Pome Fruits

Integrated Pest Management (IPM) Apple Spray Program

The Predators

The apple IPM program utilizes selective pesticides that control destructive apple pests but do not destroy beneficial species, such as the small black ladybird beetle, *Stethorus punctum*, or the predacious mite, *Amblyseius fallacis*. The program is designed to encourage predator buildup in orchards to control European red mite. If mite predators are present in sufficient numbers, the need for miticide applications is reduced during the latter part of the season

How It Works

The apple IPM program is based on the use of selective chemicals which delay the buildup of European red mites until mite predator populations increase to levels high enough to keep mite populations below economic injury levels. Beginning in late May or early June, watch for mite development. By inspecting trees periodically from several locations in each orchard, mite populations can be determined quickly. Before mite populations increase to the point of causing bronzing, a miticide should be applied in the appropriate cover spray. Frequently this occurs during July, in which case a miticide could be added to either the fourth or fifth cover spray. Other considerations for IPM are outlined below under "Following an IPM Program."

European Red Mites

The Integrated program is designed to maintain the European red mite at subeconomic levels, but not to eliminate the pest from the orchard. If the program is to be successful, mites must build up to a certain extent. The use of a carefully timed miticide application will prevent damage from reaching economic significance. Apple foliage can sustain some mite damage without affecting this years's crop or the fruit bud development for next year.

The program will not be effective in completely clean, cultivated orchards, because predators spend the winter and spring in ground cover. IPM has been most successful where sod middles were maintained and where weed control chemicals removed grass from under the trees but left a small amount of broadleaved weeds, such as dock and dandelion.

In certain orchards, the predators may not build up to sufficient numbers, even though growers practice the IPM program. Where this has occurred, include Vendex 50WP (1.0-3.0 lb/A), or Kelthane 50WP (3.0-6.0 lb/A), or Omite 30W (6-10 lb/A) when mites are first noticed during the summer (generally about the third or fourth cover spray). In orchards where the predacious mite is present, try to avoid early applications of Kelthane. Repeat the application in the next cover spray.

Spray Methods

Two spray methods may be used in this program. The traditional method is spraying every middle with COMPLETE sprays. The second method is to spray every other middle with ALTERNATE MIDDLE sprays.

Alternate Middle System of Spraying (sometimes referred to as half sprays)

Alternate middle spraying is spraying every other row with both sides of your sprayer open, then returning 3 to 10 days later and treating the alternate middles not previously sprayed. The first spray applied each year should be a complete spray.

Purpose and Advantages. The alternate middle system of spraying augments the effectiveness of the IPM program by cutting costs. The advantages of this system when used with an IPM program are:

1. The rate of pesticide is reduced.
2. Populations of predators will likely by increased.
3. Better control decision-making opportunities are possible to effect control.
4. Better use can be made of time and farm equipment.
5. The likelihood of pests developing resistance to chemicals is decreased.

Pesticide Rates. The spray gallonage applied per acre should be one-half of that applied to a block which receives complete spray coverage. Normally, the rate of pesticide added to the tank is identical to that added when complete spray coverage is employed. However, pesticide rates can frequently be reduced as sprays are applied more frequently.

Requirements. Alternate middle spraying is based on using small amounts of pesticides with short intervals between each half spray. Pesticide rates can be lower than in the standard spray program because of more frequent applications. Several precautions must be taken with the alternate middle method. Sprayers should be large enough, with enough air volume to handle the job.

The sprayer should have a high-pressure pump and be capable of displacing more than 90,000 cubic feet per minute. With an adequate sprayer, much of the nonsprayed side of each tree row should be covered. Smaller sprayers can be used if the tree size is correspondingly smaller and the rows are less than 25 feet apart.

Following an IPM Program

To employ a successful apple IPM spray program, growers should follow a number of additional practices. Whether this means subscribing to the Rutgers program, hiring a private consultant, or doing the work oneself, the grower still follows the same procedures.

These PROCEDURES are:

1. Intensive Monitoring. Orchards must be scouted regularly to tell which pests are present and at what levels. IPM involves treating only those pests present or potentially present at damaging levels. This means scouting the orchard once a week and monitoring for diseases, codling moth, leafrollers, spotted tentiform leafminers, tufted apple bud moth, aphids, white apple leafhopper, and European red mite, as well as mite predators. Weed populations may be indexed and crop leaf tissue samples taken for foliar nutrient analysis.

2. Use of Selective Pesticides at Adjusted Rates. Pesticides should control target pests but not harm predators. Cover sprays containing Guthion, Imidan, Lorsban, or Penncap-M have been least harmful to mite predators. However, certain pests necessitate the use of chemicals more toxic to these predators (see section on "Insect and Mite Pests of Apples"). Where needed, these chemicals should be used at reduced rates in combination with other pesticides. For example, where Lannate is needed for control of tufted apple bud moth or leafhopper, rates should be reduced to 1 to 2 pints per acre in combination with another general insecticide. Further, alternate middle spraying will increase effectiveness and selectivity of control.

3. Use of Economic Threshold Levels or Treatment Levels. Orchard pests can and should be tolerated at low population densities. When pests are above these levels, economic damage is likely. These pest densities are called ECONOMIC THRESHOLD LEVELS or TREATMENT LEVELS.

Orchard pests can be divided into two groups: direct and indirect pests. Direct pests are those which affect the fruit directly, while indirect pests are those which attack the foliage and have an indirect effect on the production of quality fruit. Apple scab and tufted apple bud mother are examples of direct pests, and European red mites and spotted tentiform leafminers are indirect pests. Since indirect pests do not affect the fruit directly, higher populations of these can be tolerated.

Decisions for control of direct pests, such as apple scab, leafrollers, bud moth, codling mother, and apple maggot, can usually be based on timing. Decisions for control of indirect pests can be based on timing and population levels. Treatment levels for each pest may change as the season progresses. The following factors may contribute to these levels:

1. Time of season and developmental stage of crop.
2. Crop load and whether or not there is any additional stress, such as drought.
3. Number of predators present (where applicable).
4. Stage or generation of the pest.
5. Crop value.
6. Cost of control.

In New Jersey, growers may wish to follow **Treatment level** guidelines for the pests listed in the following table.

