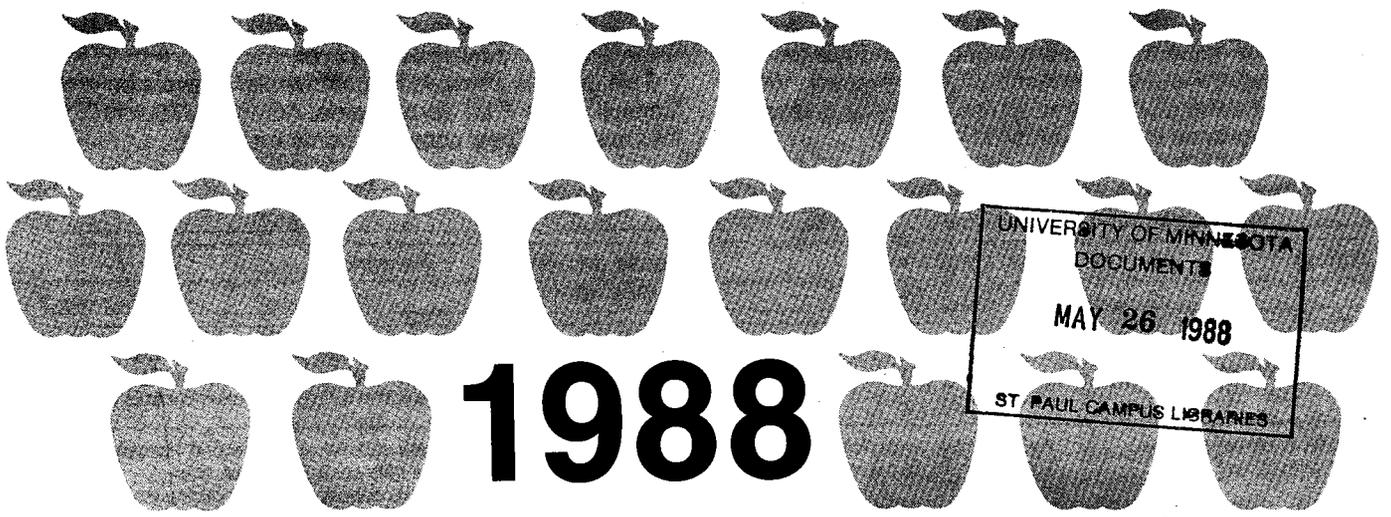


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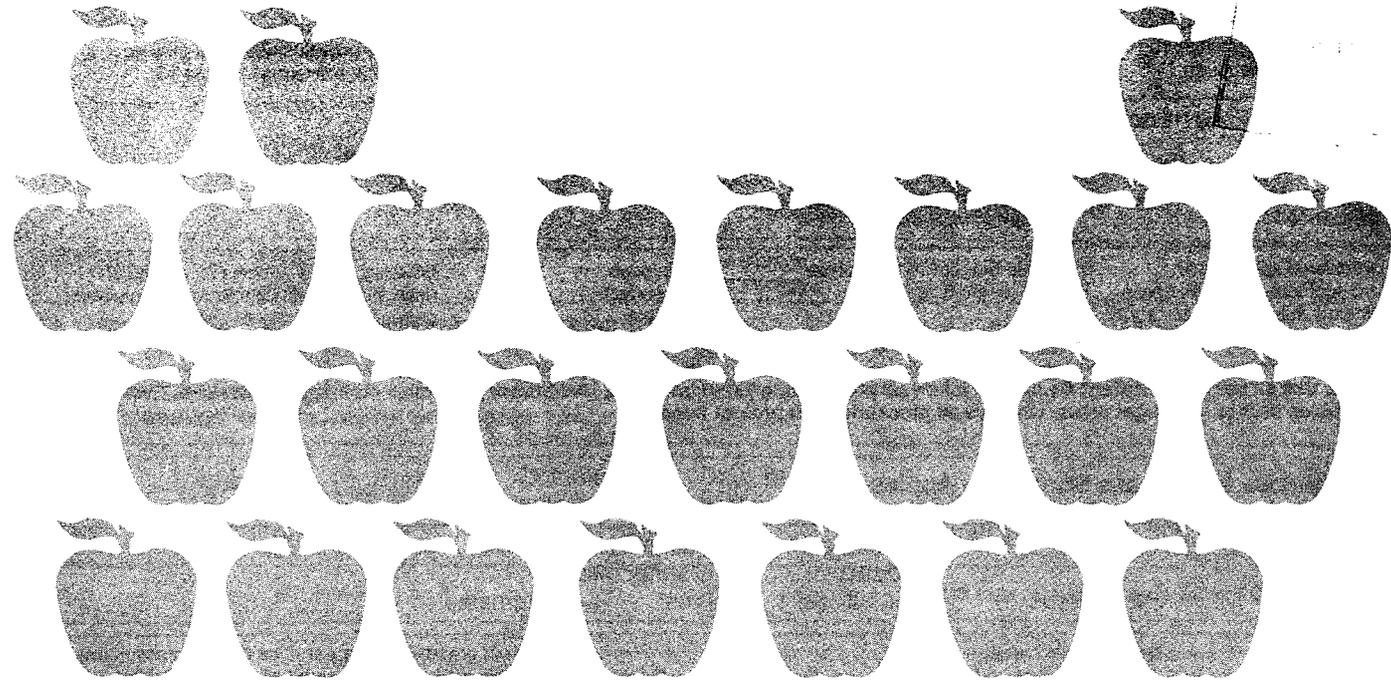
Minnesota Extension Service
University of Minnesota

