

	PAGE
ORGANIZATION OF THIS PUBLICATION	viii
1 INTEGRATED CROP AND PEST MANAGEMENT	1
1.1 Introduction.....	1
1.2 Practicing IPM	1
1.3 Components of IPM	1
1.3.1 Monitoring (Scouting)	1
1.3.2 Pest Models and Forecasting	1
1.3.3 Action Thresholds.....	1
1.3.4 Management Tactics	2
1.3.5 Recordkeeping	2
1.4 IPM Tactics.....	2
1.4.1 Cultural and Physical Controls	2
1.4.2 Biological Control.....	2
1.4.3 Chemical Control.....	2
2 ORGANIC TREE FRUIT PRODUCTION IN NEW ENGLAND	3
2.1 Introduction.....	3
2.2 What is Organic Agriculture?	3
2.3 Fungicide Options in Organic Apple Production	4
2.4 Insecticide Options in Organic Apple Production.....	5
2.5 New England Organic Apple Production Resources:	6
3 PESTICIDE INFORMATION	8
3.1 Pesticide Classification and Certification.....	8
3.2 Use Pesticides Safely	8
3.2.1 Plan Ahead.....	8
3.2.2 Move Pesticides Safely.....	8
3.2.3 Personal Protective Equipment.....	8
3.2.4 Avoid Drift, Runoff, and Spills.....	8
3.2.5 Avoid Equipment Accidents	9
3.2.6 Pesticide Storage.....	9
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
3.7.1 Requirements:	10
3.7.2 Information required for submission of 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
3.11.1 Other Safety Equipment.....	11
3.12 Acute Toxicity of Pesticide.....	11
3.12.1 Danger — Poison; Warning; Caution:	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
3.17.1 Who Must Comply?.....	13
3.17.2 What Must an Employer Do?	13
3.17.3 Additional Duties for Handler Employers	14
3.18 OSHA Hazard Communications Standard	14

	PAGE
4 SPRAYER INFORMATION	15
4.1 Solutions For Safer Spraying.....	15
4.1.1 Reducing Risk of Pesticide Exposure Through use of Engineering Controls.....	15
4.2 Minimizing Pesticide Drift in Orchards Part I.....	16
4.3 Minimizing Pesticide Drift in Orchards Part II.....	18
4.3.1 Before Spraying:.....	18
4.3.2 During Spraying:.....	18
4.4 Preparing the Air Blast Sprayer for Work	20
4.4.1 Checking the Sprayer	20
4.4.2 Fitting the Sprayer to the Tractor.....	20
4.4.3 Checking the Operation of the Sprayer	20
4.4.4 Pre-Season Maintenance.....	20
4.4.5 Sprayer Calibration.....	21
4.4.6 Dilute Spraying.....	21
4.4.7 Concentrate Spraying	21
4.4.8 Travel Speed Calibration.....	22
4.5 Rate of Output (GPM)	22
4.5.1 Example for Calibrating Rate of Output.....	23
4.6 Tree Row Volume.....	23
4.6.1 Dilute Applications.....	23
4.6.2 Concentrate Applications (Low Volume Application)	23
4.7 Nozzles on the Net.....	24
4.8 Selecting Nozzles from the Nozzle Catalogue – Airblast sprayers.....	24
4.9 Air Blast Sprayer Calibration (Use Clean Water).....	26
4.9.1 Calibrating A Kinkelder Sprayer (Use Clean Water)	27
4.9.2 Calibrating An Agtec Sprayer (Use Clean Water).....	27
4.10 Selecting Nozzles from the Nozzle Catalogue –Boom Sprayers	27
4.10.1 Selecting a Nozzle to Give Desired Spray Quality	28
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
4.13.1 Boom Applicators.....	33
4.13.2 Conventional flat fan nozzles	33
4.13.3 Pre-orifice flat fan nozzles.....	33
4.13.4 Turbo-teejet	33
4.13.5 Air induction nozzles.....	33
4.13.6 Sensor-Controlled Applicators	33
4.13.7 Controlled Droplet Applicators (CDA)	34
4.13.8 Flame Applicators	34
4.13.9 Where to look/buy	34
4.14 Decontaminating and Storing Crop Sprayers.....	35
4.14.1 Reducing Cleaning Problems	36
4.14.2 Sprayer Cleansers	36
4.14.3 Tank Rinse Systems (Low-Volume Tank Rinsing)	36
4.14.4 Cleaning the Sprayer	37
4.14.5 Tank Rinse Nozzle Suppliers	38
4.14.6 Disposal of Pesticide Waste	38
4.14.7 Mechanical Maintenance	38
4.14.8 Storage of Sprayers.....	38
4.14.9 References	39
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

