

Pesticide	Use Category ¹	Hours to Reentry	Days to Harvest
FUNGICIDE (FRAC code)			
Actigard (Group P)	G	12	7
Aliette (Group 33)	G	12	3
Cabrio (Group 11)	G	12	0
coppers, fixed (Group M1)	G	24	0
MetaStar (Group 4)	G	48	21
Presidio (Group 43)	G	12	2
Quadris (Group 11)	G	4	0
Ridomil Gold (Group 4)	G	48	21
Ridomil Gold Copper (Groups 4 + M1)	G	48	21
Ultra Flourish (Group 4)	G	48	21

See Table D-6.

¹ G = general, R = restricted

Disease Control

Damping-Off

Apply the following preplant incorporated or as a soil surface spray after planting:

mefenoxam (Ridomil Gold--1.0-2.0 pt 4E/A or 2.0-4.0 pt Ultra Flourish 2E/A), or metalaxyl (MetaStar)--4.0-8.0 pt 2E

At planting application of mefenoxam or metalaxyl will also help control early-season white rust infections in spinach.

Downy Mildew (Blue Mold) and White Rust

Rotate away from spinach for at least 2 years. Use resistant varieties where possible. Do not plant spring crop near overwintered fields. The use of mefenoxam or metalaxyl at planting for damping-off control will provide early season control. Fungicides containing copper may cause phytotoxicity.

Foliage Application: Beginning 2 to 3 weeks after emergence (or prior to symptom development), apply the following on a 7 to 10-day schedule (do not use if temperature is 90°F [32.2°C] or above):

Actigard--0.75 oz 50WG/A, or Quadris--6.0-15.5 fl oz 2.08SC/A (use 12.0-15.5 fl oz/A for downy mildew), or Presidio--3.0-4.0 fl oz 4SC/A, or Cabrio--12.0-16.0 oz 20EG/A (white rust only use 8.0-12.0 oz.), or Aliette—3.0 lb 80WDG/A, or Fixed copper, see labels for rates and details, or Ridomil Gold Copper--2.5 lb 65WP/A (14-day schedule)

FRAC code 11 fungicides, such as Quadris and Cabrio should not be applied more than twice before switching to a fungicide with a different mode of action.

Shanked application: mefenoxam--0.25 pt Ridomil Gold 4EC/A, 0.5 pt Ultra Flourish 2E/A or 1.0 pt MetaStar 2E/A may be shanked in 21 days after planting or after first cutting. A second shanked application may be made 21 days later or after the second cutting.

Leaf Spots and Anthracnose

These diseases can be prevalent in overwintered, and during periods between second and third, cuttings. Apply the following as soon as symptoms appear in the spring or

shortly after cutting and repeat every 7 to 10 days. If more than 2 applications are needed, apply a copper fungicide prior to making a third application of either FRAC code 11 fungicide:

Quadris--6.0-15.5 fl oz 2.08SC/A, or Cabrio--12.0-16.0 oz 20EG/A

FRAC code 11 fungicides, such as Quadris and Cabrio should not be applied more than twice before switching to a fungicide with a different mode of action

Cucumber Mosaic Virus

Use resistant (MR and MMR) varieties. See table.

STRAWBERRIES

For additional information, New Jersey growers refer to Commercial Strawberry Recommendations and Fact Sheets 784, and E288. “**The Mid-Atlantic Commercial Berry Guide for Commercial Growers**”, a cooperative publication for Pennsylvania, Maryland, New Jersey, Delaware, West Virginia, and Virginia, contains additional information and can be found on the website pubs.cas.psu.edu/freepubs/MABerryGuide.htm.

Annual Production System on Plastic Mulch

This system is recommended for Delaware, Maryland, New Jersey, Virginia, southeastern Pennsylvania, and for trial in other areas of Pennsylvania.

Varieties

Varieties	DE	MD	NJ	PA	VA	WV
Early						
Sweet Charlie ¹ (trial)	D	M		P	V	WV
Midseason						
Chandler	D	M	N	P	V	WV
Camrosa ² (shipping only)	D	M	N	P		WV
Allstar (for northern areas) (trial)		M	N		V	WV
DarSelect (trial)				P	V	WV
Late						
Ovation (trial)		M	N			
Everbearer						
Seascape				P		WV

¹ Matures 7 to 10 days earlier than Chandler; recommended for trial in southern regions of Maryland. Plant only in areas with low risk of frost. May require overhead sprinkler for additional frost protection during bloom.

² Must be fully red-ripe for flavor development.

Recommended Nutrients Based on Soil Tests

Before using the table below, refer to important notes in Plant Nutrient Recommendations in Section B, Soil And Nutrient Information. These notes provide additional suggestions to adjust rate, timing and placement of nutrients depending on soil type cation exchange capacity and existing fertility levels.

Strawberries Annual System	Nitrogen (N) Pounds per Acre	Soil Phosphorus Level			Soil Potassium Level		
		Low	Med	Opt	Low	Med	Opt
		Pounds P ₂ O ₅ per Acre	Pounds P ₂ O ₅ per Acre	Pounds P ₂ O ₅ per Acre	Pounds K ₂ O per Acre	Pounds K ₂ O per Acre	Pounds K ₂ O per Acre
Loamy sands	90-120 ¹	165 ¹	115 ¹	65 ¹	165 ¹	115 ¹	65 ¹
And sandy loams	60-75 ²	165 ²	115 ²	65 ²	165 ²	115 ²	65 ²
	15-25 ³	0	0	0	0	0	0
	15-25 ⁴	0	0	0	0	0	0
Loams and silt	70-90 ¹	150 ¹	100 ¹	50 ¹	150 ¹	100 ¹	50 ¹
loams	50-60 ²	150 ²	100 ²	50 ²	150 ²	100 ²	50 ²
	20-30 ³	0	0	0	0	0	0

¹ Total recommended

² Disc in before bedding

³ Inject through drip at first flowering in spring

⁴ Inject through drip at fruit enlargement (2 weeks after first flowering)

Apply 1 - 2 pounds of boron (B) per acre with broadcast fertilizer. See Table B-10 for more specific boron recommendations.