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Commercial Apple Pest



**Leonard B. Hertz, extension horticulturist
Ward Stienstra, extension plant pathologist
David Noetzel, extension entomologist**

Troublesome insects and mites in Minnesota orchards include: apple maggot, codling moth, European red mite, plum and apple curculio, aphids, oystershell scale, leaf-rollers, cankerworm, leafhoppers, and tentiform leafminer.

The major diseases in Minnesota orchards are apple scab, cedar-apple rust, and fire blight. Other diseases include frog-eye leafspot, sooty blotch, and flyspeck. Virus diseases can be a problem in apples, but these diseases are not discussed in this publication.

The following guide shows: (1) the times spray applications normally are required; (2) the pests that may be troublesome at each spray date; and (3) the chemicals that are effective for controlling the major diseases and insects troublesome to apples. All rates are on the basis of dilute spray for a hydraulic sprayer.

This guide is intended for commercial growers only. Consult *Home Fruit Spray Guide*, AG-FO-0675, for information on pest control in home orchards.

Recommended Apple Spray Schedule (both disease and insect problems)

Timing	Insect problems that may appear	Disease problems that may appear	Remarks
Green tip (before leaves are out ½ inch)		Apple scab Fire blight	Tank mixed Bordeaux mixture 2-6-100 plus 1 gal. spray oil when fire blight infection is light. Bordeaux controls scab.
Prepink spray (when buds show pink at tips)	Aphids, mites, scale, leafroller, leaf miner (adults and eggs)	Apple scab	Use superior oil, 70 second viscosity for mite control. Addition of an organophosphorus insecticide increases the effectiveness of scale control.
Full pink spray	Aphids, mites, leafminer, leafroller, leaf miner (larvae)	Apple scab Fire blight Cedar-apple rust	Mite control may be necessary if superior oil was <i>not</i> applied as a pre-pink treatment.
Blossom spray	Some pests are present, but pollinators may be harmed by insecticides	Apple scab Fire blight Cedar-apple rust	Do not apply insecticides during bloom period—protect bees. Streptomycin preferred for fire blight control.
Petal fall (after three-fourths of petals have fallen)	Curculio, codling moth, leafroller, mites, aphids, green fruitworms, leafminer (larvae)	Apple scab Fire blight Cedar-apple rust	Vydate can not be used for leafminer control as it may cause apple thinning.
First cover spray (7-10 days after petal fall or when fruit is ¼ inch in diameter)	Red-banded leafroller, curculio, codling moth, mites, aphids, oystershell scale (crawlers)	Apple scab Fire blight Cedar-apple rust	Do not continue fire blight control after terminal growth stops. Rust may no longer be a threat after June 15.
Second cover spray (10 days after first cover)	None	Apple scab	
Third cover spray (10 days after second cover)	Codling moth, mites, aphids, leafhoppers, leafrollers,	Apple scab	
Additional sprays (Use maggot traps or start approximately July 1. A 14-day spray interval is usually adequate.)	Apple maggot, mites, aphids, codling moth, leafroller	Apple scab Sooty blotch Fly speck	Observe time limitations for chemicals used. Imidan and Guthion have provided superior apple maggot control.

