7 Insect and Mite Management

Table 7.1.1. Efficacy ratings of pome fruit insecticides. *(Key is below Table 7.1.2)*

IR-AC	Trade Name (active ingredient)	AM	Aph	EAS	Int	GF	LH	OBL	PC	PP	RAA	RBL	ΔSB/BMSB	SJS	TLM	TPB	WAA
6	(abamectin) ***Agri-Mek, *Abacus, *Abamectin, *Abba, *Epi-Mek** [a]	—	—	—	—	—	3	—	—	3	—	—	—/1	—	3	—	—
4A	**Actara** (thiamethoxam)	1	1	3	1	—	3	0	3	3	3	0	2+/3	0	2	2	—
4A, 6	***Agri-Flex** (abamectin & thiamethoxam)	—	3	2	—	—	3	—	2+	3?	3	—	—/1	—	3	—	—
28	***Altacor** (chlorantraniliprole)	2	1	3	3	3	—	3	0	—	—	3	—/1	2	3	1	—
3A	***Asana, *Adjourn** (esfenvalerate)	3	2	2	2+	3	3	2+	2	2	2	3	2+/2	1	3	3	1
4A	**Assail** (acetamiprid)	3	3	2	3	—	3	0	2	2	3	0	2+/3	2	3	2	2
22A	**Avaunt** (indoxacarb)	2	1	2	2	2+	3	0	3	—	0	2+	2+/0	0	2	2	—
UN	(azadirachtin) §**Aza-Direct**, **Azatin** §**Neemix**, §**Trilogy**	—	2	1	2	1	2	1	0	—	2	1	1/1	1	3	1	1
3	***Baythroid, Tombstone** (cyfluthrin)	3	2	2	2+	3	3	2+	2	3	2+	3	3/2+	1	3	3	1
4A	**Belay** (clothianidin) w/ supplemental label	?	3	—	2+	—	3	1	2+	2+	3	—	—/3	—	3	—	—
9C	**Beleaf** (flonicamid)	—	3	—	—	—	—	—	—	—	—	—	2+/0	—	—	3	2
28	**Belt** (flubendiamide)	1	—	—	3	3	—	3	1	—	—	3	—/1	—	3	—	—
3A	(bifenthrin) [Pears only] ***Bifenture, *Brigade, *Discipline, *Fanfare**	—	2+	—	2+	2+	—	—	2	2+	—	3	3/3	1	—	3	—
11	Bt (*Bacillus thuringiensis* toxin) §**Agree**, §**Biobit**, §**Deliver**, §**Dipel**, §**Javelin**, **MVP**	0	0	0	2	3	0	3	0	0	0	3	0/0	0	0	0	0
4A	***Calypso** (thiacloprid)	3	3	3	3	—	3	1	3	3	3	1	2+/2	2	3	1	2
—	§**Carpovirusine,** §**Cyd-X** (granulosis virus) [b]	0	0	0	3	—	0	—	0	0	0	—	—	0	0	0	0
16	**Centaur** (buprofezin)	—	—	—	—	—	2	—	—	3	—	—	—/1	3	—	—	—
3A	(cyhalothrin) ***Warrior *LambdaCy, *Proaxis, *Silencer, *Taiga Z**	3	2	2	2+	3	3	2+	2	2	2	3	3/2+	1	3	3	3
3A	***Danitol** (fenpropathrin)	3	2	2	2+	3	3	2+	2	2	2	3	3/3	1	3	3	1
5	**Delegate** (spinetoram)	2	0	—	3	3	—	3	2	3	—	3	—/1	—	3	—	—
3A	(deltamethrin) **Battalion, Decis*, Delta Gold***	2+	1	2+	2+	2+	3	2	2	3	2+	3	2+/—	1	3	2+	1
1B	***Diazinon, *AG600** (diazinon)	3	1	—	2	2	1	0	2	0	3	0	2+/1	2	1	1	3
1B	**Dimate, Dimethoate** (dimethoate) [Pears only]	3	2	—	3	2	3	0	2	0	2	0	2/3	2	1	2	—
3A, 4A	***Endigo** (cyhalothrin & thiamethoxam)	3	2	2	2+	3	3	2+	2	2	2	3	3/3	2	3	3	—
5	§**Entrust** (spinosad)	2	0	—	2	3	0	3	0	—	0	3	—	—	2	0	—
7C	**Esteem** (pyriproxyfen)	0	0	—	2	0	0	0	0	3	3	0	—/1	3	2	0	—
1B	***Guthion** (azinphos-methyl)	3	1	3	3	1	1	1	3	0	1	3	2/1	2	1	1	1

Table continued on next page.

Table 7.1.1. Efficacy ratings of pome fruit insecticides. *(Key is below Table 7.1.2)*

IR-AC	Trade Name (active ingredient)	AM	Aph	EAS	Int	GF	LH	OBL	PC	PP	RAA	RBL	Δ SB/ BMSB	SJS	TLM	TPB	WAA
4A	(imidacloprid) **Admire Pro, Provado, Pasada, Sherpa**	1	3	—	—	—	3	—	—	2	3	—	2/2+	2	3	2	2
1B	***Imidan** (phosmet)	3	1	3	3	1	1	1	3	0	1	3	2/1	2	1	1	1
—	(insecticidal soap) **§Des-X, §M-Pede**	0	2+	0	0	0	1	0	0	2	1	0	—/1	1	0	0	—
18	***Intrepid** (methoxyfenozide)	0	0	—	2	—	0	3	0	—	0	3	—/1	0	2	0	—
1A	***Lannate** (methomyl)	2	2	1	3	3	3	2+	2	0	1	3	3/3	2	3	1	1
3A, 4A	***Leverage** (cyfluthrin & imidacloprid)	3	3	2	3	3	3	2+	3	2	3	3	2+/3	2	3	3	1
1B	**Lorsban, Nufos, Yuma** (chlorpyrifos) [c]	—	—	(3)	(2)	3	(1)	(3)	(3)	0	2	2	(2/2+)	(3)	1	1	—
23	**Movento** (spirotetramat)	—	3	—	—	—	—	—	—	3	3	—	—/0	3	—	—	3
3A	***Mustang Max** (zeta cypermethrin)	?	2+	2+	2+	?	3	2+	?	?	?	3	3/2	—	3	3	—
21A	**Nexter** (pyridaben)	—	0	—	—	—	2	—	—	3	—	—	—	—	—	—	—
—	oil, dormant §**JMS Stylet,** §**Omni,** §**PureSpray** etc. (petroleum distillate)	—	2	—	—	—	—	—	—	2+	2	—	—	3	—	—	—
—	oil, summer §**JMS Stylet** §**Omni,** §**PureSpray** etc. (petroleum distillate)	—	—	—	1	—	—	—	—	2	—	—	—	3	1	—	1
3A	(permethrin) ***Ambush**, ***PermUp**, ***Pounce** [c]	—	(2)	2	—	3	3	(2+)	2	2	2	3	(3/2)	1	3	3	—
21A	**Portal** (fenpyroximate)	—	—	—	—	—	?	—	—	3	—	—	—	—	3	—	—
6	***Proclaim** (emamectin benzoate)	0	0	—	2	3	0	3	1	2	0	3	—/1	0	3	0	—
3A	(pyrethrin) §**Pyganic, Pyrenone** [c]	?	?	?	?	?	?	?	?	?	—	?	—	—	—	?	—
15	**Rimon** (novaluron)	—	—	—	3	—	2	3	—	—	—	3	—/1	—	3	2	—
1A	**Sevin** (carbaryl)	2	1	2	2	1	3	2	2	0	1	1	2/2	2	1	1	1
1B	***Supracide** (methidathion)	—	3	—	—	3	—	—	—	2	2+	3	2/—	3	—	2	—
—	**§Surround** (kaolin)	2	1	—	2	2	1	1	2	2	0	1	1/2	2	2	0	—
2A	***Thionex** (endosulfan) [a]	0	2	—	0	3	3	2	0	0	2	2	3/3	1	1	1	2
16, 28	**Tourismo (**flubendiamide & buprofezin)	1	—	—	2+	3	—	3	1	2	—	3	—/1	2+	3	—	—
4A, 28	**Voliam Flexi** chlorantraniliprole & thiamethoxam)	1	3	2	3	3	3	3	2+	3	3	3	2+/3	?	3	2+	?
3A, 28	***Voliam Xpress** (chlorantraniliprole & cyhalothrin)	2	2	3	3	3	3	3	3	2	2	3	2+/2+	1	3	3	—
	***Warrior –** see cyhalothrin																
1A	***Vydate** (oxamyl) [a]	0	2	—	0	—	2	0	0	0	2	—	2+/2+	1	3	1	1

Table 7.1.2. Efficacy ratings of pome fruit miticides (and insecticides with miticide activity)

IRAC	**Trade Name** (active ingredient)	ERM	TSM	ARM	PRM
6	(abamectin) ***Agri-Mek, *Abacus, *Abamectin, *Abba, *Agri-Flex, *Epi-Mek** etc.	3	2	3	3
UN	**Acramite** (bifenazate)	3	3	0	0
10A	**Apollo** (clofentezine)	3	1	1	1
18	(azadirachtin) §**Aza-Direct**, **Azatin** §**Neemix**, §**Trilogy**	1	1	1	—
3A	***Danitol** (fenpropathrin)	1+	—	—	—
23	**Envidor** (spirodiclofen)	3	3	3	3
20B	**Kanemite** (acequinocyl)	3	3	—	—
21A	**Nexter** (pyridaben)	3	2	2	2
—	oil, dormant §**JMS Stylet,** §**Omni,** §**ProNatural,** §**PureSpray** etc. (petroleum distillate)	3	—	—	2
—	oil, summer §**JMS Stylet** §**Omni,** §**PureSpray** etc. (petroleum distillate)	3	1	2	2
21A	**Portal** (fenpyroximate)	3	3	3	3
6	***Proclaim** (emamectin benzoate)	2	2	—	—
10A	**Savey, Onager** (hexythiazox)	3	1	1	1
—	**§Surround** (kaolin)	2	—	—	—
2A	***Thionex** (endosulfan)	—	—	2+	2
12B	**Vendex** (fenbutatin oxide, hexakis)	1+	2+	2	2
1A	***Vydate** (oxamyl)	2	2+	2+	2+
10B	**Zeal** (etoxazole)	3	3	0	0

KEY TO TABLES 7.1.1 AND 7.1.2:

IRAC = Insecticide **R**esistance **A**ction **C**ommittee Mode of Action classification.

