25th ANNUAL MARCH MESSAGE
TO MASSACHUSETTS TREE FRUIT GROWERS (2003)

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INTRODUCTION

Since its inception, the intent of the March Message has been to summarize new information and offer thoughts related to the management of insect and mite pests of tree fruit in Massachusetts. The information is compiled from a wide variety of sources but mainly from results of work conducted by colleagues in northeastern states and our own work.

GENERAL IPM TOPICS AND OPINION

PROBLEM PESTS: THEIR 2002 ACTIVITY AND NEW FINDINGS

IPM MANUALS, SUPPLIES AND SERVICES

CHANGES IN ORCHARD CHEMICALS FOR 2003

Since the 2002 March Message where we presented information on 4 new pesticides labeled for use in the 2002 growing season (Acramite, Actara, AzaDirect and Valero), some new pesticides have been labeled for use in 2003 in orchards. Some others have undergone label modifications. Here's a summary of how things stand as of February 15, 2003.

A. NEWLY REGISTERED COMPOUNDS

Assail (acetamiprid) is manufactured by Ceraxagri Inc. It is a new neonicotinoid insecticide (related to Provado and Actara) that offers locally systemic, translaminar activity. This means that active ingredient sprayed onto the upper leaf surface will move through the leaf and also be effective against pests that feed on the lower leaf surface.

It is labeled for use on apples and pears and promises to be especially effective against leafminers, leafhoppers, aphids and pear psylla, with substantial effectiveness against codling moth and oriental fruit moth. Though not yet labeled against apple maggot, some research suggests it may be effective against this summer pest, which could otherwise be challenging to control in the absence of organophosphates. Two particular advantages of Assail are short re-entry time (12 hours) and rather short pre-harvest interval (7 days).

Like other nicotinoids, Assail is very toxic to bees, especially bees that are sprayed directly when foraging on flowering orchard understory plants. It's comparatively safe on predators and parasitoids.

No more than 4 applications are allowed per season, with a minimum of 12 days between applications.

Distance (pyriproxyfen) is manufactured by Valent Professional Proudcts. It has the same active ingredient as Esteem but is specifically targeted for use on non-bearing apple and pear trees to control San Jose scale, aphids and leafminers. The active ingredient is an insect growth regulator.

Entrust (spinosad) is manufactured by Dow AgroSciences. It has the same active ingredient as SpinTor but is formulated for use by organic growers. It's labeled for use on apples, pears and stone fruit. Especially effective against leafminers and also controls codling moth, oriental fruit moth and leafrollers. It has a very low impact on beneficials.

B. LABEL CHANGES

Actara (thiamethoxam) is suspected of having caused some severe bee kills in Washington State in 2002. In 2003, the label will be changed and will specify a 5-day post-application restriction on introduction of hives into treated areas. All neonicotinoid insecticides (Assail, Actara and Provado) are very toxic to bees foraging on flowering understory plants. To prevent bee kills, growers should either move or remove hives before applying any of these materials.

Esteem (pyriproxyfen) is now labeled for use on stone fruit to control San Jose scale and other scale insects.

Lorsban (chlorpyrifos) can continue to be used under a supplemental label that allows 2 applications per year to trunks (but not foliage or fruit) of apple trees for control of dogwood borer and other wood-boring insects. Preharvest interval remains at 28 days.

FOOD QUALITY PROTECTION ACT: AN UPDATE (FEBRUARY 2003)

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In the year since our last issue of the March Message, the focus of EPA's implementation of the Food Quality Protection Act (FQPA) continues to center around the organophosphate compounds. Although preliminary work on other classes of compounds is underway, the important regulatory decisions made in 2002 that will affect tree fruit growers involved the active ingredients azinphosmethyl, phosmet, diazinon and chlorpyrifos.

Azinphosmethyl – This past summer, EPA announced the finalization of the regulatory decision concerning the continued use of azinphosmethyl. The decisions that affect tree fruit have been widely reported but we summarize them here for reference purposes:

1) cancellation for use on plums – no sales after 9/1/02 but existing stocks can be used
2) phase-out for use on peaches and nectarines – cancelled as of 8/31/05 and cannot be used after 12/31/05
3) time-limited registration for use on apples, pears and cherries – cancelled 12/31/05 unless submitted data indicate registration should be continued

The exact conditions under which azinphosmethyl use on apples will be allowed during the next three years are currently unknown as EPA has yet to finalize the label. However, it is **very likely** the label will include the following:

1. a reduction in the total amount of product allowed per acre / per season
2. a 14-day restricted-entry interval for most activities except possibly fire blight shoot removal
3. an extended pre-harvest interval for PYO operations
4. more restrictive language regarding spray drift management

The final label should be released in the very near future. Recent discussions concerning the exact wording of the spray drift language have been somewhat controversial and EPA is proceeding cautiously. This language will be precedent setting and, therefore, will likely appear on the final label of other compounds as EPA continues to implement the FQPA.

It is unlikely the final label changes will affect the use of azinphosmethyl this season. The registrants have a 90 day grace period before newly manufactured product must be shipped with the new label. In addition, existing stocks of product can continue to be used under the conditions on the old label until they are exhausted. It is our understanding there should be ample supplies of product bearing the old label in the Northeast for fruit growers to use this upcoming season.

The registrants of azinphosmethyl have stated they are fully committed to the product and will continue to work with EPA with respect to the crops that have either a time limited registration or are scheduled to be phased-out. The registrants are currently conducting numerous studies requested by EPA to generate data in support of the continued use of azinphosmethyl beyond 2005.

Phosmet - Although the conditions under which the continued use of Imidan were fairly well set at this time last year, the final label has yet to be released for the same reason described in the azinphosmethyl section above; the exact wording of the spray drift language.

The six tree fruit crops on the label (apples, apricots, pears, peaches, nectarines and plums) will be reassessed in 2006. This product is not scheduled for phase-out nor are these tolerances proposed for cancellation.

The only major label revision affecting tree fruit growers using phosmet in the near future, other than spray drift management, will be a change in the restricted-entry interval (REI) which will increase from 1 day to 3 days for the tree fruit crops mentioned above when the final label is released. Gowan Company is currently manufacturing product with the old label and existing stocks can legally be used until exhausted so it is unlikely this ruling will have much impact this growing season.

Diazinon - This past fall, Makhteshim-Agan of North America announced an agreement with EPA that will affect the future use of diazinon on apples. Barring any last minute changes, when the label is finalized the use of diazinon on apples will be restricted to 1 application per season for the control of wooly apple aphid only. Again, this change will not be effective prior to the 2003 growing season.

Chlorpyrifos – Post-bloom use of foliar applications of chlorpyrifos on apples has been illegal since December 2000. The continued use as a trunk spray for borer control has been allowed for the past two seasons under a supplemental label while studies were conducted to determine if this usage would result in unacceptable fruit residue levels. Dow AgroSciences recently announced that the results of these residue trials, conducted by IR-4, were favorable and that supplemental label will continue to be in effect for the upcoming growing season. Dow and EPA will continue their discussions concerning the long-term disposition of chlorpyrifos for borer control.

APPLE IPM STUDIES IN MASSACHUSETTS IN 2002

In 2002, we conducted IPM studies in 36 blocks (144 plots) of apple trees in commercial orchards. It proved to be a good year for orchard research. Here's some of our findings.