Note: Use all pesticides safely. Be sure to follow all precautions listed on labels. Use proper protective clothing and devices. Avoid pesticide drift to nontarget areas. Observe all precautions to protect bees.

Fungicides for Disease Control on Apples

Diseases	Fungicides*	Commercial product per 100 gal. †	Days between final spray and harvest	Remarks
Apple scab	Benlate 50W** plus Captan 50W or Benlate 50W plus Polyram 80W	3 oz. 1 lb. 3 oz. 1 lb.	0 0 30	Do not graze treated areas. Use 6 oz. if infection has occurred. Fruit finish may be affected on Golden Delicious variety if more than 2 oz. is used. The use of oil with Benlate may adversely affect fruit finish on several varieties Single application at green tip stage.
	Difolatan 4F	5 qt.	0	
	Captan 50W	2 lb.	0	

Fungicides for Disease Control on Apples (continued)

Diseases	Fungicides*	Commercial product per 100 gal.†	Days between final spray and harvest	Remarks	
Apple scab (continued)	Cyprex 65W	¾ lb.	7	Do not use apples in the manufacture of apple pomace for use in livestock feeds. Do not graze livestock in treated orchards.	
	Funginex 1.6E	10 fl. oz.	To petal fall	Use from green tip to petal-fall as an eradicant.	
	Polyram 80W	2 lb.	30	Do not graze treated areas.	
	Rubigan	1⅓ to 4 fl. oz.	To second cover or when apples ½ inch.	Don't apply more than 84 fl. oz./acre/season. A 96 hour reach-back potential.	
Cedar-apple rust	Ferbam 76W	¾ lb.	7	Do not use on Golden Delicious.	
	Thylate 65W	1 lb.	0		
	Zineb 75W	1 lb.	30	First application at green tip and continue at 7-14 days.	
	Bayleton 50W	1 oz.	0		
	Funginex 1.6E	10 fl. oz.	To petal fall		Don't apply more than 84 fl. oz./acre/season. A 96 hour reach-back potential.
	Rubigan	1⅓ to 4 fl. oz.	To second cover or when apples ½ inch.		
Fire blight	Bordeaux mixture		0	Bordeaux mixture suggested at green tip stage only.	
	copper sulfate	2 lb.			
	hydrated spray lime	6 lb.			
	Streptomycin (17%)	¼-½ lb.	50	Use ½ lb. for moderate to severe fire blight.	
Sooty blotch and flyspeck	Captan 50W	2 lb.	0	Do not use on Golden Delicious. Do not graze treated areas.	
	Ferbam 76W	¾ lb.	7		
	Polyram 80W	2 lb.	30		
	Zineb 75W	1-2 lb.	30		
Powdery mildew	Dikar 80W	2 lb.	31	Powdery mildew control starts at pink and continues until terminal growth stops. If a spray oil is used, sulfur and Dikar may injure leaves if applied too close to spray oil treatments.	
	Benlate 50W plus	3 oz.	0		
	Captan 50W	1 lb.	0		
	Scab fungicide plus				
	Bayleton 50W	1 oz.	0		
	or				
Funginex 18.2E	10 fl. oz.	To petal fall			
or					
Wettable sulfur			0		
Rubigan	1⅓ to 4 fl. oz.	To second cover or when apples ½ inch.		Don't apply more than 84 fl. oz./acre/season. A 96 hour reach-back potential.	
Postharvest	Benlate 50W	8 oz.	Before storage	Postharvest dip or spray.	
	Captan 50W	2 lb.	Before storage	Postharvest dip or spray.	

*W = wettable powder; F = flowable; E = emulsifiable concentrate.

† "Commercial product per 100 gal." is average dosage at 300 gal./acre. See label for details on dosage for concentrate sprays.