Background

The annual strawberry production system has potential for increased profitability over conventional matted-row plantings. Establishment costs are higher, but production is earlier (when crop value is highest) and of higher quality. Start with small acreage and increase as knowledge and experience is gained with the system. This is an integrated system and all of the components are important for maximum production and efficiency. Omission of one or more of the following components could lead to failure.

Site Selection

Plan the field location of strawberries grown on plastic and matted rows carefully if you intend to harvest by Pick-Your-Own. Pick-Your-Own customers have a strong preference for berries grown on plastic and may not pick matted row strawberries located in adjacent fields. The annual system has given highest yields at locations with a long growing season. Select fields with good surface and internal drainage, a southern exposure, and protection from westerly winds.

Field Preparation

Have the soil tested to determine specific nutritional needs. Apply 60 to 75 pounds actual nitrogen plus P₂O₅ and K₂O at the rates recommended above and work into beds. Base additional phosphorus, potassium, and boron application rates on soil test results. Prepare raised beds (30 to 40 inches wide and 6 to 8 inches high) on 5- to 5½-foot row centers. Beds should be center-crowned and firm. Depending on soil type, plant vigor, and plant tissue test results, inject an additional 30 to 40 pounds of nitrogen per fertilized-mulched acre through the drip system in the spring. **For convenience, rates of fertilizer nutrients can be converted from a mulched acre to linear foot basis. See Table C-8.**

Weed Control.

Fumigation is essential to control weeds because labeled residual herbicides cannot be used over the top of the plastic to provide adequate weed control around the plant hole. Several weed control options are listed below to control troublesome winter annuals and other weeds that grow around plant holes.

Prepare soil, apply fertilizer, then apply fumigant. See the Chapter E "Soil Fumigation" and "Nematodes" sections under "Soil Pests--Their Detection and Control" for materials, rates, and precautions. Wait 20 days to allow the fumigant to act and disperse. Then prepare raised beds as described above and apply 4 to 6 pounds per acre of Devrinol 50DF to the surface of the bed and the area between beds. Lay drip irrigation and plastic mulch.

OR

Apply fertilizer, prepare raised beds, and inject metam-sodium (Vapam HL) at 56 to 75 gallons per acre or 37 gallons per mulched acre. Immediately reshape beds (if necessary to form a firm, crowned bed) and apply 4 to 6 pounds per acre of Devrinol 50DF to the surface of the bed and the area between beds, and lay drip irrigation and plastic mulch. Wait 20 days between fumigation and planting to allow the fumigant to act and to disperse.

OR

Apply fertilizer and prepare raised beds as described above. Apply 4 to 6 pounds per acre of Devrinol 50DF to the surface of the bed. Apply drip irrigation and plastic mulch. Inject metam-sodium (Vapam HL) through the drip system at 37 gallons per mulched acre. Wait 20 days between fumigation and planting to allow the fumigant to act and to disperse.

Weeds between the mulched beds can be controlled with standard strawberry weed control herbicides recommended for matted-row culture. Band the treatment between the strips of plastic. Grasses between the rows and around plant holes can be controlled by postemergence applications of Poast 1.5EC. See recommendations for Poast 1.5EC in the "Weed Control" section of Matted Row Culture.

Plants and Planting

The best current option is the use of transplant "plugs" propagated from actively growing runner tips. Plugs can be purchased directly or one can purchase tips and produce the plugs. To produce plugs, use a well-drained artificial mix containing 50% peatmoss and 50% horticultural vermiculite or 50% perlite. A poorly drained growing medium promotes root diseases. A list of nurseries that supply plugs and runner tips, and/or directions for propagating from tips, is available through your local county Extension office.

Plugs are easy to plant mechanically with a waterwheel-type planter. Be sure to place the crown of the transplant at the soil level when planting. Deep planting can promote decay of the plant and shallow planting allows the plant to desiccate. Space plants 12 inches apart in each of the double rows in a staggered pattern. Space double rows 12 to 18 inches apart on the bed. The 18-inch between-row spacing has produced high yields and requires a 36- to 40-inch wide bed.

Plant in late August to early September for highest first-year yields in southern New Jersey, Delaware, Maryland, and Virginia. In Pennsylvania and northern New Jersey plant in mid to late August. Mid-September is the latest recommended planting date.

Renovation

Strawberries grown on plasticulture can be renovated in July. For varieties (Sweet Charlie) and plantings with moderate vigor, mow tops with a rotary mower, leaving several leaves on the plant. For very vigorous varieties (Chandler) and plantings, cutting away a portion of the crown

with an asparagus knife leaving 3 crowns or a combination of mowing followed by crown thinning, may be the most effective renovation technique. After renovation, maintain adequate soil moisture and good insect and disease control. In early September, apply 60 pounds of N, P₂O₅, and K₂O per mulched acre via drip irrigation and manage the renovated planting using the same cultural practices as for a new planting.

Renovation has improved berry size, however, size is usually smaller than in the first harvest season. Marketable yields of renovated strawberries have been equal to yields in the first harvest season. Renovation is especially useful if the planting will be harvested as a Pick-Your-Own.