Information on the Rutgers IPM Programs. Since 1980, Rutgers Cooperative Extension has conducted a delivery program for Apple IPM. The program is available to growers for a reasonable fee to pay wages and travel expenses of field scouts. Seasonal scouting includes weekly reporting of European red mite and mite predator populations as well as levels of other pests, such as rosy aphid, green aphid, white apple leafhopper, spotted tentiform leafminer, leafrollers (three species), codling moth, and apple maggot. Diseases such as apple scab and powdery mildew are also monitored.

For further information, growers should contact their county Extension agent.

Apple IPM Treatment Level Guidelines

Pest	Time of Season or Generation	Monitoring and Treatment Levels
Apple maggot	Late June or early July in South Jersey; early to mid-July in North Jersey	Start treatment when flies are found in excess of 2 to 5 per red sticky ball trap per week. Continue as long as flies are found.
Codling moth	First generation	Always treat this generation. This spray may be timed at 250 degree days (DD)(base 50˚F) after the first initial moth catch in pheromone traps. A second spray may be needed 14-21 days after the first spray. Initial timing coincides with roughly 2-3 weeks after PETAL FALL.
	Second generation (including all other later trap catches)	Second generation sprays should usually be applied at 1250 to 1300 DD after the first initial spring capture or Spray when trap catches exceed 5 moths per trap per week. Insecticides should be applied 7-10 days after this level is reached.
European apple sawfly	PETAL FALL	Total cumulative capture of 4 to 7 per trap.
European red mite	May-early June Late June-mid July Mid to late July Late July-mid August Late August on	2 mites/leaf 5 mites/leaf 7.5 mites/leaf 10 mites/leaf at least 20 mites/leaf
Apple aphid, Spirea aphid	May-June Early July	When 50 percent or more of the terminals are infested with visible colonies.
Rosy apple aphid	May	1 or more colonies per tree
San Jose Scale	DORMANT to DELAYED DORMANT or 1st generation crawlers.	300-350 DD (base 50˚F) after 1st adult catch in pheromone traps (about early to mid June). or When 1st crawlers have been caught on sticky tape.
Spotted tentiform leafminer	First generation: PINK or PINK and PETAL FALL.	If leafminers were a severe problem the previous season.
	Second generation: late June to mid-July.	If there is an average of 0.5-1 mine/leaf
	Third generation: late July to early August.	If there is an average of 2 to 3 or more mines per leaf
	Fourth generation: late August to mid-September	Only in an emergency--usually if the first through third generations have not been controlled. Fruit drop may occur if there is an average of 10 mines/leaf.

Tufted apple bud moth	First generation: early to mid-June (SECOND and THIRD COVERS.) Second generation: SIXTH and SEVENTH covers.	When pheromone trap counts are high, if injury was noted last year, or if leaf shelters and fruit feeding are easily found. This applies to both generations. Pheromone traps and degree day records may be used for more precise timing. For first generation spray in alternate middle sprays at 500, 625, 760, and 900 DD (base 45˚F) after initial trap capture in the spring. For second generation spray at 2225, 2415, 2605, and 2795 DD after initial trap catch.
White apple leafhopper, Rose leafhopper (July-September),	First generation WALH: PETAL FALL, FIRST, SECOND COVER (last of May, early June).	0.5 leafhopper/leaf (WALH)
Potato leafhopper (July-September)	Second generation WALH: FIFTH, SIXTH COVER (early to mid-August). This includes various generations of other listed leafhoppers.	3 leafhoppers/leaf (total of all species)

IPM Apple Spray Schedule (Fresh Market)

The IPM Spray schedule and the Standard Apple Spray Schedule are identical through the first cover spray. Thus, growers may utilize any of the pesticide combinations through first cover spray.

Spray Coverage. The first spray application to each orchard should be complete coverage of every row. Alternate middle spraying can be employed in subsequent sprays. For alternate middle spraying use a 3 to 5 day schedule in the beginning of the season, and a 7 to 10 day schedule in the cover sprays.

Fungicide Tolerance. Fungicide tolerance is and will continue to be a serious problem in disease control, particularly with the apple scab fungus. This problem is most likely to develop where site specific fungicides are used alone or where they are used too frequently. To assist in preventing the build-up of resistance, site specific fungicides should always be used in combination with a broad spectrum type fungicide Below are listed the site specific and broad spectrum fungicides.

Site specific fungicides: Benlate, Topsin M, Cyprex, Funginex, Bayleton, Rubigan, Nova, and Procure.

Broad spectrum fungicides: Maneb, captan, Ferbam, Thiram, Ziram, sulfur and the copper containing fungicides.

Benlate\Topsin M and Cyprex (dodine) tolerance was a serious problem in past years. Monitoring of scab isolates in New Jersey in 1990 showed that about 50% of the isolates causing scab were tolerant of Benlate/Topsin M. None of the isolates recovered was tolerant to Cyprex. Thus, Cyprex\Dodine will provide good control of scab, but it will lose its effectiveness if used too frequently or if not used in combination with a protectant type fungicide.

Compatibility with Oil. Captan, Sulfur, Solubor, Urea, Imidan, Morestan, Lannate, Mitac, and Omite **are not compatible with oil.** Bayleton, Benlate, Dodine, Ferbam, Funginex, Maneb containing fungicides, Nova, Polyram, Procure, Rubigan, Thiram, Topsin M, Ziram, Lorsban, and Supracide, **are compatible with oil**. Therefore, be sure to **Read the label** before mixing any pesticide with oil.

Sterol Inhibiting Fungicides (SI). A number of new fungicides belong to a group called "Sterol Inhibiting Fungicides"; including Funginex, Bayleton, Nova, Rubigan, and Procure. These fungicides are generally highly active against scab, powdery mildew, and rust. Growers should use these materials only after consulting the label and following instructions completely.

Rosy Apple Aphid Control. Superior oil alone is not effective for aphid control. For best results, add a recommended aphicide to the oil or apply an aphicide at tight cluster. Lorsban is very effective against rosy apple aphid when applied from green tip to heal-inch green. Use the lower rate if applied with oil.

Fruit Finish. Full-pink, bloom, petal-fall, and first cover sprays are the most critical for fruit finish. Although temperature plays a major role at this period, the spray materials used can influence the amount of damage that occurs. Captan 50WP has consistently produced fruit with good color and finish.