** Always use a protectant fungicide such as Captan or Polyram with Benlate.

Insecticides for Insect Control on Apples

Insects	Insecticide*	Commercial product per 100 gal.†	Days between final spray and harvest	Remarks	
Aphids	Thiodan 50W	1 lb.	30	Do not exceed 3 applications during fruiting period.	
	Cygon 25W	2 lb.	28		
	Zolone 3E	1 pt.	14		
	Diazinon 50W	1 lb.	14		
	Lorsban 4E	1 pt.			Use as a delayed dormant spray.

*W = wettable powder; E = emulsifiable concentrate.

† "Commercial product per 100 gal." is average dosage at approximately 300 gal./acre. See label for details on dosage for concentrate sprays.

†† Restricted-use compound.

Insecticides for Insect Control on Apples (continued)

Insects	Insecticide*	Commercial product per 100 gal†	Days between final spray and harvest	Remarks	
Apple maggot	Guthion 50W	½ lb.	7	24 hour re-entry	
	Imidan 80W	1 lb.	7		
	††Pennncap 2FM	1 pt.	14		
	††Pydrin 2.4E	4 fl. oz.	21	Toxic to bees. Do not apply if substantial number of weeds are in bloom.	
	Diazinon 50W	1 lb.	14		
	Zolone 3E	1 pt.	14		
Sevin 80SP	1½ lb.	1			
				Do not apply within 30 days after full bloom to avoid thinning.	
Codling moth	Guthion 50W	½ lb.	7	24 hour re-entry	
	Sevin 80SP	1½ lb.	1		
					Do not apply within 30 days after full bloom to avoid thinning.
	Diazinon 50W	1 lb.	14		
	Lannate 90SP	½ lb.	8	Do not apply to Wealthy. Toxic to bees. Do not apply if substantial number of weeds are in bloom. Toxic to bees. Do not apply when bees are foraging.	
	††Pennncap 2FM	1 pt.	14		
	Imidan 50W	1 lb.	7		
Zolone 3E	1 pt.	14			
††Pydrin 2.4E	2.5 fl. oz.	21			
Mites	Carzol 92SP	6 oz.	7	Apply at delayed dormant at temperature higher than 40°F.	
	Acaralate 2E	1 qt.	14		
	"Superior" oil (70 sec. vis.)	2 gal.	NTL**		
	Omite 30W	1½ lb.	7		
	Vendex 50W	¼-½ lb.	14		
	††Vydate 2L	1 pt.	14	Do not apply within 30 days post bloom to avoid thinning.	
Oystershell scale	Diazinon 50W	1 lb.	14	For use when crawlers are present. Delayed dormant spray at temperature higher than 40°F.	
	"Superior" oil (70 sec. vis.)	2 gal.	NTL**		
Plum curculio	Guthion 50W	½ lb.	7	24 hour re-entry	
	Imidan 50W	1 lb.	7		
	††Pennncap 2FM	1 pt.	14	Toxic to bees. Do not apply if substantial number of weeds are in bloom.	
	Zolone 3E	1 pt.	14		
	††Pydrin 2.4E	2.5 fl. oz.	21		
Leafrollers	Guthion 50W	½ lb.	7	24 hour re-entry	
	††Pennncap 2FM	1 pt.	14		
					Toxic to bees. Do not apply if substantial number of weeds are in bloom.
	Imidan 50W	1 lb.	7		
	Lannate 90SP	½ lb.	8		
Zolone 3E	1 pt.	14	Do not apply to Wealthy.		
††Pydrin 2.4E	2.5 fl. oz.	21			
Tentiform Leafminer	††Vydate 2L	1 pt.	14	Do not apply within 30 days post bloom to avoid thinning. Controls eggs and sap feeders. Use when mites and/or leafhoppers are a problem. Adults only. Adults, eggs, and larvae. Pydrin, Ambush, Pounce, and Pay-off control adults and eggs, only. Will not control larvae.	
	Carzol 92SP	5 oz.	7		
	Lannate 90SP	¼ lb.	8		
	††Pydrin 2.4E	2.5 fl. oz.	21		
	††Ambush 2E	3 fl. oz.	To petal fall		
	††Pounce 3.2E	2 fl. oz.	21		

*W = wettable powder; SP = soluble powder; E = emulsifiable concentrate; L = water soluble liquid.