PLUM CURCULIO (PC)

For PC, our near-term goal has been to develop a monitoring method for pinpointing need and timing of insecticide sprays for control. Toward this end, in 2002 we compared 3 types of traps for monitoring PC along with a new approach that we conceived: trap trees. The 3 types of traps were: (1) a sticky-coated clear Plexiglas panel trap placed in the orchard border area, designed to capture PCs immigrating into orchards by flight, (2) a black pyramid trap placed in the orchard border area, designed to capture PCs immigrating into orchards by crawling, and (3) a wire-screen Circle trap wrapped around the trunk of a perimeter-row tree designed to intercept PCs crawling up tree trunks. Each trap was baited with a combination of benzaldehyde (a fruit volatile) plus grandisoic acid (= PC pheromone). A trap tree consisted of a perimeter-row apple tree whose branches were baited with benzaldehyde plus grandisoic acid. The purpose of using an entire tree as a "trap" was to maintain long-range attractiveness of these odors but reduce close-range repellency that can occur when these odors are placed on or next to traps. The purpose of having an effective trap is to use the amount of PCs captured by the trap as an indicator of the amount of PC injury to fruit that is likely to occur in the near future. The purpose of a trap tree is to aggregate PC adults and injury so that level of fresh injury can be easily monitored directly and used as a guide for need to spray. In our 2002 tests, all traps and trap trees were employed at pink, and each plot receiving a trap or trap tree was sprayed by growers 3 times after petal fall.

Results for 2002 showed the following:

- Sticky panel traps captured about 4 times more PCs than pyramid or Circle traps.
- Even so, neither sticky panel traps nor either of the other 2 trap types exhibited amounts of captures that correlated well with either weekly or season-long amounts of fresh ovipositional injury to fruit by PCs. Hence, in contrast to our optimism based on 2001 findings, none of these trap types appears to offer much promise as a tool for effectively monitoring the seasonal course of PC injury to apples in commercial orchards.
- On the other hand, trap trees gave rise to a 15-fold level of aggregation of PC injury to fruit (compared with fruit injury on unbaited trees). This means that monitoring apples on an odor-baited trap tree for fresh egglaying injury can be a very simple and useful tool for determining need and timing of PC sprays.
- As in 2001, perimeter rows comprised of Gala, Jonagold or Fuji received more trap captures and more injury than perimeter rows comprised of McIntosh or Empire.
- As in 2001, orchard blocks bordered by woods or hedgerows received more PC injury than blocks bordered by open field.
- As in 2001, PC injury was highly concentrated on perimeter-rows compared with interior rows (by a factor of nearly 10:1).
- Tests in 2000, 2001 and 2002 in non-sprayed blocks indicated that nearly 2/3 of all PCs immigrate into orchards before petal fall and move well into interiors of blocks. Hence, a whole-orchard petal fall spray is advisable. When fruit reach 6-7 mm, immigrating PCs tend not to move beyond perimeter-row trees. Hence, first and second cover sprays can be confined to perimeter rows. Trap trees on perimeter rows can tell us if and when perimeter-row sprays are needed.
- In 2003, we would like to determine the distance over which a baited trap tree exerts its aggregating effect (25, 50 or 100 m on either side) and determine the amount of fruit injury on a trap tree (1, 2, 4 or 8%) that will trigger a spray needed to prevent total orchard-wide injury by PC from exceeding 0.2-0.5%.

APPLE MAGGOT (AMF)

For AMF, our ultimate goal is to develop a trapping system that will provide outstanding control under a wide variety of orchard architectures and conditions. Toward this end, in 2002 we compared two types of odor for use in association with sticky spheres placed 10 meters apart on perimeter-row apple trees to intercept immigrating AMF. These were termed BLEND (a 5-component blend of synthetic apple odor) and BH (butyl hexanoate), a single component of apple odor used in 2002 at 1/4-strength as opposed to full strength in 2001 (to lessen the dose and draw fewer AMF toward a plot and thus possibly lessen the threat of AMF to fruit). Traps were in place from June to harvest. The three plots received either BLEND-baited traps or BH-baited traps on perimeter trees or 2-3 grower applied insecticide sprays. Also, interior trees of each plot received unbaited spheres to monitor extent of AMF penetration into plot interiors.

Results of the orchard architecture study for 2002 showed the following:

- BLEND-baited traps captured nearly 65% more AMF on perimeter-row apple trees than did the 1/4-strength BH-baited traps.
- When perimeter rows were comprised of Gala, Jonagold or Fuji, perimeter traps baited with BLEND were equal to insecticide sprays in preventing AMF penetration into interior rows and were more effective in doing so than perimeter traps baited with BH. When perimeter rows were comprised of McIntosh or Empire, all three of these approaches performed equally well in preventing penetration of AMF. Overall, our 2002 results differed slightly from our 2001 results in that BLEND-baited traps performed better in 2002 than in 2001, possibly due to our greater effort to insure that each trap was positioned optimally in the tree canopy. Across all situations, BLEND-baited traps in 2002 equaled insecticide sprays in controlling AMF.
- As in 2001, orchards bordered by woods or hedgerows received more trap captures and more injury than orchards bordered by open field.
- In 2003, we would like to evaluate a new approach to selecting distances between traps (in 2001 and 2002, there was always 10 m between traps). Drawing upon our research findings over the past few years, we are now able to create an index for determining distance between BLEND-baited traps. The index is based on a set of values. A value of 1 is assigned to large trees, highly susceptible cultivars or woods as border area. A value of 2 is assigned to medium trees, moderately susceptible cultivars or hedgerows as border area. A value of 3 is assigned to small trees, tolerant cultivars or open field as border area. Values for tree size, cultivar and border area totaling 3-4 will require traps to be 5 m apart, values totaling 5-7 = 10 m apart, and values totaling 8-9 = 15 m apart. For 2003, we would assess the characteristics of each block, assign values and place traps at appropriate distances to evaluate the performance of this approach.

In 2002, we also evaluated our latest version of pesticide-treated spheres (PTS) as a substitute for sticky spheres for AMF control. An ideal PTS is one that will attract AMF, stimulate alighting AMF to feed on sugar on the sphere surface, and in so doing ingest a small amount of imidacloprid released from the latex paint coating the sphere. The challenge has been to ensure a continual supply of sugar to the sphere surface, enough to stimulate feeding by all alighting AMF across the entire 12 week period of AMF activity in orchards.

Our 2002 version of a PTS was a sphere topped by a 1 ¾ inch tall x 2 ½ inch diameter (150 gram = 5 ounce) disc made of 80 % sugar and 20% paraffin. This disc was compressed under 20 tons of hydraulic pressure and enveloped completely by impressed hardware cloth (wire mesh) to prevent consumption by rodents. Shallow depressions in the top surface of the disc allowed rainfall to accumulate, percolate through the disc and introduce new sugar onto the sphere surface after rainfall had removed previously-existing sugar. Discs of this type could also release sugar upon absorption of moisture from the atmosphere under conditions of high humidity or morning dew.

We compared the performance of odor-baited PTS topped by above-type 2002 discs with the performance of PTS topped by 2001 discs and the performance of sticky spheres or insecticide sprays to control AMF. Plots of about one-half acre each were surrounded by spheres 5 meters apart or sprayed with insecticide by growers. Results showed the following:

- Degree of AMF penetration into plot interiors and percent fruit injured by AMF were essentially the same for plots surrounded by PTS as for plots surrounded by sticky spheres or plots that were sprayed.
- Overall, the 150 gram (2002 version) discs held up quite well for the entire 12 weeks except in small trees, where they were exposed to direct sun and tended to melt down faster. These 2002 results were encouraging in that even after 12 weeks, sufficient sugar was present on the surface of most spheres topped by 150 gram discs to kill a majority of AMF, as determined in lab tests conducted after selected spheres were removed from trees in late September.
- With modifications made in the lab in November and December of 2002 to further improve residual activity of the top caps, we feel very confident that our 2003 version of 150 gram caps will be ideal for providing a continuous 12 week supply of sugar to the sphere surface and inducing alighting flies to feed (and thereby ingest imidacloprid on the sphere surface), even in the face of harsh environmental conditions. Thus, we predict that PTS topped by 2003-version caps should be able to provide effective season-long AMF control without requiring any attention after emplacement in early July.