Row Covers

Floating row covers (FRC) are an essential part of the system to reduce the desiccating effects of winter winds, for frost and freeze protection, and early fruiting. Ultraviolet light resistant covers with a weight of 1 to 1.4 ounces per square yard and 60 to 70 percent light transmission have been effective. Apply FRC between October 15 and November 15, depending on location and planting date, for maximum fall growth and yields. FRC can be applied in early December for overwinter protection. Remove the FRC at the first signs of flower bud emergence. Leaving the covers on too long may reduce fruit size. Leave the covers at the edge of the field so plants can be quickly covered if there is a frost warning.

Irrigation

Overhead irrigation at planting is essential to cool plants and plastic in warm weather and improve establishment. Provide for irrigation in the fall to promote good plant growth before row covers are applied. Large fruit size is important for high crop value, and adequate moisture is critical for maintaining good fruit size. Drip irrigation is effective in increasing fruit size without wetting the fruit and causing increased fruit rots. Be prepared to irrigate frequently to maintain favorable soil moisture in the spring. Overhead mist irrigation may be required in the spring for frost and freeze protection.

Pest Control.

Use an effective disease control program. To control Phytophthora crown rot caused by *Phytophthora cactorum* on newly set transplants apply Ridomil Gold 4E--1.0 pt/A through the trickle irrigation system after transplanting. Apply a fungicide to control leaf spots after plants are established. Apply a fungicide plus insecticides to control aphids and mites just before covering plants with the floating row in the fall. Insecticides and miticides should be applied during late summer or early fall to prevent aphids and mites from reaching damaging levels in the spring. Maintain a good pest control program after covers are removed in the spring.

Bloom sprays are important for control of Botrytis gray mold. See "Disease Control" and "Insect Control" sections for materials and rates.

Harvesting

The Chandler variety grown with the annual system ripens about 1 week earlier than standard varieties grown in matted rows. The duration of harvest is about 3 weeks. The tips of some Chandler berries may be light colored or white, but they will ripen after harvest. For local markets, harvest when tips have red color.

Matted Row Culture

Varieties

Varieties ¹	DE	MD	NJ	PA	VA	WV
Early						
Earliglow (RSR)	D	M	N	P	V	WV
Annapolis (RSR)	D	M	N			
Midseason						
Darselect				P	V	WV
Allstar (VR,RSR)	D	M	N	P	V	WV
Honeoye				P		WV
L'Amour (trial)				P	V	
Redchief (VR,RSR)(PYO-NJ)	D	M	N	P	V	WV
Late						
Ovation (trial)			N	P	V	
Jewel				P	V	WV

Letters in parentheses indicate disease resistance possessed by varieties. See the "Abbreviations" section in front portion of this publication.

Recommended Nutrients Based on Soil Tests

Before using the table below, refer to important notes in Plant Nutrient Recommendations in Section B, Soil And Nutrient Information. These notes provide additional suggestions to adjust rate, timing and placement of nutrients depending on soil type cation exchange capacity and existing fertility levels.

Strawberries Matted Row System	Nitrogen (N) Pounds per Acre	Soil Phosphorus Level			Soil Potassium Level		
		Low	Med	Opt.	Low	Med	Opt.
		Pounds P ₂ O ₅ per Acre			Pounds K ₂ O per Acre		
<i>New Plantings</i>	110-150 ¹	165 ¹	115 ¹	65 ¹	165 ¹	115 ¹	65 ¹
Sandy loams,	30 ²	165 ²	115 ²	65 ²	165 ²	115 ²	65 ²
loamy sands,	20-30 ⁴	0	0	0	0	0	0
and sands	20-30 ⁵	0	0	0	0	0	0
	30-40 ⁶	0	0	0	0	0	0
	10-20 ⁷	0	0	0	0	0	0
<i>New plantings</i>	90-120 ¹	150 ¹	100 ¹	50 ¹	150 ¹	100 ¹	50 ¹
Loams and							
silt loams*	30 ³	150 ³	100 ³	50 ³	150 ³	100 ³	50 ³
	30-40 ⁵	0	0	0	0	0	0
	30-50 ⁶	0	0	0	0	0	0

¹ Total amount nutrient recommended

² Broadcast and disk-in deep

³ Broadcast and plow down or disk-in deep

⁴ Sidedress 2 weeks after planting

⁵ Sidedress when first runners start

⁶ Topdress in mid-August

⁷ Topdress in February or March

*Growers on clay or clayloam soils should reduce nitrogen rates to 25 percent.

Apply 1 - 2 pounds of boron (B) per acre with broadcast fertilizer.

See Table B-10 for more specific boron recommendations.

Strawberries Matted Row System	Nitrogen (N) Pounds per Acre	Soil Phosphorus Level			Soil Potassium Level		
		Low Pounds P ₂ O ₅ per Acre	Med Pounds P ₂ O ₅ per Acre	Opt. Pounds P ₂ O ₅ per Acre	Low Pounds K ₂ O per Acre	Med Pounds K ₂ O per Acre	Opt. Pounds K ₂ O per Acre
<i>Established plantings</i>							
Sandy loams and silt loams**	50-60 ¹	165 ¹	115 ¹	65 ¹	165 ¹	115 ¹	65 ¹
<i>Established plantings</i>							
Loamy sands and sands	60-80 ¹	165 ¹	115 ¹	65 ¹	165 ¹	115 ¹	65 ¹
All soil types**	30 ²	0	0	0	0	0	0

¹ Topdress at renovation

² Topdress in February or early March

**Growers on clay or clayloam soils should reduce nitrogen rates to 25 percent and reduce by half or eliminate spring nitrogen applications.

Plants

Use certified dormant plants packed dry in polyliners. These plants can be stored at 30°F (-1.11°C) for a longer period than fresh-dug plants packed in sphagnum moss.

Spacing

Plant virus-free plants as early in the spring as possible. Plant in 4-foot rows with plants 18 to 30 inches apart in row. Distance will depend on variety and soil type. The approximate number of plants needed per acre is between 5,400 and 8,700.