Arthopod pest populations are more likely to exhibit cross-resistance to pesticides within the same IRAC group number.

1A = Carbamates, 1B = Organophosphates, 2A = Organochlorines, 3A = Pyrethroids and pyrethrins, 4A = Neonicotinoids, 5 = Spinosyns, 6 = Avermectins, 7 = Juvenile hormone mimics, 9 = Homopteran feeding blockers, 10 = Mite growth inhibitors, 11 = Midgut disruptors, 12 = ATP inhibitors, 15 & 16 = Chitin inhibitors, 18 = Ecdysone agonists, 20 & 21 = Mitochondrial inhibitors, 22 = Sodium channel blockers, 23 = Acetyl CoA inhibitors, 28 = Diamides, UN = unknown.

EFFICACY RATINGS:

3 = Good**, 2+** = Fair to Good, **2** = Fair, **1+** = Poor to Fair, **1** = Poor, **0** = Little or no effect, — = Unknown or not used for this pest.

? = Pest listed on label but no efficacy rating available. Results may depend on timing, dose, or pest density

( ) = Pesticide cannot be used at typical timing at which this pest is treated.

Key to pest abbreviations:

AM = Apple maggot
Aph = Spirea aphid and apple aphid
ARM = Apple rust mite
BMSB = Brown marmorated stink bug
EAS = European apple sawfly
ERM = European red mite
GFW = Green fruitworms
Int = Internal Leps (Codling moth, Oriental fruit moth, & Lesser appleworm)
LH = White apple & Potato leafhoppers
OBL = Obliquebanded leafroller
PC = Plum curculio
PP = Pear psylla
PRM = Pear rust mite
RAA = Rosy apple aphid
RBL = Redbanded leafroller
SB = Brown, dusky brown, and green stink bugs
SJS = San Jose scale
TLM = Spotted tentiform leafminer
TPB = Tarnished plant bug
TSM = Twospotted spider mite
WAA = Woolly apple aphid

Footnotes

* = Restricted-use pesticide; only certified applicators may purchase, use requires supervision of a certified applicator.

§ = Potentially acceptable in certified organic programs.

Δ = Efficacy ratings for stink bugs are preliminary and may not apply equally for all stink bug species. SB refers to brown, dusky brown, and green stink bugs. Brown marmorated stink bug has not damaged tree fruit crops in New England as of 2011, but has become an important pest of tree fruit and other crops in the Mid-Atlantic states. BMSB ratings from the *Pennsylvania Tree Fruit Production Guide*.

[a] Abamectin rated "Good" for control of **Pearleaf blister mite**. Thionex and Vydate rated "Fair".

[b] = Granulosis virus has good efficacy against codling moth, fair against oriental fruit moth, and is not effective on lesser appleworm.

[c] Chlorpyrifos (Lorsban, Nufos, Yuma) cannot be used as canopy sprays after petal fall. Permethrin (Ambush, Perm-Up, Pounce) cannot be used for any application after petal fall. Efficacy ratings are for prebloom application, which may not be an optimum or typical threshold timing for control of the pests listed.

[d] Pyrethrin has much shorhter residual activity than alternative products.

Table 7.1.3. Relative toxicity of pome fruit insecticides and miticides to beneficial arthropods.

	Beneficial Species				
Trade Name (active ingredient)	Honeybees[1]	*Amblyseius fallacis*[2]	*Typhlodromus pyri*[2]	*Stethorus punctum*[3]	*Aphidoletes aphidimyza*[4]
(abamectin) ***Agri-Mek, *Abacus, *Abamectin, *Abba, *Epi-Mek** etc.	L	M	M	M	L
Acramite (bifenazate)	M	M	M	L	L
Actara (thiamethoxam)	M	L	L	L	L
***Altacor** (chlorantraniliprole)	L	L	L	L	L
Apollo (clofentezine)	L	L	L	L	L
***Asana, *Adjourn** (esfenvalerate)	H	H	H	H	M
Assail (acetamiprid)	L	M	L	M	M
Avaunt (indoxacarb)	M	L	L	L	L
(azadirachtin) §**Aza-Direct**, **Azatin** §**Neemix**, §**Trilogy**	M	L	L	L	L
***Baythroid, *Tombstone** (cyfluthrin)	H	H	H	H	H
Beleaf (flonicamid)	L	L	L	?	?
Belt (flubendiamide)	L	L	L	L	L
(bifenthrin) [Pears only] ***Bifenture,*Brigade, *Discipline, *Fanfare**	M-H	?	?	?	?
Bt (*Bacillus thuringiensis* toxin): §**Agree**, §**Biobit**, §**Deliver**, §**Dipel**, §**Javelin**, **MVP**	L	L	L	L	L
***Calypso** (thiacloprid)	L	L	L	M	L
§**Carpovirusine,** §**Cyd-X** (granulosis virus) [a]	L	L	L	L	L
Centaur (buprofezin)	L	L	L	M	L
(clothianidin) **Clutch**, **Belay** w/ suppl. label	H	L	L	M	L
(cyhalothrin) ***Warrior *Lambda-Cy, *Proaxis, *Silencer, *Taiga**	H	H	H	H	H
***Danitol** (fenpropathrin)	H	H	H	H	H
Delegate (spinetoram)	L	M	M	L	L
(deltamethrin) ***Battalion, Decis*, Delta Gold***	M	H	H	H	M
***Diazinon, *AG600** (diazinon)	H	M	M	M	H
Dimate, Dimethoate (dimethoate) [Pears only]	H	H	H	M	H
***Endigo** (cyhalothrin & thiamethoxam)	H	H	H	H	H
§**Entrust** (spinosad)	L	L	L	L	L
***Envidor** (spirodiclofen)	H	L	L	M	?
Esteem (pyriproxyfen)	L	L	L	M	L
***Guthion** (azinphos-methyl)	H	L	L	L	H
(imidacloprid) ***Provado, *Pasada, *Sherpa**	H	L	L	M	L
***Imidan** (phosmet)	H	L	L	L	M
(insecticidal soap) §**Des-X, §M-Pede**	L	L	L	L	L
***Intrepid** (methoxyfenozide)	L	L	L	L	L
Kanemite (acequinocyl)	L	L	L	L	?
***Lannate** (methomyl)	H	H	H	M	H
***Leverage** (cyfluthrin/ imidacloprid)	H	H	H	H	H
Lorsban, Nufos, Yuma (chlorpyrifos) [b]	H	M	M	L	L
Movento (spirotetramat)	L	L	L	L	L
***Mustang Max** (zeta cypermethrin)	H	H?	H?	H?	?
Nexter (pyridaben)	H	M	L-M	M	M

Table continued on next page.

Table 7.1.3. Relative toxicity of pome fruit insecticides and miticides to beneficial arthropods.

	Beneficial Species				
Trade Name (active ingredient)	Honeybees[1]	*Amblyseius fallacis*[2]	*Typhlodromus pyri*[2]	*Stethorus punctum*[3]	*Aphidoletes aphidimyza*[4]
oil, dormant §**JMS Stylet,** §**Omni,** §**PureSpray** etc. (petroleum distillate)	L	?	?	L	L
oil, summer §**JMS Stylet** §**Omni,** §**PureSpray** etc. (petroleum distillate)	L	L-M[a]	L-M[b]	L	L
(permethrin) ***Ambush**, ***Perm-Up**, ***Pounce** b]	H	H	H	H	L
Portal (fenpyroximate)	L	L	L	M	?
***Proclaim** (emamectin benzoate)	H	L	L	?	?
(pyrethrin) §**Pyganic, Pyrenone** [c]	M	?	?	?	?
Rimon (novaluron)	M	L	L	H	?
Savey, Onager (hexythiazox)	L	L	L	?	?
Sevin (carbaryl)	H	M	L	H	H
***Supracide** (methidathion)	H	?	?	?	?
§**Surround** (kaolin)	L	L	L	L	L
***Thionex** (endosulfan) [e]	M	L	L	M	M
Vendex (fenbutatin oxide, hexakis)	L	L	L	L	L
Voliam Flexi (chloran-traniliprole & thiamethoxam)	H	L	L	M	M
***Voliam Xpress** (chlorantraniliprole & cyhalothrin)	H	H	H	H	H
***Vydate** (oxamyl) [e]	M	H	H	L	M
Zeal (etoxazole)	L	M	M	L	L

KEY TO TABLE 7.1.3:

[1] Honeybees = *Apis mellifera*

[2] *A. fallacis* and *T. pyri* are mite predator of pest mites

[3] *S. punctum* is a ladybird beetle predator of mites.

[4] *A. aphidimyza* is an cecidomyiid fly larva predator of aphids.

Key to honeybee toxicity ratings:

L = Low; not hazardous to honey bees at any time. 1 hr to 1 day residual toxity

M = Moderate; not hazardous if applied either in evening or early morning when honey bees are not foraging, except during periods of high temperature. 3 hr to 1 day residual toxicity

H = High; hazardous to honey bees at any time. 1 day to 2 week residual toxicity.

? = unknown

Key to toxicity ratings for other beneficial species (predators):

L = low impact on population (less than 30% mortality).

M = moderate impact on poppulati (between 30% and 70% mortality).

H = high impact on opulation (more than 70% mortality).