MITES

In 2000, *Typhlodromus pyri* mite predators were released at the centers of two of the four plots that comprised each block of apple trees in 12 commercial orchards. One of these two plots received cattail pollen as a food amendment for the predators. The other release plot did not. As no differences in predator numbers were observed among plots during the 2000 or 2001 season, all plots were combined into a single unit for 2002. Once (on July 31 in 2002) leaves from trees in rows 1, 4 and 7 in each orchard were sampled and sent to cooperator Jan Nyrop in New York for pest mite and predator identification. Leaves were also sampled from American hazel trees that were planted in border areas of some plots in 2000.

Results for 2002 showed the following:

- Abundance of pest European red mites (ERM) was exceptionally low in all plots in 2002. Abundance of *T. pyri* and *Amblyseius fallacis* predators also was low but in the case of *T. pyri* was greater than that of pest mites, suggesting that *T. pyri* was providing excellent block-wide biocontrol of pest mites.

- There was no detectable difference in abundance of pest mites or *T. pyri* predators on perimeter-row trees vs. trees in the fourth or seventh interior rows, indicating an even distribution of pest and predator mites among rows.
- As in 2000 and 2001, no *A. fallacis* predators were found in 2002 on the American hazel trees that were planted in border areas in an attempt to encourage buildup of these predators.
- Our general conclusion is that *T. pyri* predators, if not adversely affected by harsh types of pesticide, can be relied upon to provide excellent suppression of pest mites over many consecutive years.

LEAFMINERS

In recent years, we have conducted rather extensive sampling of leafminers in commercial orchards and have found that in some orchards the dominant species has shifted from apple blotch leafminer (ABLM) to spotted tentiform leafminer (STLM). In 2000, we began sampling for leafminers in the 12 orchards under consideration here. In 2001 and 2002, we continued this sampling, but in greater depth, especially for the third generation in November. Our purpose is to gain understanding of possible causes of the species shift in leafminer composition, the extent of parasitism associated with each species, and the effect of perimeter-row cultivar composition and border area habitat on leafminer and parasitoid populations.

In 2002, for the first (July) and second (August) leafminer generations, we sampled sufficient leaves to obtain about 200 mines per orchard (in a few orchards, no mines could be found). For the third generation (November), we divided our samples according to plot type (grower-sprayed vs. trapped for apple maggot) and rows within plots (rows 1, 3, 5 and 7). About 200 mines were sampled per row (about 800 in all per orchard). Each mine was carefully examined under a microscope for identification of leafminers and evidence of parasitism.

Results for 2002 showed the following:

- ABLM was the dominant species in 6 orchards. STLM was dominant in 4 orchards. In all orchards, species composition in 2002 was roughly the same as in 2001.
- Densities of mines increased an average of 19-fold from the first to the third generation, about the same as the 17-fold level of increase seen in 2001.
- In none of the 12 orchards did second-generation mine density reach the recommended action threshold of 200 mines per 100 leaves, even though some orchards received no sprays against leafminers in either 2000, 2001, or 2002.
- Average levels of parasitism of larvae were 39, 23, and 11% for the first, second and third generations. In 2000, average parasitism levels for second and third generation were somewhat greater (52 and 37%), as they were in 2001 (40 and 28%).
- Average density of third generation mines was slightly less (16% less) in blocks having Gala, Jonagold or Fuji as front-row cultivars than in blocks having McIntosh or Empire as front-row cultivars. In 2001, mine densities averaged about 25% greater in the former than the latter blocks.

- There was a tendency toward decreasing leafminer densities from the perimeter row toward interior rows, whereas in 2001 there was a tendency toward increasing leafminer density from perimeter rows toward interior rows.
- Leafminer density was greater for blocks bordered by hedgerows than blocks bordered by woods or open field (which were about the same).
- In 2 of the 12 orchards, percent parasitism of leafminer larvae was exceptionally low. Each of these 2 orchards received benomyl in 2-3 summer sprays to control flyspeck. We wonder whether benomyl might be inhibiting reproduction and buildup of leafminer parasitoids, just as it does with some species of predatory mites.
- Based on data from 2000, 2001, and 2002, it is fair to say that pinpointing major factors that drive the species composition and densities of leafminers is turning out to be quite a challenge due to the many kinds of factors potentially involved. We have no firm conclusions as yet, except that absence of spray targeted against leafminers (absence of Provado or Spintor) could be an important factor in a shift from ABLM to STLM.

GUTHION VS. AVAUNT

In 2001, we initiated a 2-year study aimed at evaluating effects of whole-plot vs. perimeter-row-only sprays of Guthion vs. Avaunt for control of plum curculio (PC) and apple maggot (AM). In all, there were 4 plots (each about ½ acre) in each of 6 orchards.

Growers applied insecticide through the petal fall spray. Thereafter, we used our tractor-mounted air blast sprayer to apply 2 sprays in May/June against PC and 2 sprays in July/August against AM. These were the only sprays applied for insect control after the petal fall spray. For whole-plot sprays, all 7 rows received treatment. For perimeter-row sprays, only rows 1 and 2 received treatment.

Results for 2002 showed the following:

- Whole-plot sprays of Guthion and Avaunt were essentially equal in protection against PC as well as against AM
- Spraying only perimeter rows with Guthion was just as good as spraying whole plots with Guthion in protection of entire plots against PC as well as against AM.
- Spraying only perimeter rows with Avaunt was not quite as good as spraying whole plots with Avaunt in protection of entire plots against PC or AM.

PROBLEM PESTS: THEIR 2002 ACTIVITY AND NEW FINDINGS

TARNISHED PLANT BUG (TPB)

2002 Activity. As in 2001, TPB was abundant in 2002 in commercial orchards in Massachusetts. Both trap captures and fruit injury were well above levels of TPB seen from 1993-2000. Same was true in New York. But in Vermont, Maine and Quebec, TPB was at below-normal levels.

In the past, we've suggested that the dip in TPB from 1993-2000 was due to reduction in amount of alfalfa (a major host of TPB) and/or an increasing toll on TPB by parasitoids released in 1993. Perhaps neither of these suggestions is correct and fluctuations in TPB populations have more to do with temperatures during September that reduce or promote autumn population buildup on legumes and/or temperatures during spring that do or do not favor adult flight and feeding.

New findings. New findings on TPB involve trials of pesticide efficacy in providing control. The information below comes from Harvey Reissig and David Combs in Western New York (WNY). Treatments were applied at pink and petal fall.

	Approx. rate/100gal	% TPB damaged fruit at harvest	
		WNY-1	WNY-2
Actara 25 WG	1.5 oz	2.2	-
Avaunt 30 WG	1.6 oz	-	1.2
Guthion 50 WP	8.0 oz	0.7	1.7
Warrior 1CS	1.2 oz	3.0	-
Untreated	-	2.7	2.3

Results suggest that Avaunt performed slightly better than Guthion, which in turn performed better than Actara or Warrior in controlling TPB. In 2001, similar trials showed that Guthion was equal or superior to Actara and Warrior for TPB control.

EUROPEAN APPLE SAWFLY (EAS)

2002 Activity. In Massachusetts, other New England states and Canada, EAS trap captures and fruit injury were at normal or below-normal levels. An exception was Connecticut, where early and then extended bloom gave rise to above-average EAS.

New Findings. New findings on EAS involved trials of pesticide efficacy in providing control. The information below comes from New England Fruit Consultants (NEFCON) and Harvey Reissig and David Combs of Western New York (WNY). Treatments were applied at petal fall.

