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.

SUMMER SQUASH

Varieties

Varieties[1]

Straightneck Type (yellow)
Seneca Prolific, GS[3]
Lemondrop L, GS

Zucchini Types
Zucchini Elite
Golden Dawn III (yellow)
Senator
Spineless Beauty
Seneca Zucchini
Gold Rush (yellow)

Spring or Summer Planting

Crookneck Type (yellow)
Prelude II (**GMO**[2]), GS, (CMV, WMV2, ZYMV) PM[4]

Straightneck Type (yellow)
Liberator, (**GMO**), PY[3], (CMV, WMV2, ZYMV)
Patriot II, (**GMO**), GS, (WMV2, ZYMV)
Multipik, PY
Sunray, PY, PM
Fortune, PY
Cougar, PY (PRSV, ZYMV)
Lioness, GS (CMV, WMV2, ZYMV)
Superpik, PY
Conquerer III, (**GMO**), GS, (CMV, PRSV, WMV2, ZYMV)

Scallop Types
Peter Pan (light green)
White Ruffles
Starship (dark green)
Sunburst (golden)
Flying Saucer (yellow and green)

Specialty Types
Magda (short, light green, Mid-East type)
Zephyr (yellow, green blossom end)
Floridor (round yellow) (trial)
Eight Ball (round green) (trial)

Zucchini Types
Revenue (CMV, WMV2, ZYMV)
Justice III (**GMO**) (CMV, WMV2, ZYMV)
Independence II (**GMO**) (WMV2, ZYMV)
Payroll (WMV2, ZYMV) PM
Cashflow (ZYMV)
Judgement III (**GMO**), (CMV, WMV2, ZYMV) PM
Lynx (PRSV, WMV2, ZYMV)
Wildcat (PRSV, WMV2, ZYMV) PM
Dividend (CMV, WMV2, ZYMV)
Tigress (WMV2, ZYMV)

Viral Resistance genes: CMV=Cucumber Mosaic Virus, WMV2=Watermelon Mosaic Virus 2, PRSV=Papaya Ring Spot Virus, and ZYMV=Zucchini Yellow Mosaic Virus

[1]ALL SUMMER SQUASH VARIETIES ARE HYBRIDS. Varieties listed by maturity within each type, earliest first and are recommended for in DE, MD, NJ, PA, VA and WV.

[2]**GMO**, where denoted variety transformed with viral coat protein antisense for strong virus resistance. Varieties not denoted **GMO** have conventionally-breed resistance as indicated.

(table footnotes continued on next page)

[3]In yellow-fruited summer squash the precocious yellow gene, (PY) confers tolerance to CMV and WMV2 as compared to the green stem (GS) counterpart.

[4]PM where denoted indicates varieties with intermediate resistance to powdery mildew.

Varieties with multiple resistance are available (see above table). Varieties expressing the precocious yellowing gene (PY) such as 'Multipik' will mask the greening of fruit caused by WMV and CMV, but will become bumpy and/or distorted when infected with either PRSV or ZYMV. **All 4 viruses may be detected at some level in squash fields in our region in any given year, therefore it is best to plant varieties with resistance to more than one virus, especially in later plantings when virus transmission by aphids increases.**

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.

Summer Squash	Nitrogen (N) Pounds per Acre	Soil Phosphorus Level			Soil Potassium Level		
		Low	Med	Opt.	Low	Med	Opt.
		Pounds P_2O_5 per Acre			Pounds K_2O per Acre		
	75-100[1]	150[1]	100[1]	50[1]	200[1]	150[1]	100[1]
	25-50[2]	150[2]	100[2]	50[2]	200[2]	150[2]	100[2]
	50[3]	0	0	0	0	0	0
	25-30[4]	0	0	0	0	0	0

[1] Total amount nutrient recommended

[2] Broadcast and disk-in

[3] Sidedress or fertigate when vines start to run

[4] Apply through irrigation system

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

Seed Treatment

Check with seedsman to determine if seed has been treated with an insecticide and fungicide. If it has not been treated, use a mixture of thiram 75WP (½ teaspoon per pound or 3 ounces per 100 pounds) and an approved commercially available insecticide.