Renovation

Strawberry beds must be renovated annually (immediately after harvest) to thin the plants, retain vigor, and maintain berry size in subsequent years. Follow the steps below when renovating strawberry plantings:

1. Apply 2,4-D herbicide for broadleaf weed control. Wait 7 to 8 days for weeds to absorb the herbicide.
2. Mow off the leaves as close to the ground as possible without damaging the crowns.
3. Narrow row widths to 12 inches using a cultivator or rototiller. Allow 1 inch of soil to cover crown.
4. Apply topdressing with N, P, and K as indicated in Recommendations Based on Soil Tests above.
5. Apply preemergent herbicides.
6. Irrigate to incorporate fertilizer and herbicide.

Weed Control

Identify the weeds in each field and select recommended herbicides that control those weeds. See Tables E-2 and E-3.

Match preplant incorporated and preemergence herbicide rates to soil type and percent organic matter in each field.

Apply postemergence herbicides when crop and weeds are within the recommended size and/or leaf stage.

New Planting-Posttransplant

DCPA--6-9 lb/A. Apply 8 to 12 pints per acre Dacthal 6F. Apply preplant incorporated with shallow cultivation before transplanting, or apply anytime after transplanting to weed-

free soil. Primarily controls annual grasses and certain small-seeded broadleaf weeds.

Napropamide--1-2 lb/A. Apply 2 to 4 pounds per acre Devrinol 50DF to weed-free soil immediately after transplanting. Activate with one-half inch sprinkler irrigation within 24 hours after application. Napropamide left on the soil surface is broken down by sunlight. Irrigation moves the herbicide into the soil and prevents breakdown by the sun. Primarily controls annual grasses and suppresses or controls certain annual broadleaf weeds.

Terbacil--0.10-0.15 lb/A. Apply 2 to 3 dry ounces of Sinbar 80DF per acre after transplanting but before new runner plants start to root. Controls many annual broadleaf weeds, but may be weak on pigweed species. Do NOT add surfactant, oil concentrate, or any other spray additive, or tank-mix with any other pesticide unless the mixture is approved on the Sinbar 80DF label. If strawberry transplants are allowed to develop new foliage prior to application, the spray must be followed immediately by 0.5 to 1.0 inches of irrigation or rainfall to wash the Sinbar 80DF off the strawberry foliage, or unacceptable crop injury may result. University data has shown that more consistent weed control and less crop injury occurs when 0.05 lb/A, 1 dry ounce, of Sinbar 80DF is applied at 3 week intervals. Begin applications 3 to 6 weeks after transplanting, when the strawberries have 3 new full size trifoliate leaves, but before weeds exceed 1 inch in height.

Certain varieties differ in their sensitivity to Sinbar. Determine varietal tolerance before spraying field. Do NOT apply Sinbar 80DF to soils with less than 0.5% organic matter. Do NOT use more than 8 ounces of Sinbar per acre per year unless otherwise directed on the label.

New Planting- Postemergence (summer)

Clethodim--0.094-0.125 lb/A. Apply 6 to 8 fluid ounces per acre Select 2EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) or 12 to 16 fluid ounces of Select Max 0.97EC with nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution) postemergence to control many annual and certain perennial grasses, including annual bluegrass. Select will not consistently control goosegrass. The use of oil concentrate with Select 2EC may increase the risk of crop injury when hot or humid conditions prevail. To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 4 days.

Sethoxydim--0.2-0.4 lb/A. Apply 1 to 2 pints per acre Poast 1.5EC with oil concentrate to be 1 percent of the spray solution (1 gallon per 100 gallons of spray solution) postemergence to control annual grasses and certain perennial grasses. The use of oil concentrate may increase the risk of crop injury when hot or humid conditions prevail.

To reduce the risk of crop injury, omit additives or switch to nonionic surfactant when grasses are small and soil moisture is adequate. Control may be reduced if grasses are large or if hot, dry weather or drought conditions occur. For best results, treat annual grasses when they are actively growing and before tillers are present. Repeated applications may be needed to control certain perennial grasses. Yellow nutsedge, wild onion, or broadleaf weeds will not be controlled. Do not tank-mix with or apply within 2 to 3 days of any other pesticide unless labeled, as the risk of crop injury may be increased, or reduced control of grasses may result. Observe a minimum preharvest interval of 7 days and apply no more than 2.5 pints per acre in one season.

Terbacil--0.1-0.3 lb/A. Apply 2 to 6 dry ounces of Sinbar 80DF per acre in late summer or early fall to control winter annual broadleaf weeds. Use lower rates on coarse-textured sandy soils low in organic matter, and higher rates on fine-textured silt and clay soils high in organic matter. Do NOT add surfactant, oil concentrate, or any other spray additive, or tank-mix with any other pesticide unless the mixture is approved on the Sinbar 80DF label. If the crop is not dormant at the time of application, the spray must be followed immediately by 0.5 to 1.0 inches of irrigation or rainfall to wash the Sinbar 80DF off the foliage, or unacceptable crop injury may result.

University data has shown that more consistent weed control and less crop injury occurs when 0.05 lb/A, 1 dry Ounce, of Sinbar 80DF is applied at 3 week intervals. Begin applications 3 to 6 weeks after transplanting, when the strawberries have 3 new full size trifoliate leaves, but before weeds exceed 1 inch in height.

Certain varieties differ in their sensitivity to Sinbar. Determine varietal tolerance before spraying field. Do NOT apply Sinbar 80DF to soils with less than 0.5% organic matter. Do NOT use more than 8 ounces of Sinbar per acre per year unless otherwise directed on the label.