** NTL = No Time Limitation

† "Commercial product per 100 gal." is average dosage at approximately 300 gal./acre. See label for details on dosage for concentrate sprays.

†† Restricted-use compound.

Apple Weed Control

Herbicides can save you considerable labor in the culture of fruit crops. Under some conditions they are more effective than mechanical or hand weeding control methods, but special care is required when using them.

Herbicides are effective only within a limited range of application rates; too low rates result in insufficient control, while too high rates may injure apple trees. The amount of material to use varies with the kinds and sizes of weeds present, soil type and condition, weather, application method, and formulations.

To prevent injury, use a herbicide only on a trial basis until you are familiar with its reaction on the trees. And don't contaminate crops with spray drift or by using herbicide spray equipment for applying insecticides and fungicides. Follow these rules for the proper method of applying herbicides on fruit crops:

- **Select herbicides with specific label clearance** that have been favorably tested in your area.
- **Read, understand, and follow label directions.**
- **Mix herbicides accurately and thoroughly** so you apply them uniformly and at proper rates.
- **Apply herbicides at low pressure** (20-40 pounds), using calibrated equipment that functions properly. Hand equipment usually is unsatisfactory.
- **Use low-volume spray equipment** that applies 30-50 gallons of water per acre.
- **Have separate spray equipment** for herbicides unless you can thoroughly clean the spray tank, pump, hoses, and nozzles before applying insecticides or fungicides.
- **Store herbicides safely** in a locked storeroom, separated from other pesticides.

Apple Weed Control

Weed problem	Herbicide*	Amount/acre** (commercial product)	Time of application	Remarks
NEWLY PLANTED (first growing season)				
Annuals and knock-down of perennials (top growth only)	Gramoxone Super	2½-5 pt.	Before or after planting trees	Spray in a band 4 to 6 feet wide. A second application may be needed for season-long control. Do not allow spray to contact apple foliage.
Annuals	Devrinol 50W	8 lb.	Apply to weed-free ground after planting	Incorporation aids weed control.
	Surflan 75W Solicam 80W	3-5 lb. 4-6 lb.		Use lower rates on sandy soil.
Annual broadleaves	Goal 1.6E	1-4 qt.	Trees dormant	Do not apply after bud swell. Direct spray at base of trees. Maybe combined with Roundup, Princep or Gramoxone Super.
Grasses	Fusilade 2000	2-4 pt.	Apply to actively growing grass	Non-bearing apples only. Add 1 qt. crop oil concentrate per acre in 25 gal. water.
	Poast 1.5E	2-3 pt.		
ESTABLISHED TREES (one year or more)				
Annuals and quackgrass	Princep 80W plus Gramoxone Super	3-5 lb. 3 pt.	Early spring before weeds emerge	Use only on trees that have been established for 1 or more years. Use low rate on sandy soils.
	Sinbar 80W plus Gramoxone Super	1½-3 lb. 3 pt.	Spring	Use only on trees that have been established for 3 or more years. Use lowest rate on sandy soils.
	Karmex 80W	4 lb.	Early spring before weeds emerge	Do not apply more than 4 lb. commercial product per season.
Annuals weeds only	Solicam 80W	4-6 lb.	Spring, before weeds emerge	Use lower rate on sandy soil.
	Surflan 75W	3-5 lb.	Weed free ground	Use lower rate on sandy soil.
	Devrinol 50W	8 lb.	Weed free ground	
	Gramoxone Super	2½-5 pt.	Growing weeds	A second application may be needed for season-long control. Do not allow spray to contact foliage or fruit. May be combined with Princep or Sinbar.

*G = granular; W = wettable powder.

**Rates given are on an acre basis, but only treat the area beneath trees.

*E = Emulsifiable concentrate

Apple Weed Control (continued)

Weed problem	Herbicide*	Amount/acre** (commercial product)	Time of application	Remarks
Growing annual and perennial weeds	Roundup 3E	3 qt.	Quackgrass should be 8-10 inches tall	This herbicide will not prevent annual weeds coming up again from seeds. Do not allow spray to drift. May be combined with Princep or Sinbar.
Dandelion, poison ivy, bindweed, and other problem perennials	2,4-D (Dacamine 4D)	1 qt.	When weeds are growing rapidly	For dandelions, apply to bloom or after harvest. Prevent drift to trees.
	Roundup 3E	3-4 qt.	Follow label for weed size	Do not allow spray to drift.