Seeding, Transplanting, and Spacing

Seed April 15 through August 15 in warmer, southern regions and May 10 to August 1 in Pennsylvania and other cool areas. Use 4 to 6 pounds of seed per acre.

Container-grown plants are planted through the plastic when daily mean temperatures have reached 60°F (15.6°C). Planting dates vary from April 15 in southern regions to June 1 in northern areas. Early plantings should be protected from winds with hot caps, tents, or row covers.

Space rows 5 to 6 feet apart with plants 2 to 3 feet apart in the row.

Mulching

Fumigated soil aids in the control of weeds and soil-borne diseases. Clear, plastic mulch laid before field planting conserves moisture, increases soil temperature, and increases early and total yield. Plastic and fumigant--Vapam HL (30 to 37 gallons per acre)—should be applied on well-prepared planting beds 30 days before field planting. Plastic should be 4 feet wide (4,000-foot rolls) and laid on 5- or 6-foot centers immediately over the fumigated soil. The soil must be moist when laying the plastic. Fumigation alone may not provide satisfactory weed control under clear plastic. Herbicides labeled and recommended for use on summer squash may not provide satisfactory weed control when used under clear plastic mulch on nonfumigated soil. Consult your county agent for latest recommendations. Black plastic or paper can be used without a herbicide. Fertilizer must be applied during bed preparation. At least 50 percent of the nitrogen (N) should be in the nitrate (NO_3) form.

Foil mulches can be used to repel aphids that transmit mosaic in fall-planted (after July 1) squash. Direct seeding through the mulch is recommended for maximum virus protection. Transplants should not be used with foil or other repellent mulches. Also, a herbicide is not necessary. Fumigation will be necessary when there is a history of soil-borne diseases in the field.

Growers may wish to consider trickle irrigation. See the section on "Irrigation" in this publication.

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. See the "Mulching" section above for further information on weed control under clear plastic mulch.

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

For Weed Control Under Plastic Mulch

Black plastic mulch effectively controls most annual weeds by preventing light from reaching the germinated seedling. Herbicides are used under plastic mulch to control weeds around the planting hole, and under the mulch when clear plastic is used. Trickle irrigation tube left on the soil surface may cause weed problems by leaching herbicide away at the emitters. The problem is most serious when clear plastic mulch is used. Bury the trickle tube several inches deep in the bed to reduce this problem.

1. Complete soil tillage, and form raised beds, if desired, prior to applying herbicide(s). Do not apply residual herbicides before forming beds, or herbicide rate and depth of incorporation may be increased, raising the risk of crop injury. When beds are formed and plastic mulch laid in a single pass, the herbicide should be applied after the bed is formed, as a part of the same operation.

2. Apply herbicide(s) recommended for use under plastic mulch in a band as wide as the mulch. Condensation that forms on the underside of the mulch will activate the herbicide. Use the trickle irrigation to provide moisture if the soil is too dry for condensation to form on the underside of the mulch.

Complete by laying the plastic mulch and trickle irrigation tubing, if used, immediately after the herbicide application. Delay punching the planting holes until seeding or transplanting.

Bensulide--5-6 lb/A. Apply 5 to 6 quarts per acre Prefar 4E preemergence in a band under the plastic, immediately

before laying the mulch. Condensation that forms on the underside of the mulch will activate the herbicide. Annual grasses and certain annual broadleaf weeds will be suppressed or controlled under the mulch and around the plant hole. Use the maximum recommended rate to improve control of annual broadleaf weeds including common lambsquarter, smooth pigweed, and common purslane.

For Soil Strips Between Rows of Plastic Mulch (Directed and Shielded Band Applications)

Use the following land preparation, treatment, planting sequences, and herbicides labeled for the crop to treat **Soil Strips Between Rows of Plastic Mulch**, or crop injury and/or poor weed control may result.

1. Complete soil preparation, apply herbicide(s) under the mulch (see above), and lay plastic and trickle irrigation (optional) before herbicide application between the rows.
2. Spray preemergence herbicide(s), registered and recommended for use on the crop in bands onto the soil and the shoulders of the plastic mulch before planting and weeds germinate, **OR** apply after planting as a shielded spray combined with a postemergence herbicide to control emerged weeds. **DO NOT broadcast spray over the plastic mulch at any time!**
3. Incorporate preemergence herbicide into the soil with ½ to 1 inch of rainfall or overhead irrigation within 48 hours of application.
4. Apply Gramoxone in bands to the soil strips between the plastic mulch before the crop emerges or is transplanted, **AND/OR** as a shielded spray postemergence to control emerged weeds. Use in combination with residual herbicides that are registered for use.