HALF-INCH GREEN SPRAY (1/2-inch leaf tissue showing)

Pests	Materials	Rate/A Concentrate
Apple Scab	Best:	
	Syllit 65WP	1.5 lb, OR
	Fixed Coppers 53 WP*	4-6 lbs, OR
	Maneb 75DF (EBDC)	6 lbs, OR
	Dithane DF (EBDC)	6.4 lbs, OR
	Dithane M45 (EBDC)	6 lbs, OR
	Manzate 200DF (EBDC)	6 lb, OR
	Penncozeb 75DF, 80WP (EBDC)	6 lbs, OR
	An EBDC fungicide combination for extended use: A half rate of an EBDC fungicide plus an SI or a half rate of Benlate, Topsin, Ferbam, or Ziram.	
	Others:	
	Benlate 50WP	1.5 lb, OR
	Topsin M 70WP	1.5 lb, OR
	Ferbam 76WDG	4.5 lb, OR
	Ziram 76DF	6-8 lb, OR
	Nova 40W	4.5 oz, OR
	Rubigan 1EC	6-12 fl oz, OR
	Funginex 1.6EC	24-36 fl oz, OR
	Procure 50WS	6-12 oz
	PLUS	
European red mite, San Jose scale	superior oil, 60- or 70-second viscosity	6 gal
	PLUS	
Aphids	Lorsban 4E	1.5-2 pt, OR
	Supracide 2E	3.0-6.0 pt

*Fixed coppers can be very phytotoxic. Do not use after Half-Inch Green Spray unless rate is reduced.

Phytotoxicity: See Compatibility with Oil on proceeding page.

Oil and Freeze Injury. Do not apply superior oil if temperatures are predicted to go below 36 F - 38 F during the next 24 hours. Severe bud and leaf injury may result!

Mite Control. Due to the lack of effective miticides still labelled for summer applications, every effort should be made to reduce the population of European red mite eggs during the HALF-INCH GREEN to PINK SPRAY period. A double oil application can be every effective. For best results, the first application of 6 gallons per acre, 2 gal/100 should be made at HALF-INCH GREEN, or 4.5 gal per acre, 1.5 gal/100 at tight cluster. The second application, 3 gallons per acre, 1 gal/100 should be made at the PRE-PINK period. Apollo SC can also be applied from DELAYED DORMANT through TIGHT CLUSTER using 4-8 oz per acre. Good coverage is important.

Many years of experiment station research and grower experience show clearly that better mite control results from dilute applications, 300 gal spray per acre (mature trees), than when less spray volume is applied. Unless these oil sprays are applied dilute, the use of oil is questionable.

TIGHT-CLUSTER SPRAY (prepink)

(Start 5 to 7 days after 1/2-inch green spray, and repeat at 5 to days intervals for alternate middle sprays.)

Pests	Materials	Rate/A Concentrate
Apple scab	Best:	
	Captan 50WP	6 lb, OR
	Syllit 65WP	1.5 lb, OR
	Captan 50WP, PLUS	3.0 lb
	Syllit 65WP, or	0.75 lb
	Nova 40W, or	3-4.5 oz
	Rubigan 1EC, or	6-12 fl oz
	Procure 50WS	6-12 oz
	Others:	
	Ferbam 76WDG	4.5 lb OR
	Funginex 1.6EC	1 qt, OR
	Ziram 76DF	6-8 lb, OR
	An EBDC fungicide combination listed under the Half Inch Green Spray PLUS	
Spotted Tentiform Leafminer, Aphids	Vydate L	2.5-3.0 pt, OR
	Ambush 2EC	9.0-12.0 fl oz, OR
	Asana XL	4.8-8.0 fl oz, OR
	Pounce 3.2EC	6.0-10.0 fl oz, OR
	Carzol 92SP	12 oz, OR
	Thiodan 50WP	3 lb
	Dimethoate 4E	1.5-3.0 pt/A
European red mites	Apollo 50SC	4 oz
	Savey 50WP	3 oz

Leafminer. Ambush, Asana, Pounce, Carzol, and Thiodan will kill adults (moths) but not larvae. Apply any of these while adults are flying and before egg hatch. Two alternate middle sprays are needed for best control results. Provado use at petalfall can substitute for Vydate at pink for leafhoppers, leafminers, and aphids

Aphid Control. Tight cluster is about the last good opportunity to check the rosy apple aphid. Phosphamidon 8E at 12 oz/A is effective when applied from tight cluster to pink.

After-Infection Scab Control. A good protective schedule generally will eliminate the need for after infection control. However, when "back-action" is needed, the following materials may be used:

Rubigan 1EC at 9-12 fl oz/A, OR
Nova 40W at 6 oz/A, OR
Funginex 1.6EC at 48 fl oz/A
Procure 50WS at 12-16 oz/A.

Apply Funginex or Procure within 72 hrs, or Rubigan, or Nova within 96 hrs of the beginning of a scab infection period**.**

PINK SPRAY (as late as possible before first bloom)

Pests	Materials	Rate/A Concentrate
Apple scab	Captan 50WP	6 lb, OR
	Syllit 65WP	0.75 lb, PLUS
	Captan 50WP	3 lb
Apple scab, rust, powdery mildew	Captan 50WP	3 lb, OR
	Syllit 65WP	0.75 lb
	PLUS	
	Bayleton 50WP	3 oz, OR
	Nova 40W	3-4.5 oz, OR
	Rubigan 1EC	6-12 oz, OR
	Funginex 1.6EC	36-40 fl oz, OR
	Procure 50WS	6-12 oz, OR
	An EBDC fungicide combination listed under the Half Inch Green Spray	
	PLUS	
European red mite	Morestan 25WP	1.5-3.0 lb
	Savey 50WP	3 oz

Aphid Control. Morestan will not control aphids. If aphids continue to build up, include dimethoate 4E (1.5-3.0 pt/A) with the Morestan spray. Add Bayleton 50WP (3oz/A) for powdery mildew and rust. Do not apply after petal fall.