New Planting-Late Fall Dormant

DCPA--6-9 lb/A. Apply 8 to 12 pints per acre Dacthal 6F. Apply to weed-free soil in the fall and repeat in early spring, but do not apply after bloom. Primarily controls annual grasses and certain broadleaf weeds.

Napropamide--2-3 lb/A. Apply 4 to 6 pounds per acre of Devrinol 50DF (or OLF). Apply in late fall through early winter (not on frozen ground) or in early spring. Do not apply from bloom through harvest. Rainfall or irrigation will increase effectiveness. Primarily controls annual grasses and certain broadleaf weeds, including chickweed spp.

Clethodim--0.094-0.125 lb/A. (See the preceding "Clethodim" paragraph.)

Sethoxydim--0.2-0.4 lb/A. (See the preceding "Sethoxydim" paragraph.)

Terbacil--0.1-0.2 lb/A. Apply 2 to 4 dry ounces of Sinbar 80DF per acre just prior to mulching in late fall to extend weed control through harvest the following spring. Controls many annual broadleaf weeds, but may be weak on pigweed species. Use lower rates on coarse textured sandy soils low in organic matter, and higher rates on fine textured silt and clay soils high in organic matter. Do NOT add surfactant, oil concentrate, or any other spray additive. Do NOT apply within 110 days of harvest.

Certain varieties differ in their sensitivity to Sinbar.

Determine varietal tolerance before spraying field. DO NOT apply Sinbar 80DF to soils with less than 0.5% organic matter. DO NOT use more than 8 ounces of Sinbar per acre per year unless otherwise directed on the label.

Bearing Year-Late Winter or Early Spring

Clopyralid--0-.047-0.25 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Stinger 3A to control weeds in strawberries in New Jersey, Maryland, Pennsylvania, and Virginia. The legal use of this product may require a waiver of Liability that has been signed by the grower, and returned to Dow AgroSciences.** Apply 2 to 10.5 fluid ounces of Stinger 3A per acre in one or two applications during the spring to control certain annual and perennial broadleaf weeds. Observe a minimum preharvest interval (PHI) of 30 days. When two applications are used to control susceptible hard-to-kill perennial weeds, spray the first application in the spring at least 30 days before harvest and second application at renovation, after harvest. Stinger controls weeds in the Composite and Legume plant families. Common annuals controlled include galinsoga, ragweed species, common cocklebur, groundsel, pineappleweed, clover, and vetch. Perennials controlled include Canada thistle, goldenrod species, aster species, and mugwort (wild chrysanthemum). Stinger is very effective on small seedling annual and emerging perennial weeds less than 2 to 4 inches tall, but is less effective and takes longer to work when weeds are larger. Use 2 to 4 fluid ounces to control annual weeds less than 2 inches tall. Increase the rate to 4 to 8 fluid ounces to control larger annual weeds. Apply the maximum rate of 10.5 fluid ounces, in one or split into two applications to suppress or control perennial weeds, but do not exceed 10.5 fluid ounces in one year. Spray additives are not needed or required by the label, and are not recommended. Do NOT tank-mix Stinger with other herbicides registered for use in strawberries. Observe a minimum preharvest interval (PHI) of 30 days. Stinger is a postemergence herbicide with residual soil activity. Observe follow crop restrictions or injury may occur from herbicide carryover.

DCPA--6-9 lb/A. Apply 8 to 12 pints per acre Dacthal 6F. Apply anytime to weed-free soil in the early spring. Do not apply after bloom. Primarily controls annual grasses and certain broadleaf weeds.

Flumioxazin—0.096 lb/A. Apply 3 dry ounces of Chateau 51WDG to established stands of matted row strawberries in late winter or early spring when strawberries are dormant, or as a hooded/shielded spray between the rows of strawberries on plastic mulch before fruit set. Controls many annual broadleaf weeds, and suppresses or controls wild pansy. Tank-mix with 2,4-D to improve the spectrum of weeds controlled when treating dormant matted row strawberries, or tank-mix with Gramoxone when applying a hooded/ shielded spray between the rows of strawberries grown on plastic mulch. Oil concentrate at 1% of the spray solution (1 gallon per 100 gallons of spray solution) or nonionic surfactant at 0.25% of the spray solution (1 quart per 100 gallons of spray solution) may be added to improve the control of emerged weeds, but may also increase the risk of crop injury.

Napropamide--2-3 lb/A. Apply 4 to 6 pounds per acre Devrinol 50DF (or OLF). Apply in late fall through early

winter (not on frozen ground) OR in early spring. Do not apply from bloom through harvest. Rainfall or irrigation will increase effectiveness. Primarily controls annual grasses and certain broadleaf weeds.

Clethodim--0.094-0.125 lb/A. (See the preceding "Clethodim" paragraph.)

Sethoxydim--0.2-0.4 lb/A. (See the preceding "Sethoxydim" paragraph.)

2,4-D--1-1.5 lb/A. Apply 1 to 1.5 quarts per acre amine form of 2,4-D (Formula 40) to established stands in late winter or early spring when the strawberries are dormant. Controls many broadleaf weeds. Do not apply unless possible injury to the crop is acceptable. Do not apply 2,4-D between mid-August and winter dormancy, as it may reduce flower bud formation.