E = Emulsifiable concentrate. **Rates given are on an acre basis, but only treat the area beneath trees.

Control of Rodents in Apple Orchards

ORCHARD MICE CONTROL

Mice are troublesome in orchards primarily because they feed on tree bark, thereby girdling trunks near or below the ground line. The two species of mice concerned are the meadow mouse and the pine mouse.

Damage by the meadow mouse usually is done at or above the soil surface, so if you discover the damage in spring you often can repair it. The pine mouse feeds below the soil on the bark of roots. Although the pine mouse causes the most damage, its presence has not been reported in Minnesota.

Mouse damage is costly; you must consider mouse control as a regular orchard practice. To control mice, use mechanical and cultural aids and rodenticides.

Habitat Reduction

Mouse habitat can be reduced by regular mowing and using herbicides. Pick up brush piles, trash, and old packing crates. Eliminate apple drops if possible, especially before snow cover. Then the orchard loses some of its desirability as a nesting place for mice.

Mouse Guards

Wire guards partially protect young trees. Place a cylinder of hardware cloth (three to four wires to the inch), 8 inches in diameter and 18 inches in height, around the young tree soon after planting. Set the cylinder at least 2 inches into the soil. A plastic guard, sold under the trade name of "Arborgard," is available for mouse control. It is easily installed and has effectively protected young trees from mouse damage.

Lethal Baits

Three chemicals are available for mouse control in orchards: zinc phosphide (Orchard Bait, ZP), diphacinone (Ramik), and chlorophacinone (Rozol). All are available in pelleted form.

Grain baits are treated with zinc phosphide. Buy ready-mixed baits; home preparation results in non-uniform mixtures and a poor kill.

Be especially cautious when using these materials. They are toxic to humans. Wear proper protective clothing when mixing or applying them; wash hands and utensils thoroughly after working with treated baits.

Trail Baiting—You can apply zinc phosphide grain as a trail bait at 3 pounds per acre or in a broadcast system at 6-10 pounds per acre.

Examine the orchard floor systematically for distinctive trails made by mice under heavy cover. When you locate an active runway, place an apple cube or a teaspoon of grain in it. Then pull the grass back in position over the bait. Usually, three or four baits per tree are needed. Heavy grass, apple crates, and hay bales are logical places for runways.

Beginning at the drip line and working inward toward the trunk, examine one side of the tree at a time until you find a run. You may find that the area is inactive. Disturb the area as little as possible.

October-November is the best time for baiting. You may have to rebait an area in midwinter if there is a heavy, persistent snow cover.

Broadcasting Bait—Broadcasting grain bait by hand or machine also produces good results and is less expensive than trail baiting. Although you can spread bait by airplane, tractor-drawn seeder, or fertilizer spreader, broadcasting by hand is recommended.

To apply the bait, hurl a small handful of poisoned grain into the most likely mouse cover under each tree. Wear protective clothing and guard against accidental poisoning of nontarget animals or humans.

POCKET GOPHER CONTROL

Pocket gophers live in an underground burrow system, often a network of several hundred feet ranging in depth from a few inches to several feet. Their activity in an orchard can be identified by the presence of fresh mounds of dirt. Most mounds are made in late summer and fall when gophers are digging shallow burrows to get roots—including roots of apple trees—for the winter.

Control methods are more effective during the spring and fall when pocket gophers are most active. This activity can be noted by the presence of fresh mounds of dirt.

Traps and poisoned baits are the most practical methods of control. In small areas having a few animals, trapping or hand baiting is effective. In large and heavily infested areas, baiting with a burrow builder is more efficient.

Control by Trapping—To locate the runway, use a

stout garden trowel or shovel. Scrape the dirt from a fresh mound until a round circle of fresh dirt is found plugging the lateral runway. You can open the lateral runway and put in one trap with the claws away from the opening. However, it is usually better to dig down the lateral into the main runway and then place two traps back to back in the main runway. Secure the traps with a piece of flexible wire attached to a stake. The hole can be left either open or closed.