Note. All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft^2).

Preemergence

Bensulide--5-6 lb/A. Apply 5 to 6 quarts per acre Prefar 4E as a banded directed shielded spray preemergence to the weeds and activate with one-half inch of sprinkler irrigation within 36 hours to control most annual grasses. Use the maximum recommended rate preemergence followed by irrigation to suppress certain annual broadleaf weeds including common lambsquarter, smooth pigweed, and common purslane.

Clomazone--0.094-0.188 lb/A. Apply 4 to 8 fluid ounces per acre Command 3ME as a banded directed shielded spray preemergence to the weeds to control annual grasses and many broadleaf weeds including common lambsquarter, velvetleaf, spurred anoda, and jimsonweed. Mustards, morningglory species, and pigweed species will not be controlled. Use lowest recommended rate on coarse-textured, sandy soils low in organic matter. Higher rates should only be used on medium- and fine-textured soils and sites that have been heavily manured. Combine with Curbit 3EC to control pigweed species where Curbit is registered for use, or use Strategy, the jug-mix that contains clomozone (Command) and ethalfluralin (Curbit).

WARNING: Command spray *or* vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. Do not apply when wind or weather conditions favor herbicide drift. Do not apply to fields adjacent to horticultural, fruit, vegetable, or other sensitive crops (see label). Drift injury from offsite Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations.

Herbicide residues may limit subsequent cropping options when Command is used for weed control in cucumbers. See planting restrictions on the label or consult your local Cooperative Extension office for information regarding subsequent cropping options when Command is used.

Ethalfluralin--0.38-0.75 lb/A. Apply 1 to 2 pints per acre Curbit 3E as a banded directed shielded spray preemergence to control annual grasses and certain annual broadleaf weeds, including carpetweed and pigweed sp. Control of many other broadleaf weeds, including common lambsquarter, jimsonweed, morningglory sp., ragweed sp., mustard sp., and others may not be acceptable. Dry weather following application may reduce weed control. Cultivate to control emerged weeds if rainfall or irrigation does not occur prior to weed emergence. DO NOT preplant incorporate. DO NOT apply under plastic mulch or tunnels. DO NOT use on transplanted summer squash. DO NOT use when soils are cold or wet. Crop injury may result!

Ethalfluralin *plus* Clomazone (jug-mix)--0.394-1.575 lb/A. Apply 1.5 to 6 pints per acre of Strategy 2.1SC preemergence to control annual grasses and many annual broadleaf weeds. Use the lowest recommended rates on coarse-textured sandy soils low in organic matter. Higher rates should only be used on medium and fine textured soils and sites that have been heavily manured.

Strategy is a **jug-mix** of ethalfluralin (Curbit 3E) and clomazone (Command 3ME). Refer to the chart below to determine the amount of each herbicide at commonly used rates:

Curbit and Command Active Ingredients (ai) in Commonly Used Strategy Rates

Strategy pints/A	Ethalfluralin (Curbit) lb ai/A	Clomazone (Command) lb ai/A
1.5	0.3	0.094
2	0.4	0.125
3	0.6	0.188
4	0.8	0.25
5	1.0	0.312
6	1.2	0.375

Labeled for use in all the mid-Atlantic states. Read and follow all the recommendations and warnings (above) for ethalfluralin (Curbit) and clomazone (Command)

Halosulfuron--0.023-0.047 lb/A. Apply 0.5 to 1.0 dry ounce Sandea 75WG as a banded directed shielded spray between rows of plastic mulch to suppress or control broadleaf weeds including common cocklebur, redroot, pigweed, smooth pigweed, ragweed species, and galinsoga. Use the lower rate on coarse-textured soils low in organic matter and higher rates on fine-textured soils and on soils with high organic matter. Rainfall or irrigation after application is necessary before weeds emerge to obtain

good control. Occasionally, slight stunting may be observed following Sandea use early in the season. When observed, recovery is rapid with no effect on yield or maturity. Sandea is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. Do NOT apply Sandea to crops treated with a soil applied organophosphate insecticide, or use a foliar applied organophosphate insecticide within 21 days before or 7 days after a Sandea application. **DO NOT exceed a total of 0.047 pound per acre, equal to 1 dry ounce of Sandea, applied preemergence. Do NOT exceed total of 0.094 pounds per acre, equal to 2.0 dry ounces of Sandea per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2 dry ounces of Sandea, in a year.**