	Approx. rate/100 gal	% EAS damaged fruit at harvest NEFCON	WNY
Actara 25 WG	1.5 oz	--	0.0
Assail 70 WP	1.0 oz	--	0.7
Calypso 4 SC	1.0 oz	1.8	--
Guthion 50 WP	8.0 oz	1.0	0.3
Warrior ICS	1.2 oz	--	0.7
Untreated	--	9.5	1.0

Combined results indicate that against EAS, Actara performed best, followed by Guthion. Assail, Calypso and Warrior were not quite as effective as Guthion.

PLUM CURCULIO (PC)

2002 Activity. PC damage to apples in Massachusetts at harvest was slightly above average but substantially less than damage in 2000 and 2001. Adult immigration began with a bang during tight cluster from April 16-18 (these days were very warm) and continued in a series of spurts until late June. Fresh egglaying injury shot up from early to mid-June but tailed off thereafter. PC was at average or slightly above average levels in other New England states and Quebec.

New Findings. We now have 3 consecutive years of data on capture of immigrating PC adults on odor-baited traps placed at edges of woods, where PCs overwinter. Across the 3 years (2000-2002), 64% of all PCs immigrated by petal fall, with the remainder strung out over 6-7 weeks after petal fall. As indicated earlier (in the section on plum curculio under “apple IPM studies”), many of these pre-petal-fall immigrants spread into interior trees, justifying a whole-orchard spray against PC at petal fall. Subsequent sprays against PC can be restricted only to perimeter-row trees without compromising effective control of PC.

Several trials of pesticide effects on PC were conducted in 2002 by ourselves in commercial orchards in Massachusetts (MA), New England Fruit Consultants (NEFCON), Peter Shearer in New Jersey (NJ) and Harvey Reissig and David Combs in Western New York (WNY). The information below involves 3 applications of each material against PC (petal fall, first cover and second cover).

	Approx. rate/100 gal	% PC damaged fruit at harvest MA	NEFCON	NJ	WNY
Actara 25 WG	1.5 oz	--	--	8.3	--
Asana XL	3.3 oz	--	--	22.3	--
Avaunt 30 WG	2.0 oz	0.5	--	4.2	--
Calypso 4 SC	2.0 oz	--	3.5	9.2	--
Guthion 50 WP	8.0 oz	0.5	2.3	--	10.3
Imidan 70 WP	16.0 oz	--	--	17.5	14.0
Warrior ICS	1.2 oz	--	--	33.3	6.7
Untreated	--	--	16.3	--	63.0

Results indicate that compared with Guthion or Imidan: Actara, Avaunt and Calypso performed as well or better, whereas Warrior performed variably.

APPLE MAGGOT (AM)

2002 Activity. In Massachusetts, AM trap captures and injury were slightly less than average. The same was true in other New England states and Quebec. But in eastern New York, some orchards experienced unusually high populations of AM.

New Findings. Findings from our 2002 research on AM in commercial orchards are described earlier in the section on apple maggot under "apple IPM studies".

Several trials of pesticide effects on AM were conducted in 2002 by ourselves in commercial orchards in Massachusetts (MA), New England Fruit Consultants (NEFCON) and John Wise in Michigan (MI). Applications were made every other week for 4 weeks during July and August.

	Approx.	% AM damaged fruit at harvest			
	rate/100 gal	MA	NEFCON-1	NEFCON-2	MI
Actara 25 WG	1.5 oz	--	--	--	25.2
Assail 70WP	1.1 oz	--	--	--	2.2
Asana XL	4.2 oz	--	--	--	6.0
Avaunt 30 WG	1.9 oz	0.07	16.4	--	--
Calypso 4 SC	1.0 oz	--	--	5.3	8.5
Guthion 50 WP	8.0 oz	0.10	13.1	3.8	24.2
Provado 1.6F	2.7 oz	--	--	--	11.2
Surround WP	12.5 lb	--	--	--	22.8
Untreated	--	--	27.9	28.0	40.0

Results indicate that compared with Guthion, Assail performed exceptionally well against AM. Avaunt, Calypso and Asana also performed well, and to a lesser extent Provado. Neither Actara or Surround controlled AM well.

LEAFROLLERS (LR)

2002 Activity. The species of LR that causes the most trouble in Massachusetts orchards is oblique-banded leafroller (OBLR). In commercial orchards in MA in 2002, damage by OBLR was considerably less than in 2001 but still slightly above the 1995-2000 average. Those growers in MA affected by OBLR in 2001 used SpinTor against OBLR in 2002 and succeeded in achieving excellent control. OBLR damage was about average in other northeastern states. Orchards with little or no history of LR damage in previous years were the orchards most affected by LR in 2001 and 2002, probably because such growers were not accustomed to watching out for possible sudden buildup of this pest.

New Findings. A common theme to emerge from studies conducted in 2002 on OBLR is the exceptional diversity among (and even within) orchards in OBLR susceptibility to insecticides.

Regardless of location (New York, Quebec or Washington), OBLR in some commercial orchards was more susceptible to Intrepid, Confirm or Asana than in other orchards. There were, however, some universal themes: SpinTor seemed to be consistently effective where used, whereas Avaunt seemed to be consistently ineffective. A study by Mike Smirle and colleagues in Washington showed a high degree of correlation between resistance to Intrepid or Confirm and resistance to Guthion. There was even a high degree of OBLR resistance to Avaunt in some orchards, even though it had only slight previous use.

OBLR seems to be a rather unique apple pest (and somewhat similar to Colorado potato beetle) in that development of resistance to organophosphates (and possibly also carbamates) seems to pre-adapt individuals to be able to resist several kinds of new compounds to which they have had rather little previous exposure. The major exception thus far seems to be SpinTor, which continues to perform well in most regions. Even so, it may be only a matter of time before there is resistance to SpinTor.

Field trials of pesticides against OBLR in 2002 were conducted by Harvey Reissig and David Combs in Western New York (WNY). Intrepid was applied 3 times (June 25, July 10, July 24), whereas all other materials were applied twice (July 1, July 16).

	Approx. rate/100 gal	% OBLR damaged fruit at harvest WNY
Danitol 2.4EC	3.6 oz	9.3
Dipel DF	8.0 oz	7.5
Intrepid 2F	4.0 oz	5.0
SpinTor 2 SC	1.7 oz	5.8
Untreated	--	13.8

Results indicate that SpinTor at 2 applications performed about as well as Intrepid at 3 applications and better than Danitol or Dipel (each at 2 applications) in controlling OBLR in Western New York trials in 2002.

CODLING MOTH (CM) AND OTHER INTERNAL LEPIDOPTERA

2002 Activity. In a few orchard blocks in Massachusetts but in many entire orchards in New York, Pennsylvania, Ontario and Michigan, 2002 saw a marked increase in damage (especially late in the season) by internal-feeding lepidopteran larvae. We have become more accustomed to seeing some external damage to fruit by leafroller larvae, but we have not been accustomed to seeing the extent of injury to fruit flesh by internal leps that we saw in 2002 in a few blocks in Massachusetts. For example, in one block of Honeycrisp in central MA, 20-25% of harvested apples had to be culled because of extensive feeding by an internal lep.

Identifying the culprits responsible for this kind of injury has been a challenge. In the Honeycrisp block, large cracks in the fruit surface seemed to be associated with the appearance of insect frass (excrement) near the surface and partial tunneling of the fruit flesh by the larva. We found a few larvae in the block and believed we had ruled out oriental fruit moth (OFM) as the culprit because none of the larvae had an anal comb, which is characteristic of OFM and lesser appleworm (LAW) and can be seen using a microscope but not a hand lens. That left CM as the suspected culprit. Even so, only some of the larval trails led directly to the core and seeds, the expected feeding site of CM larvae. On the other hand, some of the trails went deeper than is normally characteristic of LAW larvae (which are thought to feed largely near the fruit surface). In fact, many of the trails looked to be characteristic of OFM trails, but as indicated above, none of the larvae we identified had an anal comb signifying OFM as the culprit. We sent some of the damaged apples to Art Agnello in New York, and he identified at least one larva as being LAW. He felt that LAW initiated the injury, which was followed later on by fruit cracking and rot at the site of injury.