Morestan. Excellent at this stage of bud development for European red mite egg (embryo) and nymph control. Also effective against powdery mildew. For best results, apply dilute, since adequate coverage of overwintering eggs is essential. Can be phytotoxic under certain conditions. Check label before mixing and applying.

Fungicide Resistance. To prevent fungicide resistance development, never use Benlate, Topsin M, Dodine, or any of the sterol-inhibiting fungicides alone. Always combine these fungicides with a protectant-type fungicide.

Rust. Apply fungicide sprays from **PINK SPRAY through SECOND COVER**. Bayleton 50WP (3-6 oz/A), Rubigan 1EC (6 fl oz), Nova 40W (4.5 oz), Funginex 1.6EC (36-40 oz), Ziram 76WDG (1 lb), and Ferbam 76WDG (0.5 lb) per acre are all effective in control.

Powdery Mildew. Apply sprays **from PINK SPRAY through THIRD COVER**. Bayleton, Morestan, Rubigan, Nova, Funginex, Wettable Sulfur, Benlate, and Topsin M are effective in control.

Boron spray due at FULL BLOOM.

BLOOM

Pests	Materials	Rate/A Concentrate
Apple scab, powdery mildew	Same fungicides and rates as PINK SPRAY	

Fire Blight. This bacterial disease can cause extensive loss when warmer weather occurs at bloom. Fixed coppers used at half inch green will decrease inoculum levels. If precipitation occurs during warm weather at bloom, use streptomycin within 24 hours of the rain.

Protect Pollinators. NO INSECTICIDE SHOULD BE USED DURING BLOOM.
In the event that gypsy mother caterpillars become troublesome during bloom, Bacillus thruingiensis (B.t.) may be applied at labeled rates. Although completely nontoxic to honeybees, this material should not be applied during bloom unless an emergency exists.

PETAL-FALL SPRAY (after petals fall and before calyx closes)

Pests	Materials		Rate/A Concentrate
Apple scab, moldy core	Same fungicides and rates as PINK SPRAY PLUS		
Plum curculio, Redbanded leafroller, European apple sawfly	Guthion 50WP Imidan 50WP Imidan 70WP PLUS		1.25-1.5 lb, OR 2.5-3.5 lb, OR 1.75-2.5 lb
White apple leafhopper, Spotted tentiform leafminer	Carzol 92SP Thiodan 50WP Lannate LV Provado Omite 30W PLUS		6 oz, OR 3 lb, OR .75-1.5 pt, OR 3-6 oz, OR 5 lb[1]
European red mite	Carzol 92SP Kelthane 35WP Kelthane 50W Omite 30W	(Note same chemical as above but increased rate for mite control)	12-16 oz, OR 4-6 lb, OR 3-4.5 lb, OR 6.0 lb

[1] Omite may be used from petal-fall through second cover for leafhopper suppression.

Insecticide Dosage. In this and subsequent sprays, the use of the lower dosage rate of insecticide is suggested in orchards which are on alternate row middle spray programs and are being adequately monitored for pests. Use high Provado rate for leafminers, low rate for leafhoppers.

Boron spray due at PETAL FALL.

Moldy Core. This disease can be troublesome when the PETAL FALL SPRAY is delayed too long, particularly with varieties such as Delicious and Golden Delicious. Captan 50WP (6 lb/A) or Captan 50WP (3 lb/A) plus either Benlate 50WP (0.75 lb) or Topsin M 70WP 0.5 lb/A) should provide the best control.

White Apple Leafhopper. In orchards were this insect has been troublesome, control may be needed at petal fall. The treatment threshold at this time is 0.5 leafhopper per leaf. Neither Guthion or Imidan is effective. Carzol and Thiodan are recommended for control. Carzol will aid in European red mite control when applied at petal fall. Although Vydate L will control white apple leafhopper, it should not be applied within 30 days after petal fall to avoid fruit thinning. Omite when used for early season mite suppression has also shown promise for leafhopper control when used at petal fall. Provado has given excellent leafhopper and leafminer control, but may increase pest mite populations.

Lannate Toxicity to Predator Beetles. Growers desiring to use Lannate for spotted tentiform leafminer control at petal hall and with other post-bloom sprays must be aware of its high toxicity to Stethorus beetles. The dosage rate should not exceed 2 pt/A. This rate and timing of Lannate is, at best, marginal for leafminer control and should be applied only in conjunction with a good monitoring program.

Tufted Apple Bud Moth. There are two flights of this insect per growing season. Egg laying usually occurs from late May through June and from late July until early September. For growers on alternate row middle spray schedules, critical sprays fall during the second half of the first cover, second, third, fifth, sixth, and seventh covers. In those orchards where bud moth is a problem, apply one of the following combinations:

Material	Rate/A Dilute
Penncap-M	1-2 pt
PLUS	
Lannate LV	.75-1.5 pt, OR
Guthion 50W	8 to 12 oz
OR	
Guthion 50W	8 to 12 oz
PLUS	
Lannate LV	.75-1.5 pt, OR
OR	
Lorsban 50WP	1.5 lb
PLUS	
Penncap-M	1-2 pt, OR
Lannate LV	.75-1.5 pt

Bud Moth Control and Predator Toxicity. Of these combinations, Penncap-M plus Guthion or Lorsban combinations are the least toxic to mite predators. Under extremely high pressure, a Lannate combination is required, but can be toxic to mite predators.

European Red Mite. If overwintering mite eggs are abundant then it is a good practice to apply a miticide at petal fall to control those mites that survived the pre-bloom treatment(s). Carzol 92SP, Kelthane 35WP or 50WP, and Omite 30W can be used at this time. Later applications of Carzol seem to be less effective. Kelthane or Omite may delay or prevent rapid mite buildup in orchards that have no history of Kelthane resistance. A pre-bloom application of either Apollo 50SC or Savey 50WP should provide excellent European red mite control without being disruptive to mite predators.

Mite Suppression. Because of mite resistance to miticides, alternative management practices are often needed. Lorsban 50W, when used in combination with other insecticides at 1.5 lb/A during the first half of the season, will often suppress or delay the build-up of red mite populations. The following Lorsban combinations will control higher red mite populations when used for general insect control. Lorsban - 2 lb/100 gal plus 60 sec. superior Oil - 1-2 pt/100 gal plus a Spreader/Sticker (Triton B1956, X-77). These rates are meant to be applied in 100 gpa on mid size trees. When greater amounts of water are used, then more ingredients are needed. Concentrate sprays at greater then 3X will not work. Treatments must be applied in a full cover (every middle) spray. If alternate middle sprays are used, then treatments must be spaced no further apart than 2 days. Successful treatments will last no more than 5-6 days before retreatment is needed.