Footnotes:

[a] = low impact on immatures, moderate impact on eggs.

[b] = low impact on adults, moderate impact on eggs and immatures. Population recovery within 7 days.

[c] = Dependent on rate.

Information compiled from 48-hr residue tests, and in some cases field tests, at the NYS Agricultural Experiment Station.
Pyrethroids and other pesticides with long residual periods have greater impact than those with a shorter residual.

Table 7.1.4. Activity spectrum of stone fruit insecticides.

Insecticide	IRAC‡	APB	Aphids	CFF	JB	OFM	PC	PTB/LPTB	SB/ BM SB[1]	TPB	WFT
Actara	4A	—	2	2	2	—	3	—	2+/3	2	—
Altacor (chlorantraniliprole)	28	—	—	2	—	3	0	—	—/1	1	—
*Ambush, *Pounce (permethrin); except plums or apricots	3	—	—	3	—	2+	2	2	3/2	3	2
*Asana (esfenvalerate)	3	1	–	3	—	2+	2	3	2+/2	3	2
Assail (acetamiprid)	4A	—	3	3	3	3	2	—	2+/3	2	—
Avaunt	22	—	—	—	3	3	3	—	2+/0	2	—
§Aza-Direct, Azatin, §Neemix (azadirachtin)	18B	—	2	—	0	2	0	2	1/1	1	—
*Baythroid (cyfluthrin)	3	—	3	3	—	2+	2	3	3/2+	3	—
Belay (clothianidin) – peach only	4A	—	—	—	—	—	2+	—	—/3	3	—
Beleaf (flonicamid)	9C	—	3	—	—	—	—	—	2+/0	3	—
Belt (flubendiamide)	28	—	—	—	—	3	1	—	—/1	—	—
*Centaur (buprofezin)	16	—	—	—	—	—	—	—	—/1	—	—
*Danitol (fenpropathrin)	3	—	—	—	—	2-3	2	—	3/3	3	—
Delegate (spinetoram)	5	—	—	3	—	3	2	—	—/1	—	3
*diazinon	1B	—	1	3	—	1	2	0	2+/1	1	—
*Endigo (cyhalothrin & thiamethoxam	3A/4A	—	—	—	—	—	2	—	3/3	3	—
§Entrust (spinosad)	5	—	—	—	—	—	0	—	—	0	3
*Guthion (azinphos-methyl)- cherries only	1B	—	0	3	—	2+	3	0	2/1	1	—
Imidan (phosmet); except sweet cherries	1B	—	1	3	1	2+	3	0	2/1	1	—
Intrepid	18	—	—	—	—	2+	0	—	—/1	0	—
*Lannate (methomyl) – peach only	1A	—	2	—	—	2	2	1	3/3	1	3
Leverage (cyfluthrin/imidacloprid)	3/4A	0	3	3	3	3	3	3	2+/3	3	—
Lorsban (chlorpyrifos) except apricots or plums	1B	3	2	3	—	—	(3)	3	(2/2+)	(1)	—
malathion	1B	—	2	1	1	1	2	0	—	1	—
§M-Pede (insecticidal soap)	—	0	2-3	0	0	0	0	0	—/1	0	—
Mustang Max (zeta cypermethrin	3A	—	—	—	—	—	—	—	3/2	3	—
Proaxis (gamma cyhalothrin)	3A	—	—	—	—	—	2	—	3/2+	3	—
Provado, Admire Pro (imidacloprid)	4A	0	3	0	2+	0	—	0	2/2+	2	—
Sevin (carbaryl)	1A	—	3	3	3	2	2	0	2/2	1	1
§Surround (kaolin)	—	—	1	2	1	2	2	—	1/2	0	—
*Thionex (endosulfan) except apricots or plums	2A	0	1	—	—	0	0	3	3/3	1	—
Tourismo (flubendiamide/ buprofezin	28/16	—	—	—	—	3	1	—	—/1	1	—
Voliam Flexi (chlorantraniprole & thiamethoxam	4A/28	—	—	—	—	3	2+	—	2+/3	2+	
*Voliam Xpress (chlorantraniliprole/lambda-cyhalothrin)	3/28	2	3	3	3	3	3	3	2+/2+	3	2
*Warrior (*lambda-cyhalothrin)	3	1	3	3	1	2+	2	3	3/2+	3	2

Key on next page.

KEY TO TABLE 7.1.4:

Key to efficacy ratings:

— = unknown or does not apply in this case; **0** = Not effective; **1** = Poor; 1^+ = Poor to Fair; **2** = fair; 2^+ =Fair to Good; 3 = Good

( ) = Pesticide cannot be used at typical timing at which this pest is treated.

* Restricted-use pesticide; may be purchased and used only by certified applicators, or used by someone under the supervision of a certified applicator.

§ = Potentially acceptable in certified organic programs

‡ = IRAC (**I**nsecticide **R**esistance **A**ction **C**ommittee) Mode of Action Classification Group: Arthropod pest populations are more likely to exhibit cross-resistance to materials within the same group.

Key to pests:

APB = American plum borer
Aphids = Black cherry, green peach aphids
BMSB = Brown marmorated stink bug [1]BMSB ratings from the 2012 Pennsylvania Tree Fruit Production Guide.
CFF = Cherry fruit flies
JB = Japanese beetle
OFM = Oriental fruit moth
PC = Plum curculio
PTB/LPTB = peachtree borer/lesser peachtree borer
SB =Brown, dusky brown and green stink bugs (native species).
TPB = Tarnished plant bug
WFT = Western flower thrips

Table 7.1.5. Degree-day accumulations (from Jan. 1) corresponding to selected fruit phenology and arthropod pest events. (Baskerville-Emin formula used to calculate degree-days)

	DD Base 43˚F		DD Base 50˚F		Approx. Date in Eastern NY	
Pest or Tree Phenology Event	***mean***	***std dev***	***mean***	***std dev***	***mean***	***std dev***
STLM Traps set out			1-April			
Pear psylla – egg laying	84	44	33	21	4-Apr	11 days
Redbanded leafroller – 1st catch	141	34	58	20	17-Apr	7 days
Rosy apple aphid – 1st nymphs present	189	55	86	30	25-Apr	7 days
STLM – 1st adult catch	154	43	66	25	18-Apr	8 days
STLM - 1st egg observed	208	65	94	36	27-Apr	5 days
Tight cluster (McIntosh)	232	21	106	16	28-Apr	6 days
Tarnished plant bug – 1st observed	222	105	105	62	25-Apr	15 days
OBLR – 1st overwintered larvae observed	236	78	112	48	29-Apr	7 days
European red mite – egg hatch observed	284	53	134	34	6-May	4 days
STLM Egg Sample			Pink			
OFM Traps set out			Pink			
Pink (McIntosh)	293	19	141	17	4-May	6 days
Oriental fruit moth – 1st adult catch	273	52	129	35	2-May	8 days
STLM – 1st flight peak	325	62	160	39	6-May	7 days
OBLR Overwintered generation sample			Bloom			
CM Traps set out			Bloom			
Full bloom (McIntosh)	384	35	195	24	10-May	6 days
Lesser appleworm – 1st catch	399	139	203	84	12-May	11 days
American plum borer – 1st catch	438	49	226	36	16-May	5 days
Oriental fruit moth – 1st flight peak	445	97	232	56	16-May	11 days
Codling moth – 1st adult catch	489	90	257	57	19-May	7 days
San Jose scale – 1st adult catch	532	86	281	58	21-May	8 days
Cherry fruit fly traps set out			20-May			

Table continued on next page.

Table 7.1.5. Degree-day accumulations (from Jan. 1) corresponding to selected fruit phenology and arthropod pest events. (Baskerville-Emin formula used to calculate degree-days)

	DD Base 43˚F		DD Base 50˚F		Approx. Date in Eastern NY	
Pest or Tree Phenology Event	***mean***	***std dev***	***mean***	***std dev***	***mean***	***std dev***
Codling moth – 1st adult catch	489	92	257	58	19-May	7 days
STLM – 1st sap-feeding mines observed	472	129	241	76	18-May	13 days
Petal fall (McIntosh)	485	38	254	26	18-May	5 days
Lesser appleworm – 1st flight peak	564	209	307	133	22-May	12 days
Plum curculio – 1st oviposition scars observed	555	77	286	37	25-May	9 days
Pear psylla – hardshell stage observed	569	87	312	51	22-May	9 days
Lesser peachtree borer – 1st adult catch	586	103	316	66	25-May	8 days
San Jose scale – 1st flight peak	661	71	362	47	30-May	8 days
ERM Sample – 2.5 mites/leaf				1-Jun		
OBLR traps set out				1-Jun		
American plum borer – 1st flight peak	784	163	455	116	4-Jun	8 days
Codling moth – 1st flight peak	791	217	455	142	4-Jun	12 days
OBLR – 1st adult catch	895	83	528	59	10-Jun	6 days
Oriental fruit moth – 1st flight ending	977	143	590	105	13-Jun	8 days
Peachtree borer – 1st adult catch	1063	284	637	193	17-Jun	11 days
STLM – 2nd gen. 1st adult catch	1067	85	650	68	16-Jun	7 days
San Jose scale – 1st crawlers observed	1124	91	688	69	19-Jun	8 days
Dogwood borer – 1st adult catch	1008	351	570	251	20-Jun	14 days
American plum borer – 1st flight ending	1309	101	828	79	27-Jun	5 days
Apple Maggot Traps Set Out (in orchard)				1-Jul		
ERM Sample – 5.0 mites/leaf				1-Jul		
Comstock mealybug tape traps set out				1 Jul (ENY), 15 (WNY)		
Oriental fruit moth – 2nd flight starting	1382	107	877	92	30-Jun	5 days
OBLR Summer Gen. 1st Sample					10-Jul	5 days
STLM Summer Gen. 1st Sample					9-Jul	7 days
RBLR – 2nd flight starting	1410	170	896	135	1-Jul	6 days
AM – 1st catch	1437	203	916	128	2-Jul	10 days
Lesser peachtree borer – peak catch	1370	469	887	331	1-Jul	17 days
STLM – 2nd flight peak	1589	207	1030	164	8-Jul	9 days
Codling moth – 1st flight ending	1569	289	1018	207	7-Jul	14 days
Lesser appleworm – 2nd flight starting	1680	271	1098	182	11-Jul	10 days
Oriental fruit moth – 2nd flight peak	1695	240	1110	185	11-Jul	10 days
American plum borer – 2nd flight starting	1764	270	1164	176	15-Jul	10 days
RBLR – 2nd flight peak	1762	216	1157	166	14-Jul	7 days
San Jose scale – 2nd flight starting	1761	168	1160	131	15-Jul	9 days
Codling moth – 2nd flight starting	1914	345	1269	246	21-Jul	14 days
Dogwood borer – peak catch	2114	416	1394	285	31-Jul	14 days
American plum borer – 2nd flight peak	2221	238	1507	169	31-Jul	8 days
Oriental fruit moth – 2nd flight ending	2256	212	1535	182	1-Aug	7 days
ERM Sample – 7.5 mites/leaf				1-Aug		
Cherry fruit fly traps in				1-Aug		
San Jose scale – 2nd flight peak	2301	198	1580	169	4-Aug	9 days

