Redbanded Leafroller	180
Tarnished Plant Bug, Pear Plant Bug.....	180
12.3 Pear Spray Table.....	180
13 GENERAL PEST MANAGEMENT CONSIDERATIONS – CHERRIES	191
13.1 Diseases.....	191
Bacterial Canker (<i>Pseudomonas syringae</i>)	191
Black Knot.....	191
Brown Rot (Blossom blight).....	191
Leaf Spot.....	192
Phytophthora Root, Crown, and Collar Rots	192
Powdery Mildew.....	192

13 GENERAL PEST MANAGEMENT CONSIDERATIONS – CHERRIES <i>(continued)</i>	
13.1 Diseases <i>(continued)</i>	
X-Disease	192
13.2 Insects and Mites	192
American Plum Borer.....	192
Black Cherry Aphid.....	193
Black Cherry Fruit Fly, Cherry Fruit Fly.....	193
European Red Mite.....	193
Japanese Beetle.....	193
Lesser Peachtree Borer, Peachtree Borer.....	193
Obliquebanded Leafroller.....	194
Plum Curculio.....	194
Scales, including European Lecanium and San Jose Scale.....	194
Storage Rots	194
13.3. Cherry Spray Table.....	195
14 GENERAL PEST MANAGEMENT CONSIDERATIONS – PEACHES AND NECTARINES	204
14.1 Diseases	204
Bacterial Spot	204
Brown Rot (Blossom Blight).....	204
Peach Leaf Curl	205
Peach Scab.....	205
Perennial (Cytospora, Valsa) Canker	205
Phytophthora Root, Crown, and Collar Rots	205
Powdery Mildew (Rusty Spot)	205
Prunus Stem Pitting Virus	206
X-Disease	206
14.2 Insects and Mites	206
American Plum Borer.....	206
Cottony Peach Scale, European Fruit Lecanium Scale, San Jose Scale	206
European Red Mite.....	207
Green Peach Aphid.....	207
Japanese Beetle.....	207
Obliquebanded Leafroller.....	207
Oriental Fruit Moth.....	207
Peachtree Borers (Including Lesser Peachtree Borer)	208
Plum Curculio.....	208
Tarnished Plant Bug, Stink Bug	208
Western Flower Thrips.....	209
14.3 Storage Rots.....	209
14.3 Peach and Nectarine Spray Table	209
15 GENERAL PEST MANAGEMENT CONSIDERATIONS – APRICOTS	218
15.1 Diseases	218
Bacterial Canker (<i>Pseudomonas syringae</i>).....	218
Bacterial Spot (<i>Xanthomonas arboricola</i> pv. <i>pruni</i>)	218
Brown Rot	218
Peach Scab.....	219
Perennial (Cytospora, Valsa) Canker	219
Phytophthora Root, Crown, and Collar Rots	219
15.2 Insects and Mites	219
European Red Mite, Twospotted Spider Mite	219
Oriental Fruit Moth.....	219
Peachtree Borers (including Lesser peachtree borer)	220
Plum Curculio.....	220
Scales, including European Lecanium and San Jose Scale.....	220
Tarnished Plant Bug, Stink Bugs.....	220
Western Flower Thrips.....	221
Storage Rots	221
15.3 Apricot Spray Tables	221

16 GENERAL PEST MANAGEMENT CONSIDERATIONS – PLUMS AND PRUNES.....	227
16.1 Diseases.....	227
Bacterial Spot (<i>Xanthomonas arboricola</i> pv. <i>pruni</i>).....	227
Black Knot.....	227
Brown Rot.....	227
Peach Scab.....	227
Perennial (cytospora, valsa) Canker.....	228
Phytophthora Root and Crown Rots.....	228
16.2 Insects and Mites.....	228
Apple Maggot.....	228
European Fruit Lecanium Scale.....	228
European Red Mite, Twospotted Spider Mite.....	228
Japanese Beetle.....	228
Lesser Peachtree Borer, Peachtree Borer, American Plum Borer.....	228
Oriental Fruit Moth.....	229
Plum Curculio.....	229
Redbanded Leafroller.....	229
Scales, including European Lecanium and San Jose Scale.....	230
16.3 Storage Rots.....	230
16.4 Plum and Prune Spray Tables.....	230
17 APPENDICES.....	235
17.1 Pesticide Data.....	235
17.2 EPA numbers and worker protection standard re-entry and personal protective equipment (PPE) guidelines.....	242
17.3 Spray Mixture Compatibility.....	247
17.4. Tree Fruit Reference Materials.....	250
17.5 Diagnostic and Analytical Services.....	252
17.6 Extension Faculty and Staff.....	253
17.7 Abbreviations and Symbols Used in this Publication.....	255

Organization of this Guide

The first chapters of this guide contain introductory information about two different, but not mutually exclusive, management approaches – integrated pest management (IPM) and organic. This is followed by general information on pesticide safety, sprayer use and calibration, and descriptions of the different materials used for pest management in tree fruits. Chapters are in the following order:

Integrated Pest Management
Organic Management
Safe and Legal Use of Pesticides
Effective Spraying
Characteristics of Crop Protectants

Following this are sections on managing diseases, insects and mites, weeds, and nutrient management and fertilizer recommendations for apple orchards.

Next, for each crop, is a section on *General Pest Management Considerations* with numbered comments on biology, cultural notes, monitoring, and pesticide use for each pest, in the following order:

CROP

Diseases

Disease 1

Biology & Timing
 Monitoring & Forecasting
 Biological & Cultural Management
 Pesticide Application Notes
 Pesticide Resistance

Disease 2, etc.

Insects and Mites

Insect 1, Etc.

Crop Spray Table

Within each group (Diseases, Insects and Mites) pest are discussed in alphabetical order.

This section is followed by a Pesticide Spray Table, which lists specific products for the control of each disease, insect and mite pest of this crop, giving products (alphabetically by trade name), rates, re-entry and pre-harvest intervals, and comments keyed to specific sections of the written notes in the preceding *General Pest Management Considerations*. For each phenological growth and management stage of the crop, pests are addressed in the order of diseases followed by insect and mite pests. Within each pest group, individual pests are listed in alphabetical order. In some cases not every brand name pesticide product with the same active ingredient on the market is listed, and instead representative product(s) for that active ingredient are listed with a note that other products with the same active ingredient are available.

Lastly is an appendix of tables showing pesticide active ingredient common names, preharvest intervals, pesticide product brand names, EPA registration numbers, Restricted Entry Intervals, Personal Protective Equipment guidelines, and spray mixture compatibility suggestions for the materials included in this publication. This is followed by a list of other fruit reference publications, and directories of diagnostic services, Extension faculty and staff in each New England state.

The last page provides a key to the abbreviations and footnotes used in this publication.