Penncap-M Use. Due to recurrent problems with bee toxicity, the Penncap-M label has been changed and reflects the following statements.

PENNCAP-M IS HAZARDOUS TO BEES exposed to direct treatment or residues on blooming crops and/or blooming weeds. Do not apply PENNCAP-M or allow it to drift to blooming crops and/or blooming weeds if bees are foraging the areas to bee treated. Refer to and follow the more specific and applicable precautions in the directions for certain crops. The apple label has been amended to read:Do not make initial application before total petal fall. Do not apply when weeds or cover crops in orchards are in bloom and bees are foraging in the areas to be treated. Application should not be made during non-foraging hours (including nighttime) when bees have been observed during normal foraging hours that day".

FIRST COVER SPRAY (10 to 14 days after petal-fall spray)

Pests	Materials	Rate/A Concentrate
Apple scab	Captan 50WP	6 lb, OR
	Syllit 65WP	0.75 lb, PLUS
	Captan 50WP	3 lb
Apple scab, rust, powdery mildew	Captan 50WP	3 lb, OR
	Syllit 65WP	0.75 lb
	PLUS	
	Bayleton 50WP	3 oz, OR
	Nova 40W	3-4.5 oz, OR
	Rubigan 1EC	6-12 oz, OR
	Procure 50WS	6-12 oz, OR
	An EBDC fungicide combination listed under the Half Inch Green Spray	
Apple scab, fruit rots	Benlate 50WP	0.75 lb, OR
	Topsin M 70WP	0.75 lb
	PLUS	
	Captan 50WP	3-6 lb
	PLUS	
Plum curculio, redbanded leafroller, green fruitworm White apple leafhopper, codling moth	Guthion 50WP	8-12 oz, PLUS
	Penncap-M	2 pt, OR
	Lorsban 50WP	1.5 lb, OR
	Imidan 50WP	1.5-2.0 lb, OR
	Imidan 70WP	1.0-1.5 lb, OR
Leafhoppers, leafhopper	Provado 1.6F	3-6 oz

Cork. Add 1.5 pounds of calcium chloride to first cover spray and to following sprays.
See notes concerning rust and powdery mildew control under PINK SPRAY.

Apple/Spirea Aphid Complex. Populations usually build up during June. Rutgers research indicates that these species are not as important as once thought. Control is suggested only when 50 percent or more of the terminals (nonsucker terminals) are infested with visible colonies.

The preferred insecticides are dimethoate and Thiodan. Lorsban will suppress apple\spirea aphids when applied in a schedule. Sucker growth removal assists control. For control of apple-spirea aphids use dimethoate 4E (1.5-3.0 pt/A) OR Thiodan 50WP (3 lb/A).

If dimethoate and Lannate are used together in the same spray, the lower rates of each may be used for aphid control.

SECOND COVER SPRAY (14 days after FIRST COVER SPRAY)

Pests	Materials	Rate/A Concentrate
Apple scab, rust, powdery mildew, black rot, Brooks spot	Same fungicides and rates as FIRST COVER SPRAY. Note: EBDC fungicides have a 77 day preharvest interval. PLUS	
Codling moth, tufted apple bud moth	Guthion 50WP	8-12 oz, OR
	Imidan 50WP	1.5-2.0 lb, OR
	Imidan 70WP	1.0-1.5 lb, OR
	Lorsban 50WP	1.5 lb, PLUS
	Penncap-M	2 pt, OR
	Lannate LV	.75-1.5 pt

THIRD COVER SPRAY (14 days after SECOND COVER SPRAY)

Pests	Materials	Rate/A Concentrate
Apple scab, powdery mildew, fruit rots, summer diseases	Best:	
	Captan 50WP	4.5 lb, OR
	Captan 50WP, PLUS	3 lb
	Benlate 50WP	0.75 lb, OR
	Topsin M 70WP	0.75 lb
	Other:	
	Ferbam 76WDG	4.5 lb, OR
	Ziram 76DF	6-8 lb, OR
	PLUS	
Codling moth, tufted apple bud moth, redbanded leafroller	Same materials and rates as SECOND COVER SPRAY	

Primary Scab is generally over by this time and fungicide rates can be reduced for scab control. However, if fruit rots or the summer diseases are troublesome in a particular block, the lower rate of fungicide may not be adequate for control. In such blocks, maintain the fungicide rates used through SECOND COVER throughout the season.

Mite Predators. Only Vendex or Omite should be used in orchards where predator mites are important. Kelthane is toxic to predator mites and Omite 6E is toxic to Stethorus beetles.

European Red Mite. If mites become a problem from **THIRD to SIXTH COVER**, the following miticides are labelled.

Materials	Rate/A Concentrate
Kelthane 35WP	4.0-6.0 lb/A
Kelthane 50WP	3.0-4.5 lb/A
Carzol 92SP	12.0-20.0 oz/A
Omite 30WP	5.0-10.0 lb/A
Vendex 50WP	1.0-3.0 lb/A
Vendex 4L	1.0-3.0 pt/A

FOURTH COVER SPRAY (14 to 21 days after THIRD COVER SPRAY)

Pests	Materials	Rate/A Concentrate
Apple Scab, fruit rots, summer diseases	Same fungicides and rates as THIRD COVER SPRAY PLUS	
Codling moth, apple maggot	Same materials and rates as SECOND COVER SPRAY	

Summer Diseases. Where summer diseases are particularly troublesome and during years with heavy rainfall, use the highest recommended rates of captan, Benlate and Topsin M.

Note: Maintain higher fungicide rates where Summer Diseases and Fruit Rots are troublesome (See FIRST COVER SPRAY).