Table 7.1.5. Degree-day accumulations (from Jan. 1) corresponding to selected fruit phenology and arthropod pest events. (Baskerville-Emin formula used to calculate degree-days)

	DD Base 43˚F		DD Base 50˚F		Approx. Date in Eastern NY	
Pest or Tree Phenology Event	***mean***	***std dev***	***mean***	***std dev***	***mean***	***std dev***
Apple maggot – peak flight	2317	223	1572	167	4-Aug	11 days
Codling moth – 2nd flight peak	2333	402	1585	307	7-Aug	15 days
Comstock mealybug – 2nd gen. crawlers emerging	2447	196	1651	141	9-Aug	12 days
OBLR –2nd flight starting	2455	200	1677	161	8-Aug	9 days
Oriental fruit moth – 3rd flight starting	2509	203	1715	152	11-Aug	9 days
Lesser appleworm – 2nd flight peak	2625	505	1792	380	17-Aug	24 days
STLM – 3rd flight peak	2775	232	1906	181	21-Aug	9 days
Oriental fruit moth – 3rd flight peak	2957	300	2043	211	29-Aug	13 days
All Traps In			30-Aug			

Abbreviations:

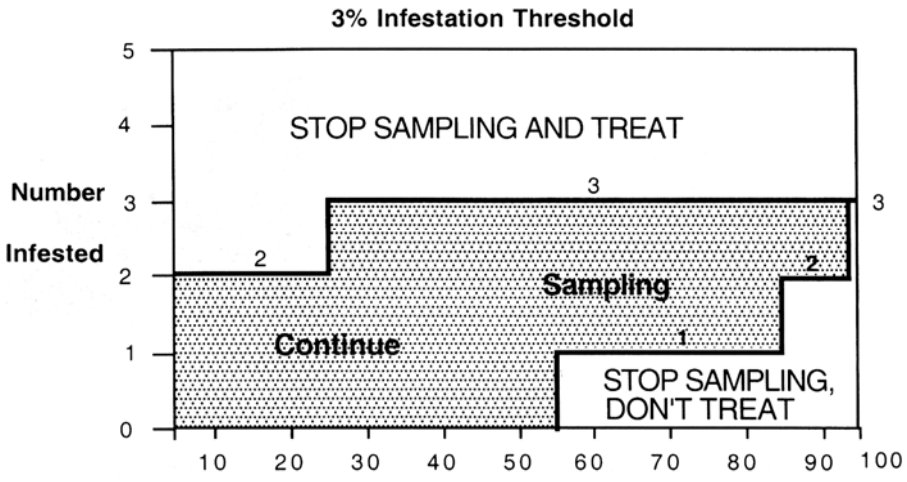
ERM = European red mite, OBLR = Obliquebanded leafroller, OFM = Oriental fruit moth

RBLR = Redbanded leafroller, STLM = Spotted tentiform leafminer

Information in this table is based on field observations. Values and dates are given +/- one standard deviation. Events are expected to occur within the stated range approximately 7 years out of 10.

This information is provided as a guide for scheduling scouting and sampling. Treatment decisions should be made on direct observations whenever possible.

Figure 7.1.1 - Obliquebanded Leafroller Sampling Form



- Examine 10 bud clusters (overwintering generation) or expanding terminals (1st summer generation) per tree for live OBLR larvae. For the 1st summer generation, sample at ~600 degree-days (43°F base) after the 1st moth flight in your area; if you do not have access to this information, use July 5 as an estimated best sample date in WNY (5-7 days earlier in ENY and Long Island).

- Sample every other tree starting with a random tree and continuing down the row. Remember that you are NOT counting OBLR larvae, but sites infested with LIVE OBLR. If trees are >10ft tall, try to include some samples from the upper canopy, or from watersprouts.

- If the total number of infested samples falls in the "Continue Sampling" zone, sample another tree. If the total falls in the "Stop Sampling, Don't Treat" zone, sampling is stopped and no treatment is recommended. If the total falls in the "Stop Sampling and Treat" zone, sampling is stopped and treatment is recommended. Refer to the Apple Pesticide Spray Table for a choice of pesticide materials.

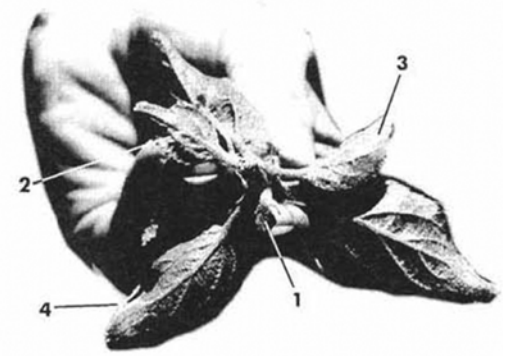
- Continue sampling until you REACH one of the boldface staircase lines in the chart above, or until you have examined a maximum of 100 clusters. If you reach the intersection of the two lines by the 100th sample, withhold treatment.

- If a no-treat decision is made for 1st summer generation larvae, resample again in 3-5 days (after approximately 100 DD more have accumulated). A second no-treat decision indicates that no treatment is recommended against this brood of OBLR.

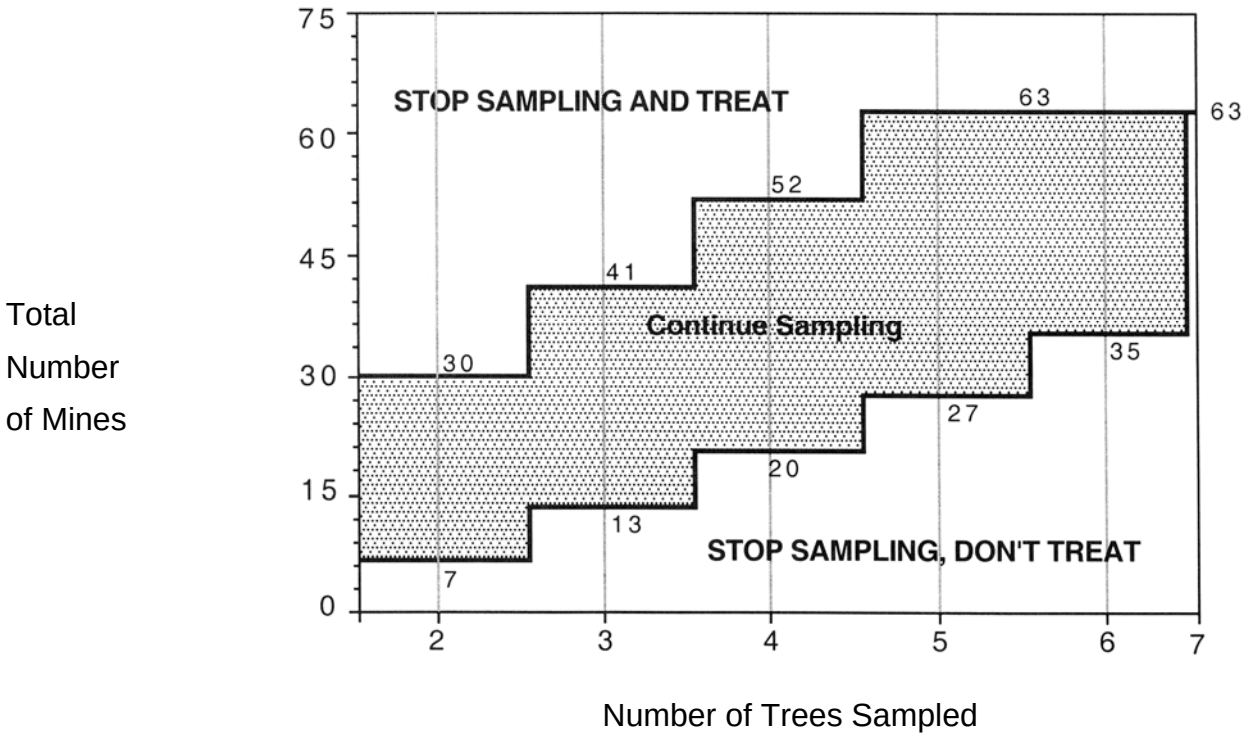
Use this table to keep track of your samples

Total Number Examined	# Infested	Total Number Examined	# Infested
10	_____	60	_____
20	_____	70	_____
30	_____	80	_____
40	_____	90	_____
50	_____	100	_____