Bearing Year Renovation-Summer

Clopyralid--0.047-0.25 lb/A. **A Special Local-Needs Label 24(c) has been approved for the use of Stinger 3A to control weeds in strawberries in New Jersey, Maryland, Pennsylvania, and Virginia. The legal use of this product may require a waiver of Liability that has been signed by the grower, and returned to Dow AgroSciences.** Apply 2 to 10.5 fluid ounces of Stinger 3A per acre in one or two applications to control certain annual and perennial broadleaf weeds. When two applications are used to control susceptible hard-to-kill perennial weeds, spray the first application in the spring at least 30 days before harvest and second application at renovation, after harvest. Stinger controls weeds in the Composite and Legume plant families. Common annuals controlled include galinsoga, ragweed species, common cocklebur, groundsel, pineappleweed, clover, and vetch. Perennials controlled include Canada thistle, goldenrod species, aster species, and mugwort (wild chrysanthemum). Stinger is very effective on small seedling annual and emerging perennial weeds less than 2 to 4 inches tall, but is less effective and takes longer to work when weeds are larger. Use 2 to 4 fluid ounces to control annual weeds less than 2 inches tall. Increase the rate to 4 to 8 fluid ounces to control larger annual weeds. Apply the maximum rate of 10.5 fluid ounces, in one or split into two applications to suppress or control perennial weeds, but do not exceed 10.5 fluid ounces in one year. Spray additives are not needed or required by the label, and are not recommended. DO NOT tank-mix Stinger with other herbicides registered for use in strawberries. Observe a minimum preharvest interval (PHI) of 30 days. Stinger is a postemergence herbicide with residual soil activity. Observe follow crop restrictions or injury may occur from herbicide carryover.

DCPA--6-9 lb/A. Apply 8 to 12 pints per acre Dacthal 6F. Apply anytime after harvest to weed-free soil. Primarily controls annual grasses and certain broadleaf weeds.

Paraquat--0.5 lb/A. Apply 2 pints per acre of Gramoxone Inteon 2SC as a directed shielded spray to control emerged weeds between the rows after crop establishment. Add nonionic surfactant to be 0.25% of the spray solution (1 quart per 100 gallons of spray solution). Do not allow spray or spray drift to contact the crop or injury may result. Use shields to prevent spray contact with the crop plants. Do not exceed a spray pressure of 30 psi. Do not apply more than 3

times per season. See the label for additional information and warnings.

Terbacil--0.2-0.4 lb/A. Apply 4 to 8 ounces per acre Sinbar 80WP at postharvest renovation after old leaves have been removed but before new growth begins. Primarily controls broadleaf weeds but does NOT control pigweed species. Use Devrinol, Dacthal, or Poast 1.5 EC to control annual grasses. Use lower rates on coarse-textured sandy soils low in organic matter, and higher rates on fine-textured silt and clay soils high in organic matter. Do NOT add surfactant, oil concentrate, or any other spray additive. Certain varieties differ in their sensitivity to Sinbar. Determine varietal tolerance before spraying field. DO NOT apply Sinbar 80DF to soils with less than 0.5% organic matter. DO NOT use more than 8 ounces of Sinbar per acre per year unless otherwise directed on the label.

Clethodim--0.094-0.125 lb/A. (See the preceding "Clethodim" paragraph.)

Sethoxydim--0.2-0.4 lb/A. (See the preceding "Sethoxydim" paragraph.)

2,4-D--1-1.5 lb/A. Apply 1 to 1.5 quarts per acre amine form of 2,4-D (Formula 40) to established stands immediately after the last picking. Controls many broadleaf weeds. Do not apply 2,4-D between mid-August and winter dormancy, as it may reduce flower bud formation.

Established Planting-Late Fall Dormant

DCPA--6-9 lb/A. Apply 8 to 12 pints per acre Dacthal 6F. Apply to weed-free soil in the fall and repeat in early spring, but do not apply after bloom. Primarily controls annual grasses and certain broadleaf weeds.

Napropamide--2-3 lb/A. Apply 4 to 6 pounds per acre Devrinol 50DF (or OLF). Apply in late fall through early winter (not on frozen ground) **OR** in early spring. Do not apply from bloom through harvest. Rainfall or irrigation will increase effectiveness. Primarily controls annual grasses and certain broadleaf weeds, including chickweed spp.

Clethodim--0.094-0.125 lb/A. (See the preceding "Clethodim" paragraph.)

Sethoxydim--0.2-0.4 lb/A. (See the preceding "Sethoxydim" paragraph.)

Terbacil--0.2-0.4 lb/A. Apply 4 to 8 dry ounces of Sinbar 80DF per acre just prior to mulching in late fall to extend weed control through harvest the following spring. Controls many annual broadleaf weeds, but may be weak on pigweed species. Use lower rates on coarse-textured sandy soils low in organic matter, and higher rates on fine-textured silt and clay soils high in organic matter. DO NOT add surfactant, oil concentrate, or any other spray additive. DO NOT apply within 110 days of harvest.

Certain varieties differ in their sensitivity to Sinbar. Determine varietal tolerance before spraying field. DO NOT apply Sinbar 80DF to soils with less than 0.5% organic matter. DO NOT use more than 8 ounces of Sinbar per acre per year unless otherwise directed on the label.

Pollination

Honey bees are important for proper set and pollination. Populations of pollinating insects may be adversely affected

by insecticides applied to flowers or weeds in bloom. Apply insecticides only in the evening hours or wait until bloom is completed before application. See section on "Pollination" in the General Production Recommendations and/or Table D-6 for relative toxicity of various pesticides for hazard to bees.

Insect Control

NOTE: Copies of specific insecticide product labels can be downloaded by visiting websites www.CDMS.org or www.Greenbook.org. Also, specific labels can be obtained via web search engines.