FIFTH, SIXTH, AND SEVENTH COVER SPRAYS (Apply on a 21 day Schedule)

Pests	Materials	Rate/A Concentrate
Apple scab, fruit rots, summer diseases	Same fungicides and rates listed under THIRD COVER SPRAY PLUS	
Codling moth, tufted apple budmoth, apple maggot, variegated leafroller, redbanded leafroller	Same materials and rates as SECOND COVER SPRAY PLUS	
Leafhoppers	Provado	3 oz, OR
Leafminer	Provado	6 oz

Lannate use: Lannate or Lannate combinations should be used where budmoth and/or leafminers are problems and the danger of mite build-ups is over.

Warning: Be aware of minimum intervals between last application and harvest.

Note: Maintain higher fungicide rates where Summer Diseases are troublesome (See FIRST COVER SPRAY).

Sooty Blotch and Fly Speck. Infections start as early as mid June, but symptoms become most visible from mid-August through harvest when temperatures become cooler and moisture is prevalent. For optimum control, summer disease treatments should be maintained within 3 weeks of harvest. A combination of captan (3 lb) plus either Benlate (.75 lb) or Topsin M (.75 lb) per acre will provide the best control. Note that for sooty blotch and fly speck control, Benlate has longer residual activity than Topsin. Combinations of Ziram (3 lb) plus sulfur (3-6 lb) have also given good control of sooty blotch and fly speck.

Tufted Apple Bud Moth and Variegated Leafroller. These leafrollers may be troublesome from late August to mid-September. Blocks where no insecticide has been applied sine mid-August may require treatment by early September. These insects will feed between leaves and fruit and are difficult to reach with concentrate sprays Use as much water as possible. If bud moth and/or leafrollers are troublesome during harvest, Bacillus thuringiensis can be used for control. THE MORE SPRAY VOLUME PER ACRE, THE BETTER THE CONTROL.

WARNING: Check for minimum interval between last application and harvest. FDA regulations specify any food crop to which a nonexempt chemical is added after harvest must be so labeled. The container that goes to the retailer must have words such as, "These apples treated with (name of chemical) to prevent scalding."

Apple Spray Schedule (Nonbearing Trees)

All rates of chemicals are per acre for full size trees.

Pest control measures on nonbearing trees are as critical as on bearing trees even though a reduced program is required. Diseases, such as apple scab, black rot, and mildew, and insect pests, such as Japanese beetles, aphids, scales, cankerworms, tent caterpillars, leafrollers, and European red mite, can devitalize young trees if control is neglected.

A control schedule for nonbearing blocks follows. This schedule will provide adequate control of common pests; however, growers are advised to inspect orchards periodically.

HALF-INCH GREEN SPRAY (1/2-inch leaf tissue showing)

Pests	Materials	Rate/A
Apple scab	Ferbam 76WDG	4.5 lb, OR
	An EBDC combination listed under the half inch green spray in the Fresh Market IPM Apple Spray Schedule	
	PLUS	
European red mite, San Jose scale	superior oil (60-to 70-second viscosity)	6 gal
	PLUS	
Aphids	Guthion 50WP	1.5 lb, OR
	Imidan 50WP	2.5-3.0 lb, OR
	Imidan 70WP	2.25-2.5 lb

SAME TIME AS PINK SPRAY FOR BEARING BLOCKS

Pests	Materials	Rate/A
Scab, powdery mildew	captan 50WP	6 lb, OR
	Ferbam 76WDG	4.5 lb, OR
	sulfur	18 lb, OR
	An EBDC combination listed under the half inch green spray in the Fresh Market IPM Apple Spray Schedule	
	PLUS	
	Guthion 50WP	1.5 lb, OR
	Imidan 50WP	2.5-3.0 lb, OR
	Imidan 70WP	2.25-2.5 lb

NOTE: A pre-bloom application of either Apollo 50SC or Savey 50WP should provide excellent European red mite control without being disruptive to mite predators.

SAME TIME AS PETAL-FALL SPRAY FOR BEARING BLOCKS

Pests	Materials	Rate/A
Scab, powdery mildew	captan 50WP	6 lb, OR
	Ferbam 76WDG	4.5 lb, OR
	sulfur	18 lb, OR
	An EBDC combination listed under the half inch green spray in the Fresh Market IPM Apple Spray Schedule	
	PLUS	
Cankerworms, tent caterpillars, leafrollers	Guthion 50WP	1.5 lb, OR
	Imidan 50WP	2.5-3.0 lb, OR
	Imidan 70WP	2.25-2.5 lb, PLUS
Leafminers	See Fresh Market IPM Apple Spray Schedule	

21 TO 28 DAYS LATER

Pests	Materials	Rate/A
Apple scab, powdery mildew, cankerworms, tent caterpillars, leafrollers, aphids	captan 50WP	6 lb, OR
	sulfur	18 lb, OR
	Ferbam 76WDG	4.5 lb
	PLUS	
	Guthion 50WP	1.5 lb, OR
	Imidan 50WP	2.5-3.0 lb, OR
	Imidan 70WP	2.25-2.5 lb, OR
	Penncap-M	2 - 4 pt

Mites. Add a recommended miticide if necessary. (See "European Red Mite" following Petal Fall Spray under the Fresh Market IPM Apple Spray Schedule.

Japanese Beetle. In July, if beetles become troublesome, apply Sevin or Imidan at labeled rates, apply Sevin (2 lb 50WP/100 gal) or Imidan (1 lb 50WP/100 gal) or methoxychlor (2 qt 2 EC/100 gal).

Generally, sprays will not be needed beyond this period. Growers should observe blocks periodically, and, if a problem is noticed, apply a spray containing suitable materials for control.

Apple Spray Schedule (Fruit for Processing)

All rates of chemicals are per acre for full size trees.

Fruit marketed in processing channels requires a definite spray program. Because the degree of pest control and fruit finish is not so critical, a wider choice of pesticides is available.

In general the same number of sprays is required as for fresh-market fruit during the early part of the season. Intervals between later season sprays usually can be extended for fruit going into processing channels.

Following is a list of materials that will control pests commonly encountered. Growers are advised to follow the timing and compatibility of sprays as outlined in the fresh-market schedule.