Figure 7.1.2 - STLM Petal Fall Sampling Form



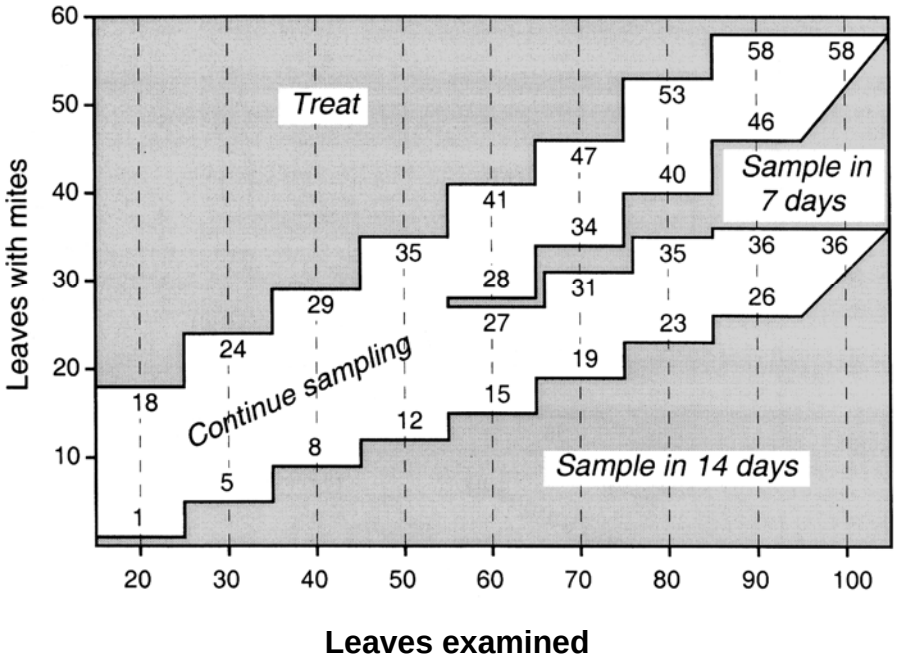
- If STLM eggs were not sampled during the pink or early bloom stage, a decision on 1st generation control can still be made by sampling sap-feeding mines at petal fall. After all the blossoms have fallen, start near one corner of the block, and go to every other tree until you have sampled enough trees to reach a decision. Select 3 fruit clusters from around the canopy of each tree sampled.
- Using a magnifier, count the mines on the undersides of the 2nd, 3rd, and 4th leaves in each cluster, counting leaves in the order they unfolded (see diagram at right).
- After 2 trees have been sampled, begin comparing the accumulated total number of mines found with the decision lines shown in the chart below for that number of trees.



- If the number of mines falls in the "Continue Sampling" zone, sample another tree. If the total is in the "Stop Sampling, Don't Treat" zone, sampling is stopped and no treatment is recommended. If the total is in the "Stop Sampling and Treat" zone, sampling is stopped and a treatment is recommended at petal fall. If 7 trees are sampled and the total number of mines equals 63, the population is below threshold.

Refer to the Apple Pesticide Spray Table for a choice of pesticide materials.

Figure 7.1.3 – Mite Sampling Chart
Threshold = 2.5 mites/leaf
(June 1 - 30)



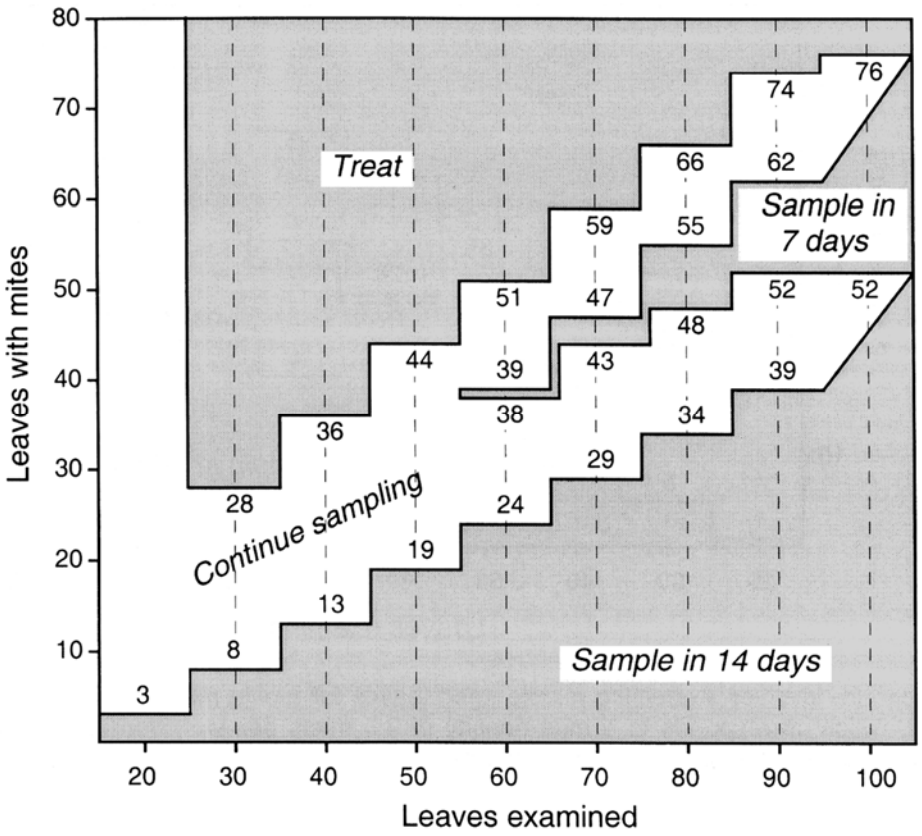
- This procedure involves examining middle aged leaves for motile mites (any stage except eggs). Use this chart, which corresponds to a mite density of 2.5 mites per leaf, from June 1 until June 30. You will not be counting mites, but will only determine whether they are present or absent on each leaf sampled.

- Starting with a random tree and sampling every other tree, collect 4 leaves in a plastic bag from each of 5 trees, choosing from each quadrant of the canopy. To make sure the leaves are of an intermediate age, pick them from the middle of the fruit cluster.

- Using a magnifier, examine the top and bottom surface of each leaf for motile mites, and keep track of the number of leaves containing motile mites. When all 20 leaves have been examined, compare this number with the numbers on the above decision guide. If the number of leaves with mites is equal to the values on the stairstep lines, the decision is the one shown in the area immediately below the value (example: For "29" after sampling 40 leaves, the decision is "Continue sampling"; for "8" the decision is to "Sample in 14 days").

- When the counts fall into any of the shaded regions, sampling is stopped and a decision is made to either treat, or else re-sample in 7 or 14 days. If the counts fall in the "Continue sampling" zone, take and examine more leaf samples in batches of 10 (5 per tree) until the counts fall into one of the shaded regions. If you reach one of the resample zones, the population is below threshold, and should remain so for at least the number of days stated. Return at the designated time and conduct another sample. If the -7 day" resample date falls during the 5.0 mites/leaf Threshold period, you can wait for a total of 14 days before resampling.

Figure 7.1.4 - Mite Sampling Chart
Threshold = 5.0 mites/leaf
(July 1 - 31)

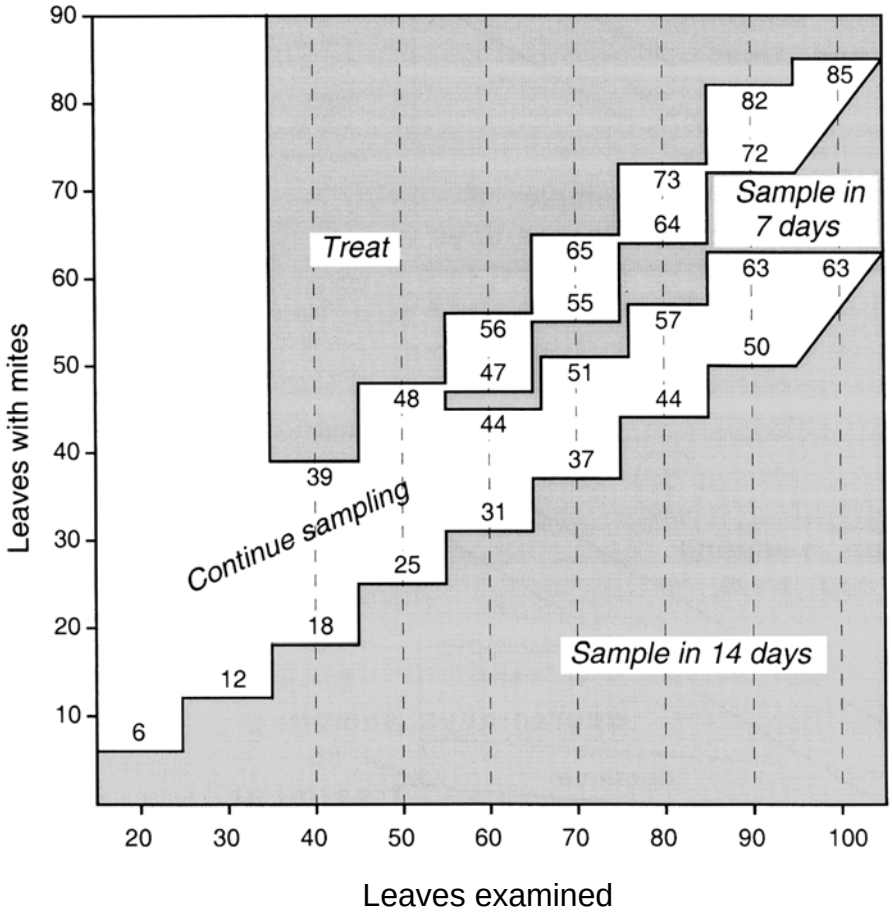


- This procedure involves examining middle aged leaves for motile mites (any stage except eggs). Use this chart, which corresponds to a mite density of 5.0 mites per leaf, from July 1 until July 31. You will not be counting mites, but will only determine whether they are present or absent on each leaf sampled.