	PAGE
5 CHARACTERISTICS OF CROP PROTECTANTS USED ON TREE FRUITS (<i>continued</i>)	
5.2 Fungicides	43
5.3 Bactericides	48
5.4 Other Materials	49
5.5 Insecticides.....	49
5.5.1 Organophosphates.....	49
5.5.2 Carbamates	51
5.5.3 Pyrethroids.....	51
5.5.4 Other Materials	53
5.6 Acaricides	56
5.7 Fumigants and Nematicides for Tree Fruits	59
5.8 Herbicides for Tree Fruits	60
6 DISEASE MANAGEMENT.....	64
6.1 Apple Scab Fungicides.....	64
6.2 Notes on Apple Scab Management	67
7 INSECT AND MITE MANAGEMENT.....	74
8 WEED MANAGEMENT.....	92
8.1 Calibration to Ensure Correct Herbicide Rate.....	92
8.1.1 Calculating Nozzle Flow Rate	92
8.1.2 Definition of Terms	92
8.1.3 Checking Herbicide Sprayer Output.....	92
8.2 Groundcover Management.....	92
8.3 Herbicides and Their Use.....	94
8.3.1 Types of Herbicides	94
8.3.2 Manage to Prevent Resistance	94
8.3.3 Herbicide Selection.....	95
8.3.4 Herbicides can Damage Trees	95
8.3.5 Leaching & Runoff Potential	95
8.3.6 Need for Rain or Irrigation	96
8.3.7 Persistent Weeds.....	96
8.3.8 Application Method	96
8.3.9 Rate of Herbicide	96
8.3.10 Timing Herbicide Applications.....	97
8.3.11 Tankmixes.....	97
8.3.12 Established Orchard Herbicide Program.....	97
9 WILDLIFE DAMAGE MANAGEMENT.....	100
9.1 Deer and Rabbits.....	100
9.2 Meadow and Pine Voles.....	100
9.3 Woodchucks.....	101
9.4 Beavers.....	101
10 NUTRIENT MANAGEMENT OF APPLE ORCHARDS	103
10.1 Introduction.....	103
10.2 Soil Analysis	103
10.3 Preplant Soil Preparation.....	103
10.3.1. Liming	103
10.3.2. Other Preplant Nutrients	105
10.4 Fertilization Program for Young Trees	106
10.5 Fertilization Program for Established Orchards.....	106
10.5.1 Using Leaf Analysis.....	106
10.5.2 Special Considerations in Foliar Application of Nutrients	109
10.6 Characteristics of Commonly Available Fertilizers	109