Postemergence

Carfentrazone--0.008-0.031 lb/A. Apply 0.5 to 2 fluid ounces of Aim 2EC or Aim 1.9EW as a banded directed shielded spray between the rows of plastic mulch to suppress or control broadleaf weeds including morninglory species, pigweed species, common lambsquarter, and nightshade species when the crop has 2 to 5 true leaves but has not yet begun to bloom or run. Aim applied postemergence will not control annual or perennial grasses. Add nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution), or oil concentrate or methylated seed oil to be 1 -2% percent of the spray solution (1-2 gallons per 100 gallons of spray solution). **The shielded (hooded) sprayer must be designed to prevent spray or drift from contacting the stems, leaves, flowers or fruit of the crop, or severe injury may occur.**

Halosulfuron--0.023-0.031 lb/A. Apply 0.5 to 0.66 dry ounce Sandea 75WG as a banded directed shielded spray between rows of plastic mulch to suppress or control yellow nutsedge and broadleaf weeds including common cocklebur, redroot pigweed, smooth pigweed, ragweed species, and galinsoga when the crop has 2 to 5 true leaves but has not yet begun to bloom or run. Sandea applied postemergence will not control common lambsquarter or eastern black nightshade. Add nonionic surfactant to be 0.25 percent of the spray solution (1 quart per 100 gallons of spray solution). Do NOT use oil concentrate. Susceptible broadleaf weeds usually exhibit injury symptoms within 1 to 2 weeks of treatment. Typical symptoms begin as yellowing in the growing point that spreads to the entire plant and is followed by death of the weed. Injury symptoms are similar when yellow nutsedge is treated but may require 2 to 3 weeks to become evident and up to a month for the weed to die. Occasionally, slightyellowing of the crop may be observed within a week of Sandea application. When observed, recovery is rapid with no effect on yield or maturity. Sandea is an ALS inhibitor. Herbicides with this mode of action have a single site of activity in susceptible weeds. The risk of the development of resistant weed populations is high when herbicides with this mode of action are used continuously and exclusively to control a weed species for several years or in consecutive crops in a rotation. Integrate mechanical methods of control and use herbicides with a different mode of action to control the target broadleaf weeds when growing other crops in the rotation. DO NOT apply Sandea to crops treated with a soil applied organophosphate (OP) insecticide, or use a foliar applied organophosphate (OP) insecticide within 21 days before or 7 days after a Sandea application. **DO NOT exceed a total of 0.031 pound per acre, equal to 0.66 dry ounces of Sandea, applied postemergence. DO NOT exceed total of 0.094 pounds per acre, equal to 2.0 dry ounces of Sandea per crop-cycle. DO NOT exceed a total of 0.094 pound per acre, equal to 2 dry ounces of Sandea, in a year.**

Paraquat--0.6 lb/A. **A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Inteon 2SC postemergence as a directed shielded spray in Delaware, Maryland, New Jersey, Pennsylvania, and Virginia.** Apply 2.4 pints per acre Gramoxone Inteon 2SC as a directed spray to control emerged weeds between the rows after crop establishment. Add nonionic surfactant according to the labeled instructions. 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. See the label for additional information and warnings.

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 14 days.

Sethoxydim--0.2-0.3 lb/A. Apply 1 to 1.5 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 14 days and apply no more than 3 pints per acre in one season.

For Seeding Into Soil Without Plastic Mulch (Broadcast Applications)

Use the following land preparation, treatment, planting sequences, and herbicides labeled for the crop when **Seeding into Soil Without Plastic Mulch**, or crop injury and/or poor weed control may result.