- Starting with a random tree and sampling every other tree, collect 4 leaves in a plastic bag from each of 5 trees, choosing from each quadrant of the canopy. To make sure the leaves are of an intermediate age, pick them from the middle of the fruit cluster or foliar terminal.

- Using a magnifier, examine the top and bottom surface of each leaf for motile mites, and keep track of the number of leaves containing motile mites. When all 20 leaves have been examined, compare this number with the numbers on the above decision guide. If the number of leaves with mites is equal to the values on the stairstep lines, the decision is the one shown in the area immediately below the value (example: For "36" after sampling 40 leaves, the decision is "Continue sampling"; for "13" the decision is to "Sample in 14 days"). When the counts fall into any of the shaded regions, sampling is stopped and a decision is made to either treat, or else re-sample in 7 or 14 days. If the counts fall in the "Continue sampling" zone, take and examine more leaf samples in batches of 10 (5 per tree) until the counts fall into one of the shaded regions. If you reach one of the resample zones, the population is below threshold, and should remain so for at least the number of days stated. Return at the designated time and conduct another sample. If the "7 day" resample date falls during the 7.5 mites/leaf Threshold period, you Can wait for a total of 14 days before resampling.

Figure 7.1.5 - Mite Sampling Chart
Threshold = 7.5 Mites/Leaf
(August 1 - 15)

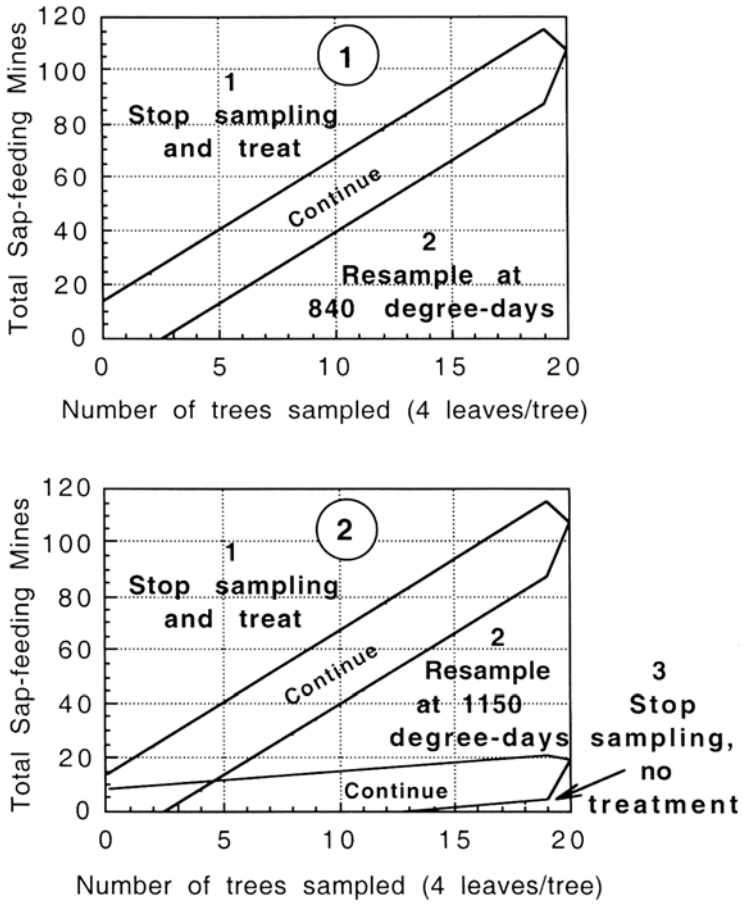


- This procedure involves examining middle aged leaves for motile mites (any stage except eggs). Use this chart, which corresponds to a mite density of 7.5 mites per leaf, from August 1-15. You will not be counting mites, but will only determine whether they are present or absent on each leaf sampled.

- Starting with a random tree and sampling every other tree, collect 4 leaves in a plastic bag from each of 5 trees, choosing from each quadrant of the canopy. To make sure the leaves are of an intermediate age, pick them from the middle of the fruit cluster or foliar terminal.

- Using a magnifier, examine the top and bottom surface of each leaf for motile mites, and keep track of the number of leaves containing motile mites. When all 20 leaves have been examined, compare this number with the numbers on the above decision guide. If the number of leaves with mites is equal to the values on the stairstep lines, the decision is the one shown in the area immediately below the value (example: For "39" after sampling 40 leaves, the decision is "Continue sampling"; for "18" the decision is to "Sample in 14 days"). When the counts fall into any of the shaded regions, sampling is stopped and a decision is made to either treat, or else re-sample in 7 or 14 days. If the counts fall in the .Continue sampling" zone, take and examine more leaf samples in batches of 10 (5 per tree) until the counts fall into one of the shaded regions. If you reach one of the resample zones, the population is below threshold, and should remain so for at least the number of days stated. Return at the designated time and conduct another sample. If the resample date falls after August 15, there should be no further need for additional samples or miticide sprays this season.

Figure 7.1.6 - STLM Summer Sampling Form



Because of variability in this pest's development from one site to the next, more than one sampling session may be needed to reach a treatment decision for 2nd generation STLM. The first sample should be taken at 690 degree-days (base 43°F) after the start of the 2nd moth flight (or approximately 25-30 days). In central MA, use July 9 as an approximate sampling date if you don't have access to pheromone trap catch data.

Start near one corner of the block and sample trees along a diagonal, moving toward the opposite corner of the block. At each tree, count all the **sap-feeding** mines on 4 mature terminal leaves randomly selected from around the outside of the canopy. Sampled leaves should be those located near the middle of the terminals. After sampling 3 trees, start comparing the accumulated total number of mines found with the appropriate chart for the sampling session and proceed as follows:

SAMPLING DONE AT 690-840 DD

If the number of mines falls in the "Continue" zone on **Chart 1**, sample another tree and check again. If the total is above this zone (area 1). sampling is stopped and a treatment is recommended. If the total is below this zone (area 2), stop sampling and sample the block again at approximately 840 DD (about 31 days) after the start of the 2nd flight.

SAMPLING DONE AT 840-1149 DD, IF NECESSARY

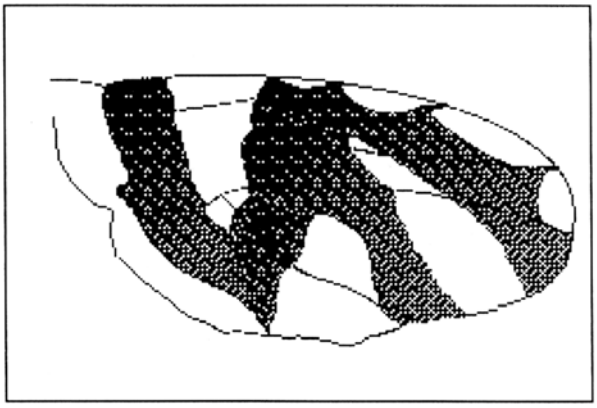
If it is necessary to sample the population a second time, refer to Chart 2 after sampling the 3rd tree. If the accumulated total falls in one of the "Continue" zones, sample another tree and check again. If the count falls in area 1, a treatment is recommended and no further sampling is necessary. If the count falls in area 2, stop sampling and sample the block again at approximately 1150 DD (about 42 days) after the start of the 2nd flight. If the count falls in area 3, treatment is not recommended and no further sampling is necessary.

SAMPLING DONE AT 1150 OR MORE DD, IF NECESSARY

If it is necessary to sample a third time, refer again to **S**, the same as in the first sampling session. This time, however, if the accumulated total number of mines falls in area 2, treatment is not recommended and no further sampling is required for this brood of STLM.

Refer to the Apple Pesticide Spray Table for a choice of pesticide materials if a treatment is elected.

Figure 7.1.7 – Apple Maggot Monitoring Form



On or before July 4, and possibly earlier in blocks with early harvest cultivars, hang 3 to 4 sticky red sphere traps per block in trees along the perimeter closest to an abandoned orchard or a stand of woods. If no abandoned trees or woodlands are nearby, choose the southern edge of the block. Use of supplementary apple volatile lures increases t he sensitivity of the traps and provides earlier warning of a developing threat from apple maggot (AM) damage. A layer of stickum about 1/8" thick provides extended stickiness without causing dripping off during hot weather. A thinner layer may not remain fully effective after 2-3weeks in the field.

Trap trees should be spaced at least 30 ft from each other. Place the traps in the outer canopy so that they are visible from outside the tree, at least 6 ft. high. Position the traps so that they are surrounded by fruit and foliage, but strip leaves as needed to create an open pocket at least 12 inches diameter around the trap to prevent foliage from sticking to it as the wind move branches, and to increase visibility. Ideally, there should be some fruit below the trap to capture female AM as they move from adjacent fruit.

No treatment is recommended until the trap catch threshold is reached. Check the traps 1-2 times per week for AM flies, which can be distinguished from similar species by the pattern of dark bands on their wings (right), a white spot on the thorax between the wings, and by a horizontal light colored stripe extending backward from the margin of the compound eyes.

If the cumulative average total of 5 AM flies per trap is reached (i.e. cumulative total of 15 AM on three baited traps, or 20 AM on four baited traps), a spray of a suitable insecticide is recommended immediately. After an insecticide application, the traps can be ignored for 7-14 days. The length of the residual period depends on the material used and the accumulation and intensity of rainfall after application. **If supplementary bait lures are NOT used, a lower threshold of 1 – 2 AM flies per trap is necessary.**

When residue from the previous application is considered to no longer be effective, remove AM, other insects and debris from the traps and begin resuming checking them to see when/if the threshold is reached again.

After about a month in the field traps may need to be recoated with stickum.

For most blocks, traps can be taken down at the end of August, but for blocks of late harvested cultivars with a history of AM damage, it may be useful to leave traps up until September 10 if it is feasible to make a late treatment if needed, or if detecting AM pressure in the block would otherwise be of use in harvest or marketing decisions.