One factor that could have contributed to the outbreak of internal leps in a few blocks and the somewhat higher than normal incidence in many orchards in MA in 2002 is the possibility that the near absence of fruit in abandoned and back-yard apple trees (due to spring frost) caused female moths to fly far in search of fruiting trees, resulting in a much higher level than normal of immigrant adults. This explanation could account for a greater incidence of CM damage but not damage by LAW or OFM (which feed on a wide variety of hosts and would be little affected by the size of crop on abandoned apple trees). Whatever the cause for the problem in 2002, we need to be more attentive to internal leps in 2003 than in past years.

New Findings. Colleagues in Michigan and Ontario feel that both CM and OFM have developed at least partial resistance to Guthion and Imidan. They further believe that lack of proper timing of spray applications (especially against OFM) is also a factor in the continuing rise of these 2 pests in orchards in these regions.

Jan Nyrop, Art Agnello and Harvey Reissig in New York have field data showing that properly-timed Guthion or Imidan can still provide very effective control of CM. Lack of sufficient well-timed sprays could in part account for the increased OFM injury seen on apples in Western NY. But OFM is a minimal problem on apples in eastern NY. Instead, LAW has shown up as an increasingly troublesome pest in eastern NY orchards. These highly experienced researchers are devoting a lot of energy to sorting out the main culprits and causes responsible for the rise in internal lep injury in NY in the past couple of years. We can look to them for guidance in better control of internal leps in MA in coming years. At present, major causes are unclear.

Across north America and around the world, perhaps more energy was devoted in 2002 to use of pheromone for mating disruption to control CM than all other research on apple insects combined. Because CM has not yet been established as a pest of sufficient concern to merit use of mating disruption for its control in MA (except perhaps in organic orchards), new developments on mating disruption of CM will not be discussed here.

In 2002, a multi-year study involving use of pheromone for disrupting mating of OFM, LAW and CM was begun in NY. Results for 2002 indicated that mating disruption was just as effective as Guthion sprays in controlling each of these pests. We will know more after 2003 research.

Trials of insecticide effects against internal leps were conducted in 2002 by Harvey Reissig and David Combs in western New York (WNY) and John Wise and associates at 2 sites in Michigan (MI). Results below are from 7 applications of each material (petal fall through August).

	Approx. rate/100 gal	% injured fruit WNY	MI-1	MI-2
Aza-Direct	11.0 oz	--	90	--
Calypso 4 SC	1.5 oz	--	--	61
Imidan 70WP	16.0 oz	1.0	39	--
Guthion 50WP	8.0 oz	0.7	41	40
Intrepid 2F	4.0 oz	--	46	--
Warrior ICS	1.2 oz	0.0	--	--
Untreated	--	38.0	90	96

Results from NY indicate that Imidan, Guthion and Warrior provided excellent control of internal leps. Results from MI indicate that Imidan, Guthion and Intrepid gave moderate control, whereas Calypso and Aza-Direct were inferior.

STINK BUGS (SB)

2002 Activity. In 2002 in Massachusetts, Connecticut and the Hudson Valley, SBs were again active in late summer in apple, pear and peach orchards, just as they have been in several other recent years. We did not quantify levels of SB damage to fruit in Massachusetts orchards in 2002, but general observations indicated damage was not insignificant in some orchards.

New Findings. The March Messages for 2001 and 2002 contain background information on SB life history and the nature of SB injury to fruit. In brief summary, SBs are most troublesome when the weather during July and August is hot and dry, as it was in 2002. Under such conditions, the adults usually leave their primary hosts (weeds such as mustard, dock, mallow, mullein, vetch and plantain) and move into pome and stone fruit orchards, where they remain through harvest. Damage usually is concentrated on peripheral rows of orchard trees. Injury appears as dark-colored circular spots that are slightly sunken. Damaged tissue below the peel is rather corky but not as dark as bitter pit. Often, damage is aggregated near the stem end of the fruit.

Several researchers are investigating the use of pheromone in traps aimed at monitoring SB population density, with the intent of developing threshold levels based on trap captures. However, in a recent study by Krupke and associates in Washington, current pheromone lures were found to aggregate large numbers of SB adults in the vicinity of pheromone traps but were not effective in actually drawing adults into the traps. Perhaps the amount of pheromone used was too great and became repulsive at close range--similar to what we have found in the past in our studies on lures for attracting plum curculio. Until an effective pheromone trap can be developed, there is no simple and reliable way of monitoring SBs short of attempting to directly observe adult numbers on fruit (a very laborious approach).

As noted by Dick Straub of the Hudson Valley lab in a 2002 issue of Scaffolds, organophosphate and carbamate insecticides are not very effective against SBs. He suggests Thiodan, Danitol or Asana as potentially effective alternatives for application up to 14 or 21 days before harvest.

BORERS INFESTING BURR KNOTS ON APPLE TREES

2002 Activity. Many orchards in Massachusetts and other northeastern states saw a considerable number of dwarf apple trees affected by dogwood borer (DWB) in 2002. Recent findings have shown that it is dogwood borer rather than American plum borer or other kinds of borers that are the principal borers infesting burr knots in apple trees in Massachusetts. It's difficult to say whether DWB are building to increasingly greater levels in MA orchards over recent years or, alternatively, whether we have simply become more aware of their presence and are looking harder to find them. Whichever, they should not be ignored.

DWB are especially attracted to burr knots on M.26 and M.9 rootstock, where adults lay eggs. Sometimes, larval damage is confined to burr knot tissue and therefore may not affect the life and productivity of the tree too much. Often, however, larvae may move to feed on the inner bark (cambium), and feeding there can be so extensive that the tree dies.

New Findings. Studies in 2002 in New York by Dave Kain and Dick Straub of the Hudson Valley Lab confirmed that applications of Lorsban 4E at half-inch green, pink or petal fall were equally effective in providing excellent control of DWB. They indicate that one of the major reasons underlying the effectiveness of Lorsban 4E, even at these early application times, is the ability of Lorsban 4E to penetrate and remain active in bark tissue for a long period of time. Penetration of pre-bloom Lorsban into bark tissue is sufficient to kill large larvae from previous-year infestations, and longevity of pre-bloom Lorsban is sufficient to kill larvae hatching from eggs laid by adults 2-4 months later, in July and August. That's a remarkable performance by any kind of insecticide.

A new finding by both Dave Kain and Dick Straub of the Hudson Valley Lab and Tracy Leskey and Starker Wright of the USDA Lab in West Virginia is that presence of plastic mouse guards has no apparent effect on the presence or amount of damage caused by DWB on apple. Mouse guards do invite buildup of American plum borer on apple, but evidently not DWB. Nonetheless, maintenance of a clean, weed-free area at the base of dwarf apple trees is recommended to minimize the attractiveness of exposed rootstock to borers.

Another new finding by Tracy Leskey and Starker Wright indicates that crab tree pollinizers may be highly prone to attack by DWB.

LEAFHOPPERS

2002 Activity. White apple leafhoppers (WALH) and rose leafhoppers (RLH) were abundant in several Massachusetts apple orchards in July, prompting several growers to treat with SpinTor or Provado. Some growers who chose not to treat wound up with enough hopper adults at harvest to bother pickers. We have now had 2 consecutive years of troublesome levels of WALH and/or RLH in Massachusetts. Potato leafhoppers (PLH) were at below-normal levels in most Massachusetts orchards in 2002.

New Findings. Relevant new findings involve insecticide trials conducted in 2002 against LH by New England Fruit Consultants (NEFCON) and John Wise and colleagues in Michigan (MI). All materials were applied 6 times beginning at petal fall.