Half-Inch Green Through Full Pink

Pests	Materials	Rates/A
Apple scab	Captan 50WP	5-6 lb, OR
	Syllit 65WP	1.5 lb, OR
	Rubigan 1EC	5-9 fl oz, OR
	Nova 40W	3-4.5 oz, OR
	Funginex 1.6EC	36-40 fl oz, OR
	Procure 50 WS	6-12 oz, OR
	Ferbam 76WDG	4.5 lb, OR
	Ziram 76DF	6-8 lb, OR
	Sulfur 90WP	18 lb, OR
	An EBDC or EDBC combination listed under the half inch green spray in the Fresh Market IPM Apple Spray Schedule	
Powdery mildew	Bayleton, Nova, Rubigan, Funginex, Procure, Sulfur	
Rust	Bayleton, Nova, Rubigan, Funginex, Procure, Maneb, Mancozeb, Ferbam, Ziram	
	OR	
	An EBDC or EDBC combination listed under the half inch green spray in the Fresh Market IPM Apple Spray Schedule	
Insects, mites:	Same as Standard Apple Spray Program	

BLOOM

Pests	Materials	Rates/A
Apple scab, rust	Fungicides and rates listed for powdery mildew above.	

PETAL FALL AND COVER SPRAYS

Pests	Materials	Rates/A
Apple scab, rust, summer diseases	Same fungicides & rates powdery mildew listed above, PLUS	
	Captan 50WP	3-6 lb, PLUS
	Benlate 50WP	0.75 lb, OR
	Topsin M 70WP	0.75 lb
	OR	
	EBDC combinations listed under half inch green	
Insects	Guthion 50WP	1.5 lb, OR
	Imidan 50WP	2.5-3.0 lb, OR
	Imidan 70WP	2.25-2.5 lb,
	PLUS	
Leafhoppers, leafminer	Provado 1.6F	3-6 oz
	PLUS	
Mites	Any miticide list under Third Cover in Standard Apple Spray Schedule	
Note:	**Funginex is not to be applied after petal fall.**	

Insecticides: Insecticides for prebloom through cover sprays may be the same as those used for fresh market apples, with the exception that Lannate is usually not needed. Lannate is used for budmoth control which is not a critical pest of processing fruit. Penncap-M may be used for cover sprays only, see warnings on bee toxicity. Lorsban may be used at any time, but may be most helpful to suppress aphids during the second and third cover sprays.

Mites: Any miticide listed in section on "European Red Mite" following Third Cover Spray under the Fresh Market IPM Apple Spray Schedule.

Pear Spray Schedule

All rates of chemicals are per planted acre.

DORMANT SPRAY (before buds are swollen)

Pests	Materials	Rate/A Concentrate
European red mite, scale, pear psylla	superior oil, 60- or 70 second viscosity	6 gal
	PLUS	
Fire blight	Kocide	4 - 8 lb OR
	Bordeaux mixture (copper sulfate plus spray lime	8+8/100gal

DELAYED-DORMANT SPRAY (when buds are swollen but before buds are open)

Pests	Materials	Rate/A Concentrate
European red mite, scale, pear psylla	superior oil, 60- or 70 second viscosity	6 gal
	PLUS	
Pear psylla	Mitac 1.5EC	2-4 pt, OR
	Mitac 50WP	1.5-3 lb, OR
	Morestan*	3 lb, OR
	M-Pede	2 gal/100, OR
	Ambush 2EC	18.0 oz, OR
	Ambush 25WP	18.0 oz, OR
	Pounce 3.2 EC	10.0-14.0 oz, OR
	Asana XL	12.0-16.0 oz, OR
	Lorsban 4EC	1.5-3.0 pt, OR

Morestan: Do not use Morestan within 7 days of an oil application, or use oil or spreader-stickers with Morestan because of possible phytotoxicity. Do not use on Asian pears.

Pear Psylla Control. This tiny insect has developed resistance to practically all insecticides used for its control since the 1960's. Years ago when one material failed another was soon available to take its place. However today the list of effective materials is short and few if any new ones are on the horizon. Wise use of the few effective materials left and thorough spray coverage can prolong this usefulness.

Psylla adults become active and start laying eggs in spring as soon as outdoor temperatures reach 45F. Yellowish-white eggs are laid on bud scales, bark cracks, and crevices of fruiting spurs. Soon nymphs hatch and commence sucking sap from tender young leaves. For best results commence control early in the growing season. Thorough spray coverage is absolutely essential for control. A dilute spray application invariably results in better, more lasting control than a concentrate application. Superior oil, plus a pyrethroid insecticide (Asana, Ambush, or Pounce) or Lorsban, applied dilute during the dormant period when eggs are first laid, is still one of the most effective means of delaying psylla build-up. In problem blocks, a second oil application plus a pyrethroid is advised during the green cluster bud stage. A pyrethroid application may also be made pre-bloom. Be sure to read the labels for restrictions when using pyrethroids before bloom.

In orchards where pyrethroid resistance occurs Morestan can be substituted pre-bloom. Morestan, like oil, is an ovicide (kills eggs) and is thought to control newly hatched nymphs. Due to possible phytotoxicity Morestan should not be used in combination with oil, or

shortly before or after an oil application. There are other precautions, so consult the Morestan label before using.

Post-bloom use of any pyrethroid insecticide is discouraged. Pyrethroids are rough on various predator insects and their repeated use only serves to speed up the selection of resistant psylla populations. Instead, alternate Imidan and Mitac in cover sprays. It is best if Mitac is used sparingly and only when the psylla population is on the increase.

Do not tank mix Mitac with ferbam, Bordeaux mixture, Ziram or other highly alkaline material sprays.

Insecticidal Soap has been shown to be effective in controlling young psylla nymphs post-bloom but is less effective on psylla eggs and adults, and other pear pests such as plum curculio and codling moth. Soap (M-Pede) is environmentally safe but can cause fruit russetting.

In every 100 gal of water, mix two gal of soap plus one qt of vegetable oil plus defoamer at manufacturer's suggested rate. Read the label before using.