Date checked	Number of AM Flies caught since last check or residue depletion	Cumulative Avg. AM caught per trap since last check or resiude depletion
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

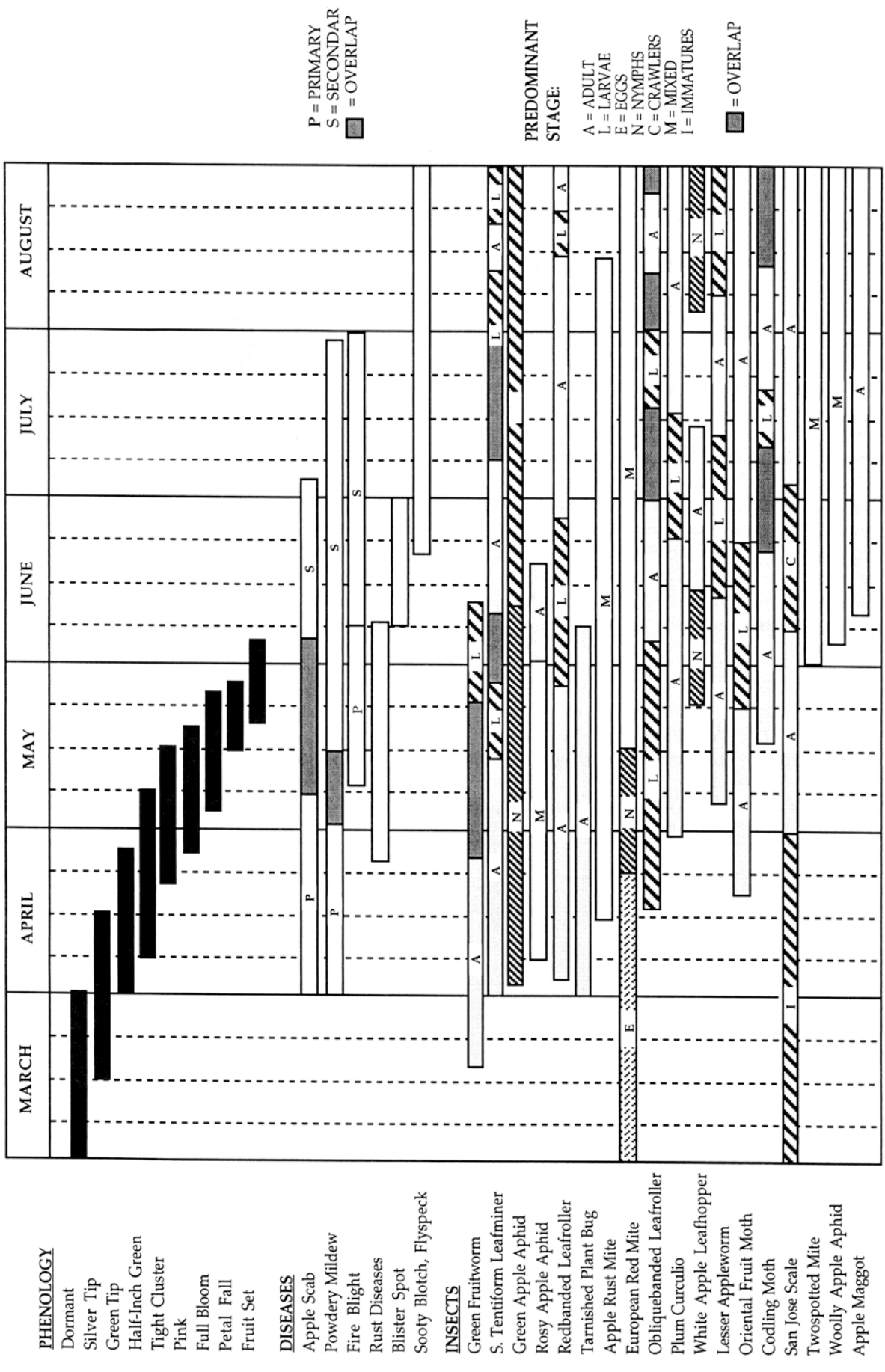


Figure 7.1.9. Average Timing for Apple Events for New England

Figure 7.1.10. Average Timing for Pear Events for New England