	Approx. rate/100 gal	Level of infestation WALH NEFCON	WALH MI	PLH MI
Aza Direct	11 oz	-	5	68
Calypso SC	1 oz	0	-	-
Guthion 50 wp	8 oz	-	0	1
Imidan 70 wp	16 oz	-	0	0
Intrepid 2F	4 oz	-	10	88
Surround WP	8 lb	-	0	89
Untreated	-	8	13	90

Results show that 6 sprays of Calypso, Guthion, Imidan or Surround gave excellent control of WALH. Guthion and Imidan gave excellent control of PLH. Neither Aza Direct or Intrepid controlled either WALH or PLH well, and Surround was not effective against PLH.

APHIDS

2002 Activity. Except for wooly apple aphids (WAA), aphids caused little trouble in Massachusetts orchards and elsewhere in the Northeast in 2002. More WAA than normal were seen throughout the region, including western New York and Quebec. No one really knows why WAA were more evident on tree limbs and stem ends of fruit in 2002, but possible reasons include a recent turn towards Provado rather than Thiodan for aphid and leafhopper control or warmer winters that allow better survival of underground nymphs, the source of the winged adults that infest the trees.

New Findings. Relevant new findings involve insecticide trials conducted in 2002 against WAA by John Wise and associates in Michigan. Each material was applied once (July 27).

	Approx. rate/100gal	% mortality of WAA Lab assay	Field assay
Actara 25 WG	1.5 oz	100	-
Aza Direct	11.0 oz	49	54
Provado 1.6F	2.7 oz	100	59
Sevin 80 S	7.0 oz	48	42
Thiodan 50 WP	27.0 oz	100	82
Untreated	-	3	-

Results indicate that Actara, Provado and Thiodan all performed extremely well in the lab trials, and that Thiodan performed best of all in the field trial. Sevin and Aza Direct were only moderately effective in both lab and fields trials. Provado was not as effective in the field trial as in the lab trial.

LEAFMINERS (LM)

2002 Activity. Populations of LM in Massachusetts and elsewhere in the region averaged well below normal in 2002, reaching threshold levels in only a few orchards. In Massachusetts, only about 15% of monitored growers treated specifically against LM in 2002.

New Findings. Recent unpublished research by Jan Nyrop of the Geneva, New York experiment station suggests that except for McIntosh and perhaps a few other less common cultivars, LM are generally of little consequence, as trees can tolerate many more mines per leaf than thought previously without suffering a negative effect on photosynthesis or fruit drop. For some reason (yet unknown), McIntosh may be the lone major cultivar that can suffer excessive fruit drop from high LM populations. As suggested in the 2001 March Message, Nyrop's recent research indicates that we need to continue to pay close attention to LM on McIntosh but perhaps can pay less attention to LM on most other major cultivars.

Trials of pesticidal effects on LM were conducted in 2002 by New England Fruit Consultants (NEFCON) and by Harvey Reissig and David Combs in western New York (WNY). There were 6 applications of each material (petal fall though summer).

	Approx.	Mines per 100 leaves	
	rate/100 gal.	NEFCON	WNY
Calypso SC	1.0 oz	0.0	-
Guthion 50 WP	8.0 oz	-	1.0
Warrior 1CS	1.2 oz	-	0.1
Untreated	-	2.6	1.3

Results indicate that both Calypso and Warrior gave excellent LM control when used in a season-long spray schedule beginning at petal fall.

MITES

2002 Activity. Problems with pest mites were a rarity in Massachusetts in 2002, despite the warm, dry weather that prevailed during summer months. The same was true in neighboring states. Increasingly widespread establishment of *Typhlodromus pyri* as an effective mite predator combined with attempts by most growers to apply 2 pre-bloom oil sprays could be important factors, along with decreasing use of predator-unfriendly insecticides and miticides, in keeping pest mites below threshold levels in most Massachusetts orchards the past 3 years.

New Findings. A January 2003 report by Jan Nyrop, Kevin Iungerman, Peter Jentsch and Dick Straub of New York summarizes results of a 2-years study on the effectiveness of released *Typhlodromus pyri* mite predators in providing biocontrol of pest mites in the Hudson Valley and Champlain Valley. Surveys showed that *T. pyri* was present (before release) in 17 of the 36 orchards, though usually at very low density. Releases augmented existing *T. pyri*, and when coupled with careful attention to avoiding use of pesticides harmful to *T. pyri* (especially synthetic pyrethroids), released *T. pyri* were able to provide highly effective control of pest mites over the 2-

year study, even in total absence of any miticide except oil. In the absence of *T. pyri*, pest mites sometimes reached densities of 100 per leaf. The data implicated pre-bloom use of pyrethroids against tarnished plant bug and/or leafminers as being highly toxic to *T. pyri* and inviting outbreaks of pest mites. Nyrop et al. suggest use of Actara or Avaunt rather than pyrethroids against TPB. The bottom line of this study was that even in orchards where *T. pyri* are few if not released, *T. pyri* can build from those few into effective biocontrol numbers if not done under by pyrethoids and carbamates such as Lannate and Vydate (Sevin has little negative effect on *T. pyri*). One other finding of note from this study: once well-established, *T. pyri* outcompetes and displaces *Amblyseius fallacis* as a predator.

In a second recently-published study out of New York (by Amy Roda, Jan Nyrop and colleagues), a fascinating set of lab and field tests showed a lack of influence of leaf hair density on pest mites but a profound effect on *T. pyri*. Cultivars with a large amount of pubescence (hairs) on the lower leaf surface (e.g., McIntosh) supported high numbers of *T. pyri,* whereas cultivars with comparatively little pubescence (e.g., Red Delicious, Golden Delicious) harbored far fewer *T. pyri*. It seems that *T. pyri* like to spend time on hairy leaves and highly favor leaf hairs as sites for laying eggs. These findings go a long way toward explaining why hairy-leaf cultivars such as McIntosh usually have fewer mite problems than smooth–leaf cultivars like Red Delicious and Golden Delicious. Even so, if no harsh pesticides whatsoever are used, *T. pyri* can be sufficiently abundant on smooth-leaf cultivars to provide good biocontrol of pest mites.

A recent article by David James and Tanya Price in the Good Fruit Grower reported that application of Provado (Imidacloprid) to fruit trees stimulates two-spotted mites (TSM) to lay a lot more eggs per female than normal and also results in longer-lived TSM. The net result can be a tendency toward explosive populations of TSM on Provado-treated trees. The cause of this increased egglaying by TSM, according to Jan Nyrop, might be the increased amount of nitrogen available to TSM on Provado-treated trees. It seems that imidacloprid mimics a plant hormone that enhances nitrogen availability. So even though use of Provado can be effective in controlling leafminers and leafhoppers, it may invite buildup of TSM (and possibly also red mites).

Trials of acaricide effects against mites in 2002 were conducted by New England Fruit Consultants (NEFCON), Dick Straub and Peter Jentsch of the Hudson Valley lab (HV), and John Wise and associates in Michigan (MI). The information below involves different times of application of each material and different intervals between application and sampling, as indicated.