Aphids, Spittlebug

Apply 10 days after new growth begins:

- acetamiprid (Assail 70WP or OLF)
- diazinon (Diazinon AG500 or OLF)
- endosulfan (Thionex 3EC or OLF)
- fenpropathrin (Danitol 2.4EC)
- imidacloprid (foliar-Nuprid 1.6F, Provado 1.6F or OLF)
- methomyl (Lannate LV or OLF) (**aphids only**)

Leafroller

Apply one spray 10 days after full bloom:

- acetamiprid (Assail 70WP or OLF)
- bifenthrin (Brigade WSB or OLF)
- carbaryl (Sevin 80S or OLF)
- diazinon (Diazinon AG500 or OLF)
- spinetoram (Radiant 2SC)
- spinosad (Entrust 80W, SpinTor 2SC or OLF)

Potato Leafhopper

- acetamiprid (Assail 70WP or OLF)
- malathion (Malathion 57 EC or OLF)

Root Weevils

- bifenthrin (Brigade WSB or OLF). Apply at first sign of leaf injury; repeat at 7-10 day intervals.
- Entomopathic nematodes (use *Heterorhabditis bacteriophora*). Apply 1-2 billion per acre during evening or early morning when soil temperatures are 60°F (15.6°C) or greater, then irrigate them into the soil.
- malathion (Malathion Aquamul or OLF)

Sap Beetles

Sap beetles are attracted to ripe, decaying fruit and bore into berries. They are a nuisance, especially in Pick-Your-Own fields where rotting, over-ripe berries abound.

Preventing the accumulation of decaying fruit on or between beds is one way of avoiding beetle buildup.

- acetamiprid (Assail 70WP or OLF)
- bifenthrin (Brigade WSB or OLF)
- fenpropathrin (Danitol 2.4 EC)

Slugs

Slugs prefer a cool, wet, dark environment. Mulch, weeds, and other plant trash in beds during a wet spring provide the perfect setting for their development. Mulch removal and adequate weed control are two ways to reduce the slug population. Sevin Bait broadcast over the beds several days before first harvest may be useful.

- carbaryl (Sevin 5%Bait or OLF)
- metadehyde (Deadline MP, Trail's End LG or OLF)

Strawberry Rootworm

Use of carbaryl or endosulfan for other pests will aid in controlling strawberry rootworm.

Strawberry Weevil (Strawberry Clipper)

Apply after new growth starts and before fruit buds are visible. Repeat 10 days later:

- chlorpyrifos (Lorsban 4E or OLF). Apply when buds first appear and again 10-14 days later. DO NOT apply when fruit sets or berries are present.
- fenpropathrin (Danitol 2.4 EC)

Tarnished Plant Bug

- bifenthrin (Brigade WSB or OLF)
- endosulfan (Thionex 3EC or OLF)
- fenpropathrin (Danitol 2.4EC)

Thrips

- acetamiprid (Assail 70WP or OLF)
- methomyl (Lannate LV or OLF)
- spinetoram (Radiant 2SC)
- spinosad (Entrust 80W, SpinTor 2SC or OLF)

Two-Spotted Spider Mite (TSSM)

For best results, control TSSM early in the spring before eggs are laid. Thorough underleaf spray coverage is necessary. Alternate materials with different modes of action:

- abamectin (Agri-Mek EC, Abba EC, Temprano or OLF)
- bifenthrin (Brigade WSB or OLF)
- bifenazate (Acramite 50 WS)
- etoxazole (Zeal)
- fenbutatin-oxide (Vendex 50WP or OLF)
- fenpropathrin (Danitol 2.4EC)
- hexythiazox (Savey 50WP or OLF)
- spiromesifen (Oberon 2SC)

Pesticide	Use Category ¹	Hours to Reentry ²	Days to Harvest
INSECTICIDE			
abamectin	R	12	3
acetamiprid	G	12	1
bifenthrin	R	24	0
bifenazate	G	12	1
carbaryl (foliar/bait)	G	12	7/1
chlorpyrifos	R	24	Prebloom
diazinon	R(NJ),G	12,24	5
endosulfan	R	24	4
etoxazole	G	12	1
fenbutatin-oxide	G	48	1
fenpropathrin	R	24	2
hexythiazox	G	12	3
imidacloprid	G	12	7
malathion	G	12	3
metaldehyde ³	G	12	0/7
methomyl (fresh/processing)	R	48	3/10
spinetoram	G	4	1
spinosad	G	4	1
spiromesifen	G	12	3
FUNGICIDE (FRAC code)			
Abound (Group 11)	G	4	0
Aliette (Group 33)	G	12,24	0
Cabrio (Group 11)	G	24	0
Captan (Group M4)	G	24	1
Captivate (Groups 17 + M4)	G	24	0

(table continued)

Pesticide (continued)	Use Category ¹	Hours to Reentry	Days to Harvest
FUNGICIDE (FRAC code)			
copper, fixed (Group M1)	G	24	0
Elevate (Group 17)	G	4	0
iprodione (Group 2)	G	12	0
Rally (Group 3)	G	24	1
Pristine (Groups 11 + 7)	G	12	0
Procure (Group 3)	G	12	1
Ridomil Gold (Group 4)	G	48	NA
Switch (Groups 9 + 12)	G	12	0
Thiram (Group M3)	G	24	3
thiophanate-methyl (Group 1)	G	12	1

See Table D-6.

¹ G = general, R = restricted

² Chemicals with multiple designations are based on product and/or formulation differences. CONSULT LABEL

³ Depends on product formulations. CONSULT LABEL

Nematode Control

See Chapter E - "Nematodes" section of Soil Pests--Their Detection and Control. Use fumigants listed in the "Soil Fumigation" section.

Preplant

Nemacur 3SC--2.5-3.5 qt/A

Postplant

Nemacur 15G--12-18 lb/A, or

Nemacur 3SC--2.5-3.5 qt/A

(Note: Sale and distribution of Nemacur will be discontinued as of May 31, 2007)

Disease Control

Transplant Treatment

Iprodione can be used as a preplant dip for gray mold control in the plants. Use 2.0 pounds of 50WP per 100 gallons of water.

Angular Leaf Spot

Begin applications when symptoms first appear.