1. Complete soil tillage, apply preplant incorporated herbicide(s), and incorporate. Use a finishing disk or field cultivator that sweeps at least 100% of the soil surface twice, at right angles, operated at a minimum of 7 miles per hour (mph), OR a PTO driven implement once, operated at less than 2 miles per hour (mph).
2. Seed and apply preemergence herbicide(s) immediately after completing soil tillage, and mechanical incorporation of preplant herbicides. Irrigate if rainfall does not occur, to move the herbicide into the soil and improve availability to germinating weed seeds within 2 days of when the field was last tilled, or plan to control escaped weeds by other methods.

Note. All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft^2).

Preplant Incorporated or Preemergence

Bensulide--5-6 lb/A. Apply 5 to 6 quarts per acre Prefar 4E before planting and incorporate 1 to 2 inches deep with power-driven rotary cultivators, or apply preemergence and activate with one-half inch of sprinkler irrigation within 36 hours to control most annual grasses. Use the maximum recommended rate preemergence followed by irrigation to suppress certain annual broadleaf weeds including common lambsquarter, smooth pigweed, and common purslane.

Preemergence

Clomazone--0.094-0.188 lb/A. Apply 4 to 8 fluid ounces per acre Command 3ME preemergence to a direct-seeded crop to control annual grasses and many broadleaf weeds including common lambsquarter, velvetleaf, spurred anoda, and jimsonweed. Mustards, morningglory species, and pigweed species will not be controlled. Use lowest recommended rate on coarse-textured, sandy soils low in organic matter. Higher rates should only be used on medium- and fine-textured soils and sites that have been heavily manured. Combine with Curbit 3EC to control pigweed species where Curbit is registered for use. Some temporary crop injury (partial whitening of leaf or stem tissue) may be apparent after crop emergence. Complete recovery will occur from minor early injury without affecting yield or earliness. Banding the herbicide reduces the risk of crop injury and offsite movement due to vapor drift.

WARNING: Command spray *or* vapor drift may injure sensitive crops and other vegetation up to several hundred yards from the point of application. Do not apply when wind or weather conditions favor herbicide drift. Do not apply to fields adjacent to horticultural, fruit, vegetable, or other sensitive crops (see label). Drift injury from offsite Command movement is extremely apparent; therefore, do not use Command on fields near sensitive locations.

Herbicide residues may limit subsequent cropping options when Command is used for weed control in cucumbers. See planting restrictions on the label or consult your local Cooperative Extension office for information regarding subsequent cropping options when Command is used.

Ethalfluralin--0.38-0.75 lb/A. Apply 1 to 2 pints per acre Curbit 3E preemergence to control annual grasses and certain annual broadleaf weeds, including carpetweed and pigweed sp. Control of many other broadleaf weeds, including common lambsquarter, jimsonweed, morningglory sp., ragweed sp., mustard sp., and others may not be acceptable. Dry weather following application may reduce weed control. Cultivate to control emerged weeds if rainfall or irrigation does not occur prior to weed emergence. DO NOT preplant incorporate. DO NOT apply under plastic mulch or tunnels. DO NOT use when soils are cold or wet. Crop injury may result!

Ethalfluralin *plus* Clomazone (jug-mix)--0.394-1.575 lb/A. Apply 1.5 to 6 pints per acre of Strategy 2.1SC preemergence to control annual grasses and many annual broadleaf weeds. Use the lowest recommended rates on coarse-textured sandy soils low in organic matter. Higher rates should only be used on medium- and fine-textured soils and sites that have been heavily manured.

Strategy is a **jug-mix** of ethalfluralin (Curbit 3E) and clomazone (Command 3ME). Refer to the chart under Ethalfluralin *plus* clomazone (jug-mix) in the section **For Soil Strips Between Rows of Plastic Mulch** to determine the amount of each herbicide at commonly used rates.

Read and follow all the recommendations and warnings (above) for ethalfluralin (Curbit) and clomazone (Command).

Postemergence

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 14 days.

Sethoxydim--0.2-0.3 lb/A. Apply 1 to 1.5 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 14 days and apply no more than 3 pints per acre in one season.

Postharvest
With or Without Plastic Mulch

Paraquat--0.6 lb/A. **A Special Local-Needs 24(c) label has been approved for the use of Gramoxone Inteon 2SC for postharvest desiccation of the crop in Delaware, New Jersey and Virginia.** Apply 2.4 pints per acre Gramoxone Inteon 2SC as a broadcast spray after the last harvest. Add nonionic surfactant according to the labeled instructions. Use to prepare plastic mulch for replanting, or to aid in the removal of the mulch. See the label for additional information and warnings.