	Approx. rate/100 gall	No. motile mites and eggs per leaf					
		NEFCON-1*	NEFCON-2**	HV***			MI****
		ERM	ERM	ERM	TSM	ARM	ERM
Acramite 50 WS	5.0 oz	3.0	-	-	-	-	-
Agri Mek 0.15 E	3.3 oz	-	-	3.6	0.7	12.8	-
Apollo 42% SC	2.0 oz	-	0.0	2.4	5.3	17.1	-
Envidor 240 S	5.0 oz	2.1	-	-	-	-	5.0
Fujimite 5%	11.0 oz	-	-	-	-	-	5.1
Mesa .078 EC	7.0 oz	-	0.0	-	-	-	10.0
Pyramite 60 W	1.5 oz	4.5	1.4	0.4	12.8	16.7	7.4
Untreated	-	13.8	7.1	8.0	3.6	36.2	80.0

*   Application on August 28, sampling on September 11
**   Application on May 22, sampling on July 23
***   Application on July 11, sampling on August 1
**** Application on July 11, sampling on August 7

Results for European red mites (ERM) suggest that Apollo, Mesa, Envidor and Acramite performed slightly better than Pyramite in NEFCON trials, Pyramite performed better against ERM than Agri Mek or Apollo in HV trials, and Envidor and Fujimite performed slightly better than Pyramite against ERM in MI trials (Mesa was slightly inferior to Pyramite in MI). Results for two-spotted mites (TSM) in HV indicate that Agri Mek was superior to Apollo and Pyramite, with each of these three materials providing 50-70% control of apple rust mites (ARM).

PEACH PESTS

2002 Activities. During 2002, we in Massachusetts did not monitor the activity of peach pests. But assessments in New York, Ontario and Michigan again affirmed the importance of oriental fruit moth, cat-facing insects and tree borers as pests of major concern.

New Findings. In a very recent (2002) published study (Journal of Economic Entomology 95: 803-812) by Atanassov, Shearer and colleagues in New Jersey, an advanced-level IPM approach was taken toward management of oriental fruit moth (OFM) through use of pheromone to disrupt mating in combination with a ground cover management program for control of tarnished plan bug (TPB) and stink bug (SB), both of which cause cat-facing injury to fruit. For OFM, about 200 dispensers per acre (about 1 per tree) were deployed in May to shut down ability of males to find females for mating. For TPB and SB, the area beneath tree canopies received herbicide to maintain it weed-free and the fescue-based sod in alleyways was mowed to prevent buildup of flowering plants. Compared with conventional orchards that received sprays to control OFM and that had moderately abundant flowering plants beneath tree canopies and alleyways, the advanced IPM orchards showed equally effective control of OFM and had only 20 % as many TPB and SB. Advanced-level IPM orchards received 1.5 organophosphate applications compared with 4.8 applications in conventional orchards.

In another recent study (New York State IPM Publication 219), Debbie Breth and Harvey Reissig showed that mating disruption was just as effective as organophosphate sprays in controlling OFM in several New York peach orchards. Overall, mating-disruption orchards received only 4 insecticide sprays compared with 8 sprays in conventional orchards. Cost of OFM control using pheromone was slightly more than using insecticide, and greater effort in orchard management was required using pheromone. In New York, there exists some level of OFM resistance to organophosphates, a factor driving increased interest in mating disruption. Even so, several refinements are required before mating disruption can be recommended for OFM control in the Northeast.

In the same publication as the preceding, Art Agnello and Dave Kain in New York tell about their success in using mating disruption to control peach tree borer (PTB) and lesser peach tree borer (LPTB). Both species were controlled by deployment of pheromone dispensers (1 per tree) just as well as by 3 applications of Asana to tree trunks and lower limbs and at no greater cost.

Mating disruption of PTB and LPTB has proven to be a simple, effective and cost-competitive method of control. The technology underlying use of mating disruption for borer control in peaches is presently more refined and more reliable than that for OFM control.

IPM MANUALS, SUPPLIES AND SERVICES

PURCHASE OF 2003 PEST CONTROL GUIDES, IPM MANUALS, ETC.

For 2003, the monthly newsletters; weekly *Healthy Fruit* messages; the *March Message*; the *Peaches, Pears and Plums, A Production Guide*; and the 2003-2004 *New England Apple Pest Management Guide* will be available for a subscription of $50. Subscriptions may be ordered by sending a check for $50 made out to the University of Massachusetts to the UMass Fruit Program, 205 Bowditch Hall, University of Massachusetts, Amherst, MA 01003-9294. Single copies of the March Message are also available for $5, and may be useful to out-of-state growers as an alternative to the entire Massachusetts subscription. Copies of the following publications may be ordered individually from the UMass Extension Bookstore, Draper Hall, University of Massachusetts, Amherst, MA 01003.

The 2003-2004 New England Apple Pest Management Guide will be mailed to all who subscribe to the $50 package of information and need the guide. With Bill Coli as editor, the guide contains new information up to February of 2003.

The 1999-2000 Peaches, Pears and Plums, A Production Guide includes updated pest biologies and control methods. The Peach, Pear and Plum Guide is edited by the UMass Tree Fruit Team.

> Tree fruit management guides should only be used during the growing season(s) for which they were written. Information obtained from old guides may be outdated and may result in illegal pesticide application, or growers may miss new information about phytotoxicity or effectiveness. We highly recommend that growers discard old pest management guides in favor of the updated versions or other new information.

Two fact sheets are available on biological control of mites and leafminers on apples.

Costs:

2003-2004 *New England Apple Pest Management Guide*			$15.00
1999-2000 *Peaches, Pears and Plums, A Production Guide*			$ 7.50
Opportunities for Increased Use of Biological Control in Massachusetts ID Code: EXPF 0900 0718			$ 7.00
Biological Control Fact Sheets:	Apple Blotch Leafminer	ID Code: IPMA 000L 594A	$ 2.95
	Spider Mites in Apples	ID Code: IPMA 000L 595A	$ 2.95

The costs above include production, handling and mailing expenses. Checks should be made out to the University of Massachusetts and sent together with your order to the UMass Extension Bookstore, Draper Hall, University of Massachusetts, Amherst, MA 01003. Please use the ID code (if provided) to specify the publication you are ordering.

Fruit Notes of New England is a quarterly journal published by the UMass Fruit Program. It contains new research findings on fruit growing in Massachusetts. The subscription price is $10 per year ($12 US funds for foreign subscriptions), and checks should be made out to the University of Massachusetts and sent to the UMass Fruit Program, 205 Bowditch Hall, University of Massachusetts, Amherst, MA 01003-9294.

Healthy Fruit is published weekly from early April through harvest, and contains timely information regarding pest management, such as insect and disease phenologies and management options and crop management strategies, such as thinning and fruit maturity. It is provided to all package subscribers via e-mail or first-class mail, or just the weekly newsletter can be faxed for an additional $20 fee. Subscription requests, e-mail distribution requests, and fax copy requests should be sent to Doreen York [dyork@pssci.umass.edu].

2002-2003 Tree Fruit Production Guide. Penn State University. Price $13.00. Make checks payable to Penn State and send with your name, address and the title of the publication you are requesting to Publications Distribution Center, College of Agricultural Sciences, Penn State University, 112 Ag Administration Building, University Park, PA 16802. Penn State's distribution center can also take telephone order (for credit card purchases) at (814) 865-4700.

Updated New York Fact Sheets Among others, the Tree Fruit Fact Sheets set includes:

Pear Psylla	Codling Moth
Plum Curculio	Green Fruitworm
Obliquebanded Leafroller	Peachtree Borer
Apple Maggot Fly	Spotted Tentiform Leafminer
European Red Mite	Predatory Mites
Rosy Apple Aphid	San Jose Scale
White Apple Leafhopper	Dogwood Borer
Woolly Apple Aphid	Oriental Fruit Moth
Beneficial Insects	Redbanded Leafroller
Brown Rot	Fire Blight
Powdery Mildew	Cedar Apple Rust
Apple Scab	Sooty Blotch and Flyspeck
European Apple Sawfly	Tarnished Plant Bug
Comstock Mealybug	Phytophagous Mirid Bugs

The New York Fact Sheet series features excellent photographs, and a set of 30 can be purchased for $28.35. Individual sheets are also available for $2.00 each. These can be ordered from Media Services Resource Center-GP, 7 Research Park, Cornell University, Ithaca, NY 14850.