Control with Poisoned Bait—Zinc phosphide baits are available commercially for pocket gopher control. Gophacide at 0.1-0.2 percent is available as a finished bait. Two baiting methods are effective. One method involves dropping baits by hand into the underground runways. With the other method, a tractor-drawn machine

called a "burrow builder" makes artificial burrows and automatically drops bait into them.

Hand Baiting—Remove the earth plug from the lateral tunnel of a fresh mound of dirt. With a long-handled spoon, insert a tablespoonful of the bait into the main runway. Cover the opening to exclude light and loose dirt. The main runway can also be located by probing with a stick or metal rod approximately 8-18 inches back from the plug mark in the mound. When the runway is found, enlarge the hole to put in the bait and cover as before. After 48 hours, scrape over mounds and retreat those still active. One pound of bait material will treat 5-8 acres.

For extensive hand baiting, good probes can be made of ¾-inch pipe welded to a blunt point and cut to 34 inches in length. A footrest can be made 16 inches from the end.

Apple Growth Regulator Sprays

CHEMICAL THINNING OF APPLE FRUITS

Many apple varieties frequently set more fruits than is optimum for good apple production. As a result, fruit size and quality are reduced, as is the effectiveness of a pest control program. Blossoming generally is sparse the year after a heavy crop, so trees develop a biennial or alternate bearing cycle.

Hand thinning fruits is costly and does not increase the return bloom the following year. Certain growth regulators effectively reduce the concentration of fruits on a tree. The return bloom the following year also is increased by the thinning procedure.

Materials Recommended—NAA (naphthalene acetic acid) and NAD (naphthalene acetamide) are the chemicals most often used for thinning apples. NAA is sold under such trade names as Fruitone and Stafast or as naphthalene acetic acid. NAD is sold as Amid-Thin.

Precautions—Chemical thinning is not an exact operation. Even though concentration and timing appear to be identical, the amount of thinning obtained on the same variety in the same block may vary considerably from year to year. These differences may be due to weather or to the condition of the trees. Vigorous trees (requiring high concentrations) are more difficult to thin than trees of low vigor (requiring low concentrations).

Recommendations for Use—Under Minnesota conditions NAA results in more thinning of fruits than NAD. Foliage injury can occur with NAA, especially if it is used on early varieties. NAA is most active when applied under fast drying conditions with 65°-70°F temperatures.

NAD is absorbed best when weather conditions favor slow drying. Since its action is milder than that of NAA, NAD seldom causes foliage injury at concentrations up to 75 ppm (see also table on page 8).

You can determine the need for additional thinning of fruits treated with NAA by examining trees 7-10 days after spraying. Use NAA if additional thinning is necessary.

Spray trees thoroughly in the same manner as for pest control. Apply NAA or NAD as a separate spray; do not combine it with petal fall or cover sprays for pest control. In order to evaluate results, leave unsprayed check trees of each variety. If you have not had experience in

chemical thinning or if you are thinning varieties of unknown response to sprays, limit sprays to a trial basis (see also table on page 8).

Use of Sevin—The insecticide Sevin may be useful for thinning fruits, especially in areas where temperatures are warm early in the postbloom period. If you use Sevin, apply it at the rate of 1½ pounds of 50W per 100 gallons of water; make the application 7 days after petal fall. Varying the concentration of Sevin has not appreciably changed the degree of thinning obtained. (Also Sevin has not been as consistent or adequate for thinning as NAA or NAD.)

Caution: *To avoid the possibility of excessive fruit thinning, do not use Sevin as an insecticide until 14 days after petal fall.*

Defruiting Young Apple Trees—Sevin (1½ pounds 50W per 100 gallons of water) in combination with NAA (10 ppm) causes severe thinning. The combination has been useful for removing all fruits from young trees.

STOP-DROP SPRAYS FOR APPLES

Preharvest fruit drop is a problem in nearly all orchards. You can reduce losses by using stop-drop or "sticker" sprays. Oriole, Beacon, Wealthy, Haralson, Fireside, McIntosh, and Connell Red drop excessively.