	PAGE
11 GENERAL PEST MANAGEMENT CONSIDERATIONS – APPLES	112
11.1 Diseases	112
Apple Rust Diseases	112
Apple Scab	112
Bitter Rot	114
Black Rot, White Rot (frog-eye leaf spot and fruit infections).....	114
Blister Spot	114
Blossom End Rots	115
Crown Rot (Collar Rot).....	115
Fire Blight	115
Powdery Mildew	116
Sooty Blotch and Fly Speck	117
11.2 Insects and Mites	117
American Plum Borer refer to <i>Dogwood Borer</i>	117
Apple Aphid, Spirea Aphid	117
Apple Maggot.....	117
Apple Rust Mite	118
Codling Moth, Lesser Appleworm, and Oriental Fruit Moth	118
Comstock Mealybug.....	118
Cutworms	119
Dogwood Borer, American Plum Borer	119
European Apple Sawfly.....	119
European Red Mite.....	119
Green Fruitworms.....	120
Japanese Beetle.....	120
Mullein Plant Bug	120
Obliquebanded Leafroller.....	121
Oystershell Scale	121
Plum Curculio.....	121
Redbanded Leafroller	121
Rosy Apple Aphid	121
San Jose Scale	122
Spotted Tentiform Leafminer, Apple Blotch Leafminer	122
Tarnished Plant Bug	123
Variegated Leafroller, Sparganothis Fruitworm	123
White Apple Leafhopper, Potato Leafhopper	123
Woolly Apple Aphid	123
11.3 Storage Disorders.....	123
Storage Rots	123
Storage Scald.....	124
Senescent Breakdown (Mcintosh).....	124
11.4 Notes On Scald Control	124
11.4.1 Materials	124
11.4.2 Application Equipment.....	124
11.4.3 Variety Requirements	124
11.5 Apple Spray Table	125
11.6 Growth Regulator Use In Apples.....	143
11.6.1 Chemical Thinning	143
11.6.2 Weather Factors that affect Thinning Response	143
11.6.3 Tree Factors that affect Thinning Response	144
11.6.4 Chemicals Registered for Thinning	144
11.6.5 Chemicals not Registered for Thinning that Influence Cropload	146
11.6.6 Spray Timings	146
11.6.7 Suggested Strategies For New England Growers	146
11.6.8 Summary	147

	PAGE
11 GENERAL PEST MANAGEMENT CONSIDERATIONS – APPLES (continued)	
11.7 Other Growth Regulator Uses In Apples In New England	154
11.8 Growth Regulator Chemicals Registered in New England	154
12 GENERAL PEST MANAGEMENT CONSIDERATIONS – PEARS	158
12.1 Diseases.....	158
Fabraea Leaf Spot.....	158
Fire Blight.....	158
Pear Scab	158
Sooty Blotch	159
12.2 Insects and Mites.....	159
Aphids, Including Spirea Aphid	159
Codling Moth.....	159
Comstock Mealybug.....	159
European Red Mite, Twospotted Spider Mite	160
Green Fruitworms.....	160
Obliquebanded Leafroller.....	160
Pear Midge.....	160
Pear Psylla	160
Pear Rust Mite	161
Pearleaf Blister Mite	161
Plum Curculio	161
Redbanded Leafroller	161
Tarnished Plant Bug, Pear Plant Bug.....	161
12.3 Pear Spray Table	162
13 GENERAL PEST MANAGEMENT CONSIDERATIONS – CHERRIES	171
13.1 Diseases.....	171
Bacterial Canker (<i>Pseudomonas syringae</i>)	171
Black Knot	171
Brown Rot (Blossom blight).....	171
Leaf Spot	172
Phytophthora Root, Crown, And Collar Rots	172
Powdery Mildew.....	172
X-Disease.....	172
13.2 Insects and Mites.....	172
American Plum Borer	172
Black Cherry Aphid.....	173
Black Cherry Fruit Fly, Cherry Fruit Fly	173
European Red Mite	173
Japanese Beetle	173
Lesser Peachtree Borer	173
Obliquebanded Leafroller	173
Plum Curculio	173
Storage Rots.....	174
13.3. Cherry Spray Table	174
14 GENERAL PEST MANAGEMENT CONSIDERATIONS – PEACHES AND NECTARINES	183
14.1 Diseases.....	183
Bacterial Spot	183
Brown Rot (Blossom Blight)	183
Peach Leaf Curl	184
Peach Scab	184
Perennial (Cytospora, Valsa) Canker.....	184
Phytophthora Root, Crown, and Collar Rots	184
Powdery Mildew (Rusty Spot)	184
Prunus Stem Pitting Virus.....	185
X-Disease.....	185