Pest Management Fact Sheets. Cooperative Extension Service, University of New Hampshire, Durham, NH 03824. Free of charge. Fact sheets are available on:

Tarnished Plant Bug	Codling Moth
Redbanded Leafroller	Apple Maggot Fly
Plum Curculio	European Red Mite
Two Spotted Spider Mite	Aphids
Scale Insects	Fire Blight
Apple Scab	

Common Tree Fruit Pests, published in 1994. A comprehensive guide to identification and control of more than 50 arthropod pests of tree fruits. Written by entomologist Angus Howitt of Michgan State University. Contains many excellent color pictures and straightforward information on most pests encountered in the field. Available in hardcover ($20.00) or laminated ($10.00) from: Bulletin Office-TFP, Michigan State University, 10B Agricultural Hall, East Lansing, MI 48824-1034. The publication number is NCR-63 (Common Tree Fruit Pests). Checks should be made out to Michigan State University. **This publication should be in every grower's library.**

Mid-Atlantic Orchard Monitoring Guide. Published in 1995 by the Northeast Regional Agricultural Engineering Service, under the guidance of West Virginia University and with input from fruit researchers throughout the Mid-Atlantic region. Contains thorough and current information on pest and disease biology, monitoring and treatment, as well as nutrition, irrigation and fruit evaluation. Many color photographs. Available for $75.00 from Northeast Regional Agricultural Engineering Service, Cooperative Extension, 152 Riley-Robb Hall, Ithaca, NY 14853-5701. Checks should be made payable to NRAES.

Fruit Crop Ecology and Management. Published in 2003 and edited by Joy Landis of Michigan State University, this book can assist those growers interested in adopting sustainable orchard practices. The book includes ecological principles and horticultural practices for both tree fruit and small fruit growers. It considers how growers can interact with the environment surrounding the farm, comply with evolving laws and restrictions, and respond to neighbors questions and concerns. The book can be ordered by calling the MSU Bulletin Office at 517-355-0240 and requesting Extension Bulletin E-2759. The price is $ 16.00.

MONITORING AIDS: TYPES AND VENDOR INFORMATION

A variety of pheromone and visual traps is commercially available to growers as pest monitoring aids. We have had considerable experience with the following traps as part of our IPM research and extension efforts over the past years.

1. Pheromone Traps

Leafminers – Pheromone traps for spotted tentiform leafminer (STLM) adults have been used in Massachusetts, but they are of uncertain effectiveness in attracting apple blotch leafminers (ABLM), which is also present in most commercial orchards in Massachusetts.

Codling Moth (CM), Obliquebanded Leafroller (OBLR), Oriental Fruit Moth (OFM), Redbanded Leafroller (RBLR), Variegated Leafroller (VLR), Lesser Appleworm (LAW), Sparganothis Fruitworm – Although traps have been used in the Massachusetts IPM program, these pests have not usually been a problem and so we have rarely used trap-capture data for management decisions. As part of our ongoing extension efforts, we plan to continue to monitor these pests closely, as these pests may have the potential to develop resistance to commonly used organophosphate compounds. Monitoring for these pests will be more important with a very low spray schedule, as shown by recent increases in Oriental fruit moth activity under reduced spray schedules.

Lesser Peachtree Borer, Peachtree Borer, Dogwood Borer – Pheromone traps are available for determining appearance and abundance of adults.

Tufted Apple Bud Moth, Green Fruit Worm – Generally these pests have not been a problem in Massachusetts orchards and we have not used pheromone traps for them in our IPM program. Green fruitworm was a major problem in a few western Massachusetts orchards in the early 1980's but numbers have declined in subsequent years.

2. Visual Traps

Tarnished Plant Bug (TPB) - We continue to experience good results with the sticky white rectangle traps for TPB. These traps should be set out at silver tip (no later), with pesticide application need and timing based on cumulative captures from silver tip to tight cluster or pink.

Leafminers - Sticky red visual traps, stapled to tree trunks at silver tip, continue to prove useful in indicating adult emergence and in predicting need for treatment at pre-bloom or at petal fall in orchards dominated by ABLM. Orchards with mixed or unknown LM species composition may gain more reliable data from horizontal LM traps placed in the tree canopies.

European Apple Sawfly (EAS) - EAS adults are highly attracted to sticky white rectangle traps that mimic apple blossoms. Traps should be placed at pink; the need for pesticide application is based on cumulative captures from pink to petal fall.

Apple Maggot Fly (AMF) - Sticky red spheres that mimic ripe Delicious apples are an excellent aid in monitoring AMF abundance. They are especially helpful in June and July for determining first arrival of flies in early-variety blocks and in August and September for determining arrival of late season flies immigrating into blocks of Delicious and other late season varieties. Traps should be positioned in late June for early-developing and mid-season varieties and in early July for late-developing varieties. Sticky red spheres baited with synthetic apple volatiles developed in New York are 4-6 times more effective in capturing AMF than unbaited sticky spheres alone. Traps should be cleaned of insects and debris regularly, preferably once every 2 weeks, as capturing effectiveness will decrease with the accumulation of dead insects. Several variations of sticky red spheres, including lightweight plastic molded traps, are available from the IPM products division of Gempler's and Great Lakes IPM.

Pear Psylla - Sticky yellow traps can be placed 1-2 m from the ground in the south quadrant of the tree to monitor adult activity in spring.

Pear Thrips - Sticky yellow traps should be set three feet high. We use a tomato stake and a metal shelf bracket to mount the trap in the correct position. Traps should be checked at least weekly from ground thaw until fruit bloom. Current recommendations call for a minimum of four traps per ten acre block. Monitoring for thrips populations in nearby overwintering areas (e.g. sugar bushes) can help to determine the potential for thrips immigration.

3. Tangletrap (A Tanglefoot Co. product)
Tangletrap (Bird Tanglefoot) is a clear, odorless, non-drying adhesive that is used to coat the reusable red sphere traps. Tree Tanglefoot is also a non-drying adhesive, but it should not be used with the red sphere traps since it is not clear or odorless.

4. Bird Control Balloons
Scare-Eye bird control balloons have given good to excellent results in reducing bird injury to Cortlands (+ other susceptible varieties). One balloon is effective over a radius of about 20 yards.

Suppliers:
Pheromone traps, synthetic apple volatiles, visual traps, bird repelling balloons, Tangletrap, and magnification equipment for use in sampling are available from:

Gempler's
211 Blue Mounds Road
P.O. Box 270
Mt. Horeb, WI 53572-0270
(800) 382-8473 (Orders)
(800) 332-6744 (Customer Service)

Great Lakes IPM
10220 Church Road
Vestaburg, MI 48891
(517) 268-5693 or
(517) 268-5911

Many pest management supplies are also available from:

OESCO, Inc. (Orchard Equipment)

Rt. 116
Conway, MA 01341
(413) 369-4335

PEST MANAGEMENT SERVICES AVAILABLE IN 2003 IN MASSACHUSETTS

In addition to the weekly monitoring and other information provided through University of Massachusetts Extension IPM, growers are strongly urged to monitor their own orchards, or hire private consultants to do so.

The UMass Fruit Advisor is available on the World Wide Web, at http://www.umass.edu/fruitadvisor/. This site includes Tree Fruit Team contact information; current issues of *Fruit Notes,* the *March Message* and *Healthy Fruit*; and links to other resources, such as chemical labels, the NEAPMG, and nutrient management information. Questions about the web site should be referred to Wes Autio [autio@pssci.umass.edu].

Two private consulting businesses will continue to offer IPM consulting, scouting, and other services in Massachusetts in 2003. Their addresses are:

New England Fruit Consultants (NEFCON)
56 Taylor Hill Road
Montague, MA 01351
(413) 367-9578
(413) 367-0313 (FAX)

Polaris Orchard Management
364 Wilson Hill Road
Colrain, MA 01340
(413) 624-5104