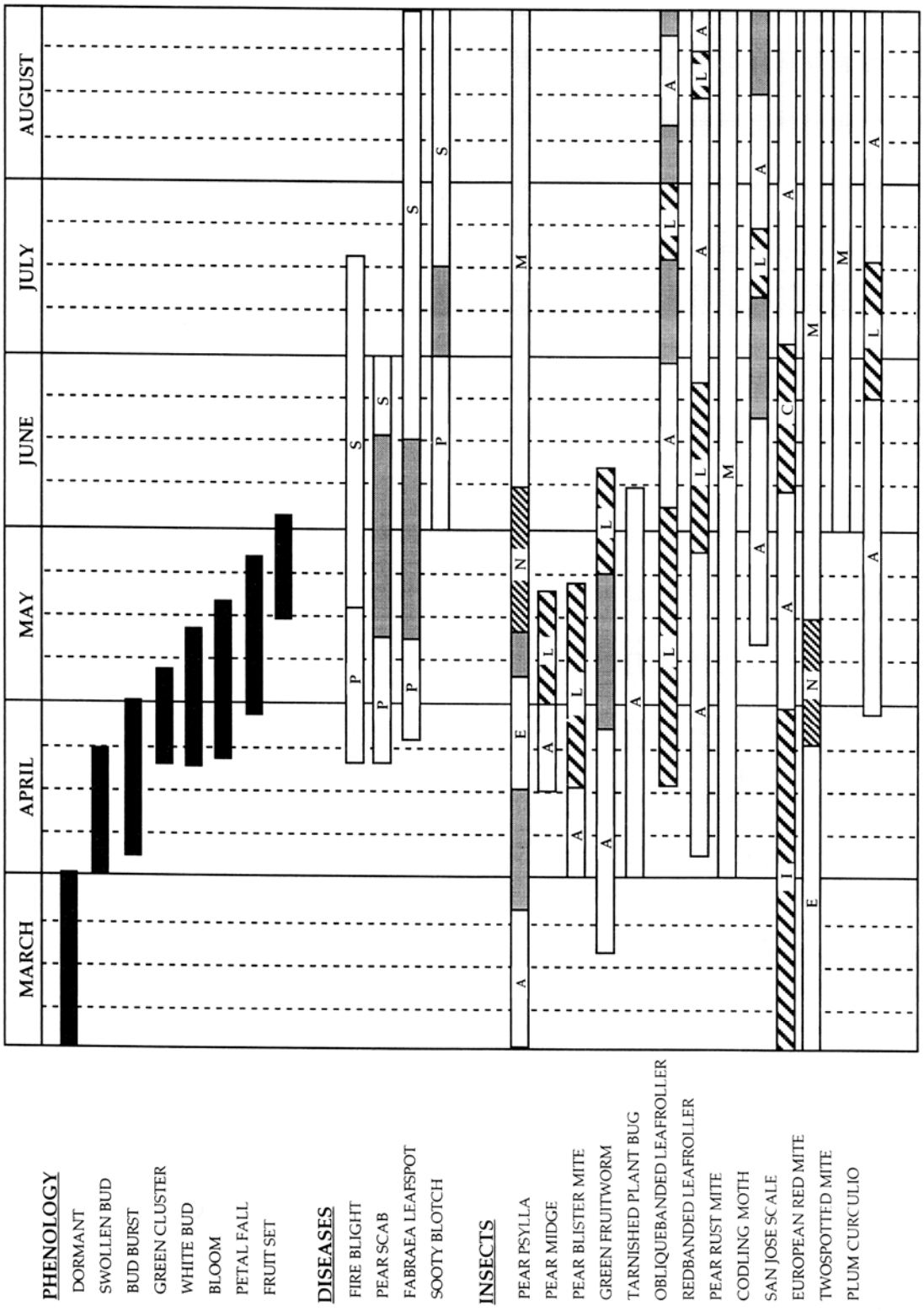


Figure 7.1.11. Average Timing for Cherry Events for New England

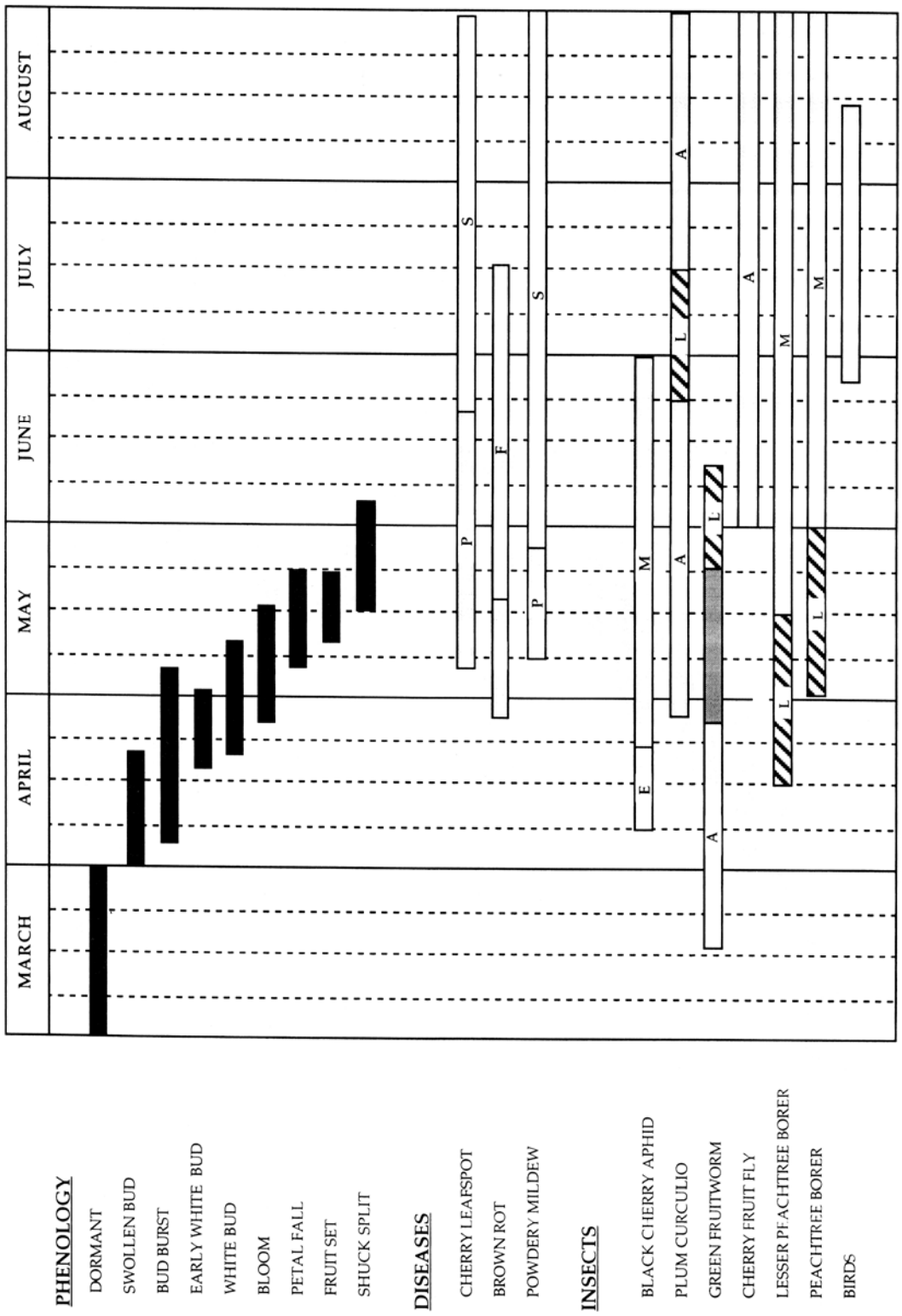
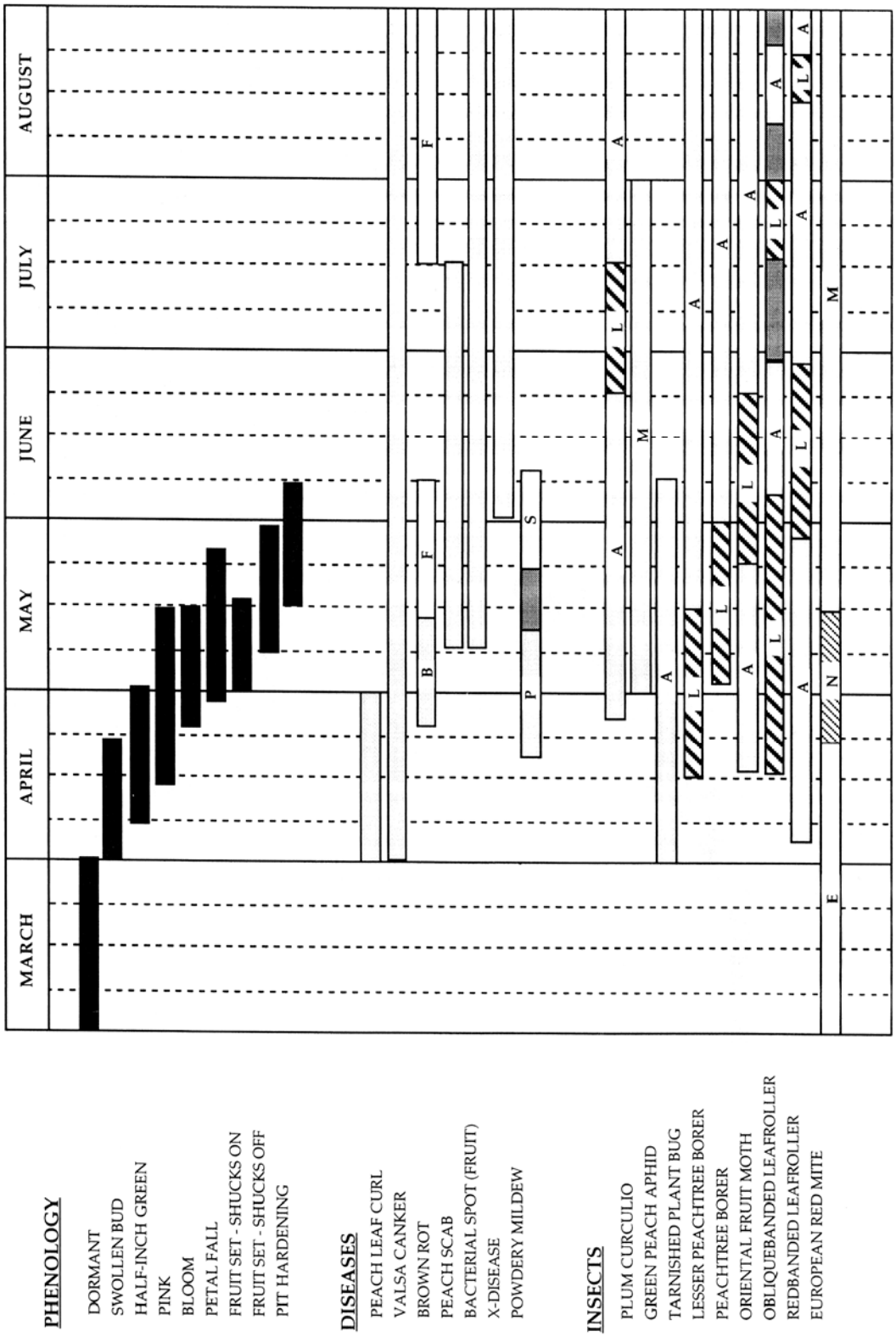


Figure 7.1.12. Average Timing for Peach Events for New England



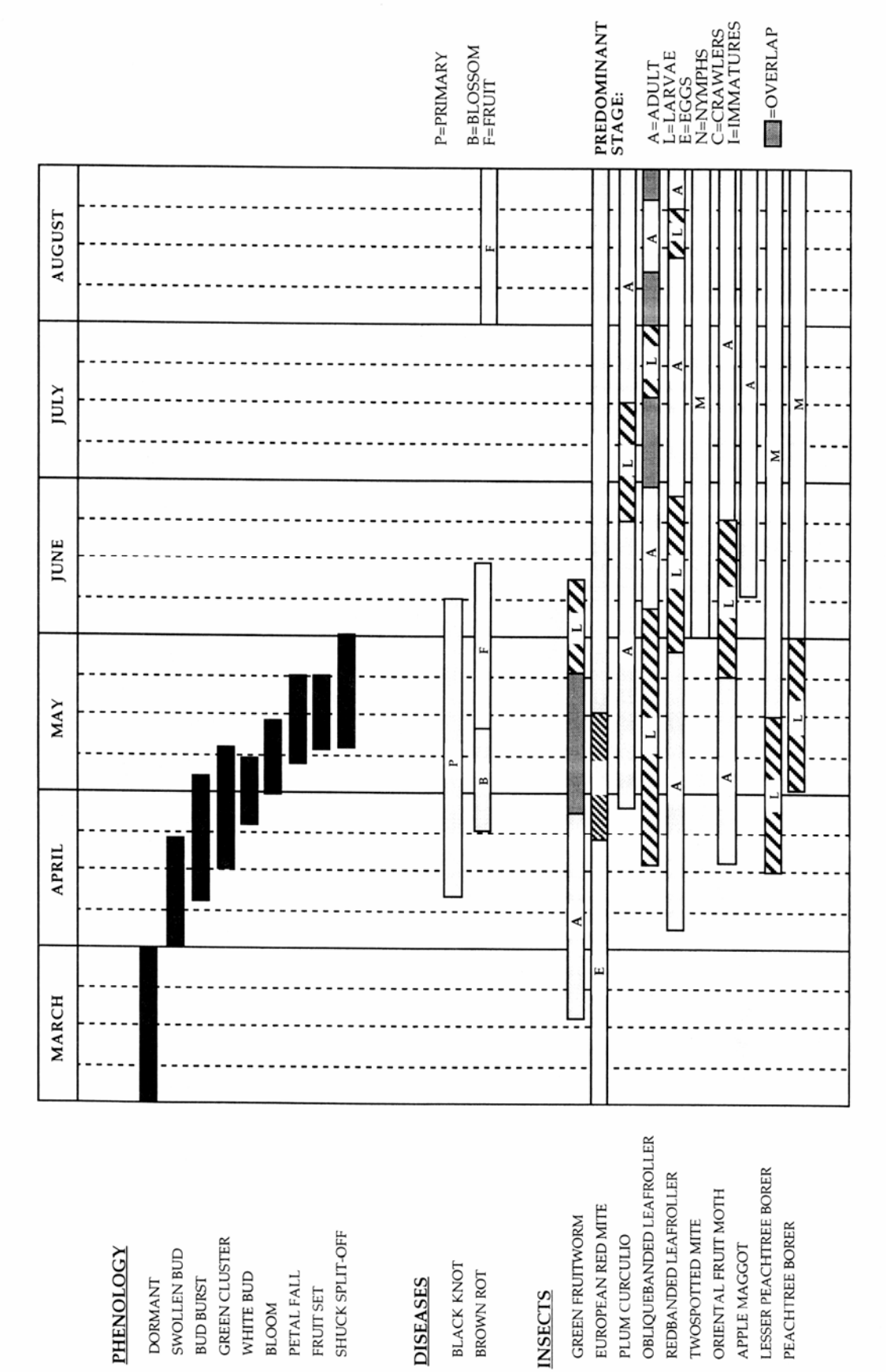


Figure 7.1.13. Average Timing for Prune and Plum Events for New England