Materials Recommended—NAA (naphthalene acetic acid) and Alar have been used effectively on most apple varieties in Minnesota.

NAA is recommended at the rate of 10 ppm. However, rates as low as 5 ppm may be effective on summer or early fall varieties if you spray when temperatures are relatively high. On late maturing varieties, 15-20 ppm may be needed.

Apply NAA 3-4 days before you expect heavy fruit dropping to begin. It becomes effective in approximately 2 days. Do not make more than 2 applications and do not make applications within 2 days of harvest. NAA is effective for a relatively short time, usually not more than 7-10 days.

Apply Alar at ¾ to 1 pound per 100 gallons, 60-70 days prior to harvest (do not exceed 3 lbs./acre). In addition to preharvest drop control, Alar will increase fruit firmness and delay water core development.

Sufficient Coverage—When applying stop-drop sprays, you must obtain thorough and even coverage of foliage. If you combine stop-drop sprays with pest control sprays, the effectiveness of the stop-drop sprays is reduced, particularly if the pest control spray contains lime.

Weather Conditions—Stop-drop sprays are more effective during warm than cool temperatures. Dew and high humidity also increase their effectiveness, but drought reduces it. Occasionally, heavy drops may occur in spite of weather or treatment.

Precautions—Fruit maturity may be hastened by stop-drop sprays, but never delayed. Do not allow apples to become overmature before harvesting. Carefully check fruit for maturity; pick it when optimum maturity is attained. Ease of picking or dropping from the tree cannot be used as a sign of maturity.

Sprays that are too concentrated also can lead to an undesirable hastening of maturity. Do not exceed maximum recommended concentrations.

TO PROMOTE APPLE COLOR AND UNIFORM RIPENING

Ethrel (ethephon) can be applied before the normal harvest period to promote early development of red color

and ripening. For apples maturing earlier than McIntosh, use ½ pint per 100 gallons of water applied 7-12 days before normal harvest. Because Ethrel promotes fruit drop, use in combination with a preharvest stop-drop spray, such as NAA (Fruitone).

Apples treated with Ethrel must be harvested at proper maturity, and the fruit must not be allowed to become overripe on the trees. Color alone is not always an adequate indicator of fruit maturity. Other methods, such as undercolor or a pressure gauge, should be used frequently. If overmature apples are harvested and stored, the fruit may soften sooner than would nontreated fruit.

ALAR ON APPLES

Alar-85 can produce several fruit and vegetative modifying responses, depending on the time and rate of application. The fruit-modifying effects include stimulation of apple color, increased fruit firmness, and a reduction in apple drop and water core.

When only fruit-modifying effects are desired, Alar should be applied 60-70 days before normal harvest. Rates of application of ¾ to 1 lb./100 gal. are suggested (do not exceed 3 lbs./acre). The rate does depend upon tree vigor, variety, and crop load. Trees low in vigor should not receive Alar; with moderate vigor use ¾ lb. Trees with high vigor receive the high rate, 1 lb. Uniform and thorough tree coverage is essential. Don't apply Alar more than once during the growing season.

GUIDE TO THINNING MINNESOTA APPLE VARIETIES

Materials	When to apply	Concentration (ppm)*				Varieties	Remarks
		Easy to thin (10 ppm)	Intermediate (15 ppm)	(20 ppm)	Hard to thin (25 ppm)		
Napthalene acetamide (NAD) (Amid-Thin)	Petal fall		50			Beacon Wealthy Paulared Duchess Lodi State Fair Red Baron Minjon	If possible, use when weather conditions favor relatively slow drying. NAD often is applied in the evening. Use on varieties earlier than McIntosh.
Napthalene acetic acid (NAA) (Fruitone) (Stafast)	5-10 days after petal fall	McIntosh	Cortland	Golden Delicious	Haralson		Use on varieties ripening with or later than McIntosh. In some regions, NAA is preferred for almost all varieties.
		N.W. Greening	Spartan	Honeygold	Minjon		
		Red Delicious	Sweet Sixteen	Keepsake	Redwell		
		Jonathan	Regent		Prairie Spy		
		Fireside Connell Red					

*ppm = parts per million

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