Note. All herbicide rate recommendations are made for spraying a broadcast acre (43,560 ft^2).

Pollination

Honeybees, squash bees, bumblebees and other wild 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 the websites www.CDMS.org or www.Greenbook.org. Also, specific labels can be obtained via web search engines.

Seed Corn Maggot

(See Chapter E "Maggots" section in “Soil Pests--Their Detection and Control”.) **Note.** The use of imidacloprid at planting will reduce seed corn maggot populations.

chlorpyrifos (seed treatment- Lorsban 50W or OLF)

Cucumber Beetle

Cucumber beetles can transmit bacterial wilt and cause stand losses by direct feeding injury. If adult beetles are abundant and there is a history of disease problems, insecticides should be applied before beetles feed extensively on the cotyledons and first true leaves. If foliar insecticides are used, begin spraying shortly after plant emergence, and repea t applications at weekly intervals if new beetles continue to invade fields:

acetamiprid (Assail 30SG or OLF)
beta-cyfluthrin (Baythroid XL)
bifenthrin (Brigade EC, Sniper, or OLF)
carbaryl (Sevin 80S or OLF)
carbofuran (Furadan 4F. **A Special Local-Needs Label 24(c) is in effect for carbofuran at planting.) Note.** Use of carbofuran at planting frequently leads to spider mite outbreaks later in the season.
cyfluthrin (Renounce 20WP, Tombstone or OLF)
dinotefuron (Venom 70SG or OLF)
endosulfan (Thionex 3E or OLF)
esfenvalerate (Asana XL)
fenpropathrin (Danitol 2.4EC)
imidacloprid (at plant/chemigation/in-furrow/hill drench/postseeding- Admire 2F, Admire PRO or OLF)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
methomyl (Lannate LV or OLF)
permethrin (Perm-Up, Pounce 3.2EC or OLF)
thiamethoxam (soil- Platinum 2SG or OLF)

Squash Vine Borer

When vines begin to run, apply to bases of plants four times at 7-day intervals. Pheromone traps for squash vine borer are commercially available. These traps can be used to indicate when moth activity begins. **Note:** Use of spinosad for looper control will reduce squash vine borer populations.

bifenthrin (Brigade EC, Sniper, or OLF)
endosulfan (Thionex 3E or OLF)
esfenvalerate (Asana XL)
permethrin (Perm-Up, Pounce 3.2EC or OLF)

Cutworms

(Also see Chapter E the "Cutworms" section in “Soil Pests--Their Detection and Control”.)

beta-cyfluthrin (Baythroid XL)
bifenthrin (Brigade EC, Sniper, or OLF)
esfenvalerate (Asana XL)
methomyl (Lannate LV or OLF)
permethrin (Perm-Up, Pounce 3.2EC or OLF)

Pickleworm, Melonworm

Make one treatment prior to fruit set, and then treat weekly:

beta-cyfluthrin (Baythroid XL)
bifenthrin (Brigade EC, Sniper or OLF)
carbaryl (Sevin 80S or OLF)
chlorantraniliprole (chemigation/foliar- Coregan 1.67SC)
cyfluthrin (Renounce 20WP, Tombstone or OLF)
endosulfan (Thionex 3E or OLF)
esfenvalerate (Asana XL) **(pickleworm only)**
flubendiamide (Synapse WG)
indoxacarb (Avaunt 30WDG)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
methomyl (Lannate LV or OLF)
methoxyfenozide (Intrepid 2F)
permethrin (Perm-Up, Pounce 3.2EC or OLF)
spinetoram (Radiant 2SC)
spinosad (Entrust80W, SpinTor 2SC or OLF)

Aphids

Note. Aphids transmit mosaic virus. Thorough spray coverage beneath leaves is important. For further information on aphid controls, see the preceding "Mulching" section. Treat seedlings every 5 to 7 days or as needed.