Discontinue applications if plant injury occurs:

copper, fixed--at labeled rates

Anthracnose Fruit Rot

Begin sprays no later than 10% bloom or prior to disease development and continue on a 7 to 10 day interval.

Use the higher rate and shorter intervals when disease pressure is high. **Do not make more than two (2) consecutive applications of either Pristine, Cabrio or Abound, before switching to another fungicide.**

Apply the following combinations:

Application #1:

captan--4.0 lb 50WP/A plus Pristine--18.5-23.0 oz 38 WG/A

Application #2:

captan--4.0 lb 50WP/A plus Abound--6.0-15.5 fl oz 2.08SC/A, or

Cabrio--12.0-14.0 oz 20EG/A

Application #3:

Captevate--3.5-5.25 lb 68WDG/A

For subsequent applications:

Alternate:

captan--4.0 lb 50WP/A plus Abound--6.0-15.5 fl oz 2.08SC/A, or

Cabrio--12.0 to 14.0 oz 20EG/A, plus captan--4.0 lb 40WP/A, or

Captevate--3.5-5.25 lb 68WDG/A.

Gray Mold (Botrytis Fruit Rot)

Apply at 5 to 10 percent bloom and every 10 days until harvest because 90% of fruit infections occur through the flower. During periods of excessive moisture, spray intervals of 5 to 7 days may be necessary. Tank-mix and rotate fungicides from different FRAC codes to reduce the chances for fungicide resistance development.

Application #1:

captan--4.0 lb 50WP/A plus thiophanate-methyl--1.0 lb 70WP, or

Switch--11.0-14.0 oz. 62.5WG/A

Application #2:

Elevate--1.1-1.5 lb 50WDG/A, or

Pristine--18.5-23.0 oz 38 WG/A

Application #3:

captan--4.0 lb 50WP/A plus thiophanate-methyl--1.0 lb 70WP, or

Switch--11.0-14.0 oz. 62.5WG/A

For subsequent applications:

Alternate:

captan--4.0 lb 50WP/A, or

Captevate--3.5-5.25 lb 68WDG/A, or

Switch--11.0-14.0 oz. 62.5WG/A, or

Pristine--18.5-23.0 oz 38WG/A, or

Thiram--4.0-5.0 lb 65WSB/A

Fungal Leaf Blight, Leaf Scorch and Leaf Spot

Apply one spray 10 to 14 days before full bloom. On susceptible varieties, fall sprays on a 3-week schedule may be necessary. Do not make more than 2 consecutive applications of either FRAC code 11 fungicide (Cabrio or Abound) before switching to another fungicide. Do not use Abound in propagation nurseries and do not apply more than 1.92 quarts per acre per season.

Abound--6.0-15.5 fl oz 2.08SC/A or OLF, or

Cabrio--14.0 oz. 20EG/A, or

Rally--2.5-5.0 oz 40WSP/A, or

thiophanate-methy--1.0 lb 70WP/A

Materials with different modes of action (FRAC codes) should always be rotated to reduce the chances for fungicide resistance development.

Powdery Mildew

Begin applications when the disease first appears and repeat at 14 to 21 day intervals.

Alternate:

Cabrio--14.0 oz 20EG/A, or

Rally--2.5-5.0 oz 40WSP/A, or

Procure--4.0-8.0 oz 50WSP/A

With the following fungicide:

thiophanate-methy--1.0 lb 70WP/A

Materials with different modes of action (FRAC codes) should always be rotated to reduce the chances for fungicide resistance development.

Virus Diseases

Use certified, virus-free plants.

Red Stele and Phytophthora Crown Rot

Where possible, prevent spread of the fungus via cultivation equipment and/or surface runoff water. Planting on high, raised beds may offer some relief. Planting in well-drained soils may provide a measure of control. In the case of red stele, control by crop rotation is of little value, because the red stele fungus persists for many years in the soil.

Use varieties resistant to strains of the red stele fungus if present. The varieties 'Allstar', 'Earliglow', 'Guardian' and 'Latestar' have resistance to several races. Resistance is not available to crown rot. Also, use disease-free plants when establishing planting.

For additional control, apply one of the following:

New Plantings

Aliette--2.5-5.0 lb 80WDG/A. Begin 14 to 21 days after planting and continue on a 30 to 60 day interval as long as favorable disease conditions occur, or

Ridomil Gold--1.0 pt 4EC/A. Make one application at transplanting plus an additional application at fruit set or 30 days before harvest.

Established Plantings

Aliette--2.5-5.0 lb 80WDG/A. Begin in spring when plants start active growth and repeat every 30 to 60 days, or

Ridomil Gold--1.0 pt 4EC/A. Apply in spring before first bloom and repeat once in the fall.

Verticillium Wilt

This disease is a serious problem with most varieties. However, 'Guardian' and 'Latestar' have good wilt resistance. Resistant varieties will become infected if soil is heavily infested with the *Verticillium* fungus. A 5-year delay following tomato, potato, eggplant, or pepper plantings is generally sufficient to permit the planting of susceptible varieties in infested fields. Practice strict weed control during the rotation period, because a number of common weed species serve as alternate hosts for *Verticillium*.

For control, use one of the following:

methyl bromide *plus* chloropicrin (67% *plus* 33%)--250 lb/A, or

Vapam HL--50.0-75.0 gal/A. Apply in the fall before planting.

Black Root Rot

This is a disease complex caused by many different fungi and by nematode feeding injury. The most prevalent fungi causing the disease are *Rhizoctonia* and *Pythium*.

Crop rotation of 4 to 5 years will reduce the incidence of black root rot. In fields with a high water table, the use of raised beds will provide some control. Nematicides may provide additional control when combined with an adequate rotation period.