GREEN CLUSTER BUD (separation of flower buds, before petals show)

Pests	Materials	Rate/A Concentrate
Pear scab, Fabraea leaf spot, powdery mildew	Maneb 80WP	6 lb, OR
	Mancozeb 80WP	6 lb, OR
	Benlate 50DF	12 oz, OR
	Rubigan 1EC	6-12 fl oz, OR
	Procure 50WS	6-12 oz, OR
	Ferbam 76WDG, PLUS	3-4 lb
	Bayleton 50WP	4 oz, OR
	Ziram 76WDG, PLUS	6 lb
	Bayleton 50WP	4 oz
	PLUS	
Pear psylla	superior oil, 60- 70 second viscosity	6.0 gal
	PLUS	
	one of the materials listed in the Delayed Dormant section	

Pear Leaf Blister Mite causes brownish blisters beneath the leaves. By late summer blisters may nearly cover the entire under leaf. In spring as buds develop, tiny (1/125-inch long) mites commence feeding on leaves, forming blisters. Blister mites can be controlled at cluster bud through first or second cover with Carzol SC (1.0-1.5 lb/A), Mitac 1.5EC (2-3 qt/A), OR Morestan*25WP (4.0-5.0 lb/A).

Pear Rust Mite. Rust mite feeding results in a russeting on the fruit. If rust mites were troublesome the previous season, start controls at green cluster bud and repeat at petal fall. Thorough spray coverage is essential for satisfactory control of mites. Concentrate or alternate row sprays generally result in inadequate control due to minimal spray deposit. Carzol 92SP (0.5-1.5 lb/A) or Kelthane 35WP (3-4 lb/A) are the miticides of choice however, Mitac 1.5EC (2-4 qt/A), Vendex 50WP (1.5-3 lb/A, and Vydate L (3 qt/A) are also labeled.

Important. Do not apply Vydate within 30 days of full bloom or fruit thinning may occur.

PREBLOOM SPRAY (Popcorn state--just before blossoms open)

Pests	Materials	Rate/A Concentrate
Pear scab, Fabraea leaf spot	Same fungicides and rates as GREEN CLUSTER BUD.	
	PLUS	
Pear psylla	Same choices as under delayed dormant sprays. **Do not use Morestan in this or later sprays.**	
Pear Psylla Control.	See previous comments	

Fire Blight Control. Apply streptomycin at 100 ppm when the first blossoms open if temperature and relative humidity are above 65F and 60 percent respectively. Repeat this application if similar weather conditions continue or recur when three-fourths of the blossoms are open. Streptomycin can be reduced to 50 ppm if 2 quarts of glycerin (USP or CP Grade) are added. Bartlett, Bosc, Clapps Favorite, and Gorham are extremely susceptible.

Pollination of Pears. Pears require honeybees for adequate pollination. Because pears have so little sugar in the nectar, honeybees prefer to visit other flowers. Therefore, it is especially important to eliminate dandelions, mustard, and other competing flowers from the vicinity of pear orchards. Growers should supply two to three colonies of bees for each acre of pears. For general comments on honeybee pollination, see "General Orchard Information."

BLOOM SPRAY

Pests	Materials	Rate/A Concentrate
Fire blight	streptomycin 17W	24 oz, OR
	streptomycin 17W	12 oz
	PLUS	
	glycerin	4 qt
	or	
	Regulaid	8 oz
	PLUS	
Leaf spot, fruit spot, scab	Same fungicides and rates as GREEN CLUSTER BUD.	

Febraea Leaf Spot is a serious disease on some varieties of pears, while other varieties are essentially immune to the disease. Where troublesome, apply protectant sprays on 14 day schedule beginning at bloom. The disease attacks the leaves, fruit, and twigs of the tree. Once the disease becomes established it is difficult to control. Fungicides which are effective include Maneb, Ferbam, Thiram, and Ziram. Longer residual fungicides such as Ferbam. Maneb, and Ziram may be more effective if the spray interval exceeds 14 days.

PETAL-FALL SPRAY (when most petals have fallen)

Pests	Materials	Rate/A Concentrate
Pear scab, sooty blotch Febraea leaf spot	Same fungicides and rates as GREEN CLUSTER BUD	
	PLUS	
Plum curculio, codling moth	Guthion 50WP	1.5 lb, OR
	Imidan 50WP	3 lb, OR

COVER SPRAYS (10-14 day intervals until harvest)

Pests	Materials	Rate/A Concentrate
Pear scab, Fabraea leaf spot, fly speck, sooty blotch	Benlate 50DF	12 oz, OR
	Ferbam 76WDG	3 lb
	PLUS	
Codling moth	Guthion 50WP	1.5 lb, OR
	Imidan 50WP	3 lb, OR
	Penncap-M	3-6 pt
Pear Psylla	Mitac 50WP	1.5-3 lb, OR
	Agrimek 0.15EC	10-20 oz PLUS
	Paraffinic Spray Oil	Minimum 1 gal

NOTE: Maneb, Mancozeb, and Dithane (EBDCs) may be used through Second Cover if the "Extended Application Schedule" is used. This is the same use pattern as listed for apples, and consists of a half rate of an EBDC fungicide plus an SI or a half rate of Benlate, Topsin, Ferbam or Ziram.

NOTE: Agrimek plus parrafinic spray oil will control both mites and pear psylla. For the best control of these pests, applications should be made early in the season prior to leaf hardening. Parrafinic spray oil must be tanked mixed with this product. Do not exceed 20 fl oz of Agrimek per acre per application or 40 fl oz per acre in a growing season. Limited to 2 applications per growing season. Do not apply within 28 days of harvest.

Pear Psylla Control. Add Mitac, or insecticidal soap, or Imidan, or Agrimek plus oil in cover sprays if psylla continue to build up. When applying any of these materials, at least 50 and preferable 100 gallons of spray is required per acre. Alternate row applications are not recommended when attempting to control pear psylla

Mite Control. If European red and two spotted spider mites appear, the following are labelled for control:

Miticide	Rate/Acre
Apollo SC[1]	4-8 oz
Savey 50WP[2]	4-6 oz
Kelthane 35WP	3-5 lb
Kelthane 50WP	3-4 lb
Agrimek 0.15EC[3]	10-20 oz

[1]Apply no closer to harvest than 21 days. Only one application allowed per season. Do not allow livestock to graze in treated orchards.

[2]If Apollo has been applied do not apply Savey; if Savey has been applied do not apply Apollo.

[3]Apply Agrimek with minimum of 0.25% parrafinic spray oil in the dilute spray mixture and not less than 1 gallon of parrafinic spray oil per acre in final finished spray.