Note. Virus-resistant cultivars including transgenic varieties are commercially available.

dinotefuron (soil or foliar- Venom 70SG or OLF)
endosulfan (Thionex 3EC or OLF)
flonicamid (Beleaf 50SG or OLF)
imidacloprid (at plant/chemigation/in-furrow/hill drench/postseeding-Admire 2F, Admire PRO or OLF)
oxydemeton-methyl (Metasystox-R 2SC)(**GPA only**)
pymetrozine (Fulfill 50WDG or OLF)
thiamethoxam (soil-Platinum 2SG or OLF; foliar-Actara 25WDG)

Squash Bug

Begin treatments if greater than one egg mass per plant is present. Sprays should target nymphal stages. **Note.** Use of dinotefuran for aphid control will reduce squash bug populations:

bifenthrin (Brigade EC, Sniper, or OLF)
carbaryl (Sevin 80S or OLF)
dinotefuron (soil or foliar- Venom 70SG or OLF)
endosulfan (Thionex 3EC or OLF)
esfenvalerate (Asana XL)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
permethrin (Perm-Up, Pounce 3.2EC or OLF)

Leafminers

abamectin (Agri-Mek EC, Abba EC, Temprano, or OLF)
dinotefuran (soil or foliar- Venom 70SG or OLF)
oxamyl (Vydate L)
permethrin (Perm-Up, Pounce 3.2EC or OLF)
spinosad (Entrust 80W, SpinTor 2SC or OLF)

Rindworms (cucumber beetle larvae)

Damage to the rinds may result from a complex of insects including cucumber beetle, wireworms, and a number of "worm" species, (beet army worm, etc.). Management of adult cucumber beetles early in the season may help reduce damage. See cucumber beetle section for labeled products.

Cabbage Looper

Bacillus thuringiensis (Biobit, Dipel, Dipel 2X, Javelin, XenTari or OLF)
beta-cyfluthrin (Baythroid XL)
bifenthrin (Brigade EC, Sniper, or OLF)
chlorantraniliprole (Coragen 1.67SC)
esfenvalerate (Asana XL)
fenpropathrin (Danitol 2.4EC)
flubendiamide (Synapse WG)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
methomyl (Lannate LV or OLF)
methoxyfenozide (Intrepid 2F)
permethrin (Perm-Up, Pounce 3.2EC or OLF)
spinetoram (Radiant 2SC)
spinosad (Entrust 80W, SpinTor 2SC or OLF)

Mites

Mite infestations generally begin around field margins and grassy areas. CAUTION: DO NOT mow or maintain these areas after midsummer since this forces mites into the crop. Localized infestations can be spot treated. Begin treatment when 10 to 15 percent of the crown leaves are infested early in the season, or when 50 percent of the terminal leaves are infested later in the season.

Note. Continuous use of carbaryl, carbofuran, or pyrethroids may result in mite outbreaks.

abamectin (Agri-Mek EC, Abba EC, Temprano, or OLF)
bifenthrin (Brigade EC, Sniper, or OLF)
bifenzate (Acramite 50W)
fenpropathrin (Danitol 2.4EC)
oxydemeton methyl (Metasystox-R 2SC)
spiromesifen (Oberon 2SC)

Thrips

dinotefuran (soil/foliar-Venom 70SG or OLF)
lambda-cyhalothrin (Lambda-Cy, LambdaT, Silencer, Warrior, Warrior II or OLF)
oxamyl (Vydate 2L)
spinosad (Entrust 80W, SpinTor 2SC or OLF)

Pesticide	Use Category[1]	Hours to Reentry[2]	Days to Harvest[3]
INSECTICIDE			
abamectin	R	12	7
Bacillus thuringiensis	G	4	0
beta-cyfluthrin	R	12	0
bifenthrin	R	12	3
bifenzate	G	12	3
carbaryl	G	12	3
carbofuran	R	48	AP
dinotefuran (soil/foliar)	G	12	21/1
endosulfan	R	24	2
esfenvalerate	R	12	3
fenpropathrin	R	24	7
flonicamid	G	12	0
imidacloprid (soil)	G	12	21
indoxacarb	G	12	3
lambda-cyhalothrin	R	24	1
methomyl	R	48	3
oxamyl	R	48	1
oxydemeton-methyl	R	48	14
permethrin	R	12	0
pymetrozine	G	12	0
spinetoram	G	4	3
spinosad	G	4	3
spiromesifen	G	12	7
thiamethoxam (soil/foliar)	G	12	30/0
FUNGICIDE (FRAC code)			
Cabrio (Group 11)	G	12	0
chlorothalonil (Group M5)	G	12	0
copper, fixed (Group M1)	G	24	0
Curzate (Group 27)	G	12	3
Forum (Group 40)	G	12	0
Gavel (Groups 22 + M3)	G	48	5
Mancozeb (Group M3)	G	24	5
maneb (Group M3)	G	24	5
MetaStar (Group 4)	G	48	AP
Presidio (Group 43)	G	12	2
Previcur Flex (Group 28)	G	12	2
Pristine (Groups 11 + 7)	G	12	0

(table continued next page)

Pesticide *(continued)*	Use Category[1]	Hours to Reentry[2]	Days to Harvest[3]
FUNGICIDE (FRAC code)			
Procure (Group 3)	G	12	0
Quadris (Group 11)	G	4	1
Rally (Group 3)	G	24	0
Ranman (Group 21)	G	12	0
Ridomil Gold (Group 4)	G	48	0
Tanos (Groups 11 + 27)	G	12	3
Ultra Flourish (Group 4)	G	48	0

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] AP -At plant

Nematode Control

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

Vydate L--1-2 gal 2L/A. Incorporate into the top 2 to 4 inches of soil or 2 to 4 pints 2L per acre applied 2 weeks after planting and repeat 2 to 3 weeks later.

Disease Control

Damping-Off

Apply the following in a 7-inch band after seeding. Use formula in the "Calibration for Changing from Broadcast to Band Application" section of Calibrating Granular Application Equipment to determine amount of Ridomil Gold, Ultra Flourish or MetaStar needed per acre:

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

Viruses (CMV, WMV2, PRSV, and ZYMV)

Varieties with multiple resistance packages are available (see above table). Varieties expressing the precocious yellowing gene such as "Multipik" will mask the greening of fruit caused by WMV and CMV but will become distorted when infected with either PRSV or ZYMV. **All 4 viruses may be detected at some level in squash fields in the region in any given year, therefore plant varieties with resistance to more than one virus** The following control measures should also be used.

If possible, plant fields as far apart as possible from existing cucurbit plantings to reduce the chances for aphid transmission. Using reflective mulch may help to prevent aphid transmission of viruses. (See preceding "Mulching" section.)

Bacterial Wilt

Controlling striped and spotted cucumber beetles is essential for preventing of wilt. See preceding "Cucumber Beetle" section under Insect Control for specific recommendations. Insecticide applications made at seeding may not prevent beetle damage season long, therefore, additional foliar insecticide applications may be neccessary.

Powdery Mildew

The fungus that causes cucurbit powdery mildew can develop resistance to high-risk fungicides. Resistance to strobilurin (FRAC code 11) and DMI (FRAC code 3) fungicides have been reported in the Eastern U.S. Proper fungicide resistance management should be followed.

Powdery mildew generally occurs from mid-July until the end of the season. Make first application when powdery mildew is observed in the area or is detected by scouting (one lesion on the underside of 45 old leaves), begin the following fungicide program:

Alternate:

Rally--5.0 oz 40WSP/A *plus* chlorothalonil-2.0-3.0 pt 6F/A, or
Procure--4.0-8.0 oz 50WS/A *plus* chlorothalonil--2.0-3.0 pt 6F/A

With:

a tank mix containing Pristine--12.5-18.5 oz 38WG/A *plus* chlorothalonil--1.5-3.0 pt 6F/A

Downy Mildew

Scout fields for disease incidence early in the growing season. Begin sprays when plants meet in the row or if disease occurrence is predicted for the region. Refer to the Cucurbit Downy Mildew Forecasting website (www.ces.ncsu.edu/depts/pp/cucurbit/) for current status of the disease. Preventative applications are much more effective than applications made after the disease is detected. The following are the most effective materials. Tank-mix these products with a protectant such as chlorothalonil--1.5-2.0 pt 6F/A or OLF:

Ranman--2.1-2.75 fl. oz. 400 SC/A, or
Presidio--3.0-4.0 fl oz 4SC/A, or
Previcur Flex--1.