	PAGE
14 GENERAL PEST MANAGEMENT CONSIDERATIONS – PEACHES AND NECTARINES (continued)	
14.2 Insects and Mites	185
American Plum Borer.....	185
Cottony Peach Scale, European Fruit Lecanium Scale.....	185
European Red Mite.....	185
Green Peach Aphid.....	186
Japanese Beetle.....	186
Obliquebanded Leafroller.....	186
Oriental Fruit Moth.....	186
Peachtree Borers (Including Lesser Peachtree Borer)	186
Plum Curculio.....	187
Tarnished Plant Bug, Stink Bug	187
Western Flower Thrips.....	187
14.3 Peach and Nectarine Spray Table	188
Table 14.3.2. Growth Regulator Uses in Peaches and Nectarines.....	193
15 GENERAL PEST MANAGEMENT CONSIDERATIONS – APRICOTS	194
15.1 Diseases	194
Bacterial Canker (<i>Pseudomonas syringae</i>)	194
Bacterial Spot (<i>Xanthomonas arboricola</i> pv. <i>pruni</i>)	194
Brown Rot	194
Peach Scab.....	195
Perennial (<i>Cytospora</i> , <i>Valsa</i>) Canker	195
Phytophthora Root, Crown, and Collar Rots	195
15.2 Insects and Mites	195
European Red Mite, Twospotted Spider Mite	195
Oriental Fruit Moth.....	195
Peachtree Borers (including Lesser peachtree borer)	195
Plum Curculio.....	196
Tarnished Plant Bug	196
Western Flower Thrips.....	196
Storage Rots	196
15.3 Apricot Spray Tables	197
Table 15.3.2. Plant Growth Regulator Use in Apricots	200
16 GENERAL PEST MANAGEMENT CONSIDERATIONS - PLUMS AND PRUNES	202
16.1 Diseases	202
Bacterial Spot (<i>Xanthomonas arboricola</i> pv. <i>pruni</i>)	202
Black Knot.....	202
Brown Rot	202
Peach Scab.....	203
Perennial (<i>cytospora</i> , <i>valsa</i>) Canker	203
Phytophthora Root and Crown Rots	203
16.2 Insects and Mites	203
Apple Maggot.....	203
European Fruit Lecanium Scale	203
European Red Mite, Twospotted Spider Mite	203
Lesser Peachtree Borer, Peachtree Borer, American Plum Borer.....	203
Oriental Fruit Moth.....	203
Plum Curculio.....	204
Redbanded Leafroller	204
16.3 Storage Rots.....	204
16.4 Plum and Prune Spray Tables	205
17 WEED CONTROL GUIDELINES.....	208
17.1 Apples	208
17.2 Pears.....	211
17.3 Cherries.....	214

	PAGE
17 WEED CONTROL GUIDELINES (<i>continued</i>)	
17.4 Peaches.....	216
17.5 Apricots.....	219
17.6 Plums and Prunes	221
18 APPENDICES.....	224
18.1 Pesticide Data.....	224
18.2 Diagnostic and Analytical Services.....	244
18.3 Extension Faculty and Staff	245
18.4 Abbreviations and Symbols Used in this Publication	248

Organization of this Publication

The first part of this manual contains introductory information about pesticides, sprayer calibration, and references pertaining to crop protectant efficacy and use characteristics for each pest category (diseases, insects, etc.). This is followed by a section on nutrient management and fertilizer recommendations for apple orchards. Information on forecasting, sampling and monitoring is included for selected pests. This is followed by a section on nutrient management and fertilizer recommendations for apple orchards. Next, for each crop, a section on General Pest Management Considerations contains numbered comments on biology, cultural notes, monitoring, and pesticide use for each pest, in the following order:

Diseases

Disease 1

- Biology & Cultural
- Monitoring & Forecasting
- Biological & Non-chemical Control
- Pesticide Application Notes
- Pesticide Resistance

Disease 2, etc.

Insects and Mites

Insect 1, Etc.

Diseases are addressed first, followed by insects and mites (as a group), each in alphabetical order. Reference may be made here to additional publications available for further information. 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. Pests are addressed in order as above, proceeding phenologically through the season.

Weed control guidelines are listed next, separately for each crop.

Lastly is an appendix of tables listing common names, product names, EPA registration numbers, Personal Protective Equipment guidelines, and spray mixture compatibility suggestions for the materials included in this publication, followed by a list of other fruit reference materials, diagnostic services, and faculty and extension programs.

A key to the abbreviations and footnotes used in this publication is found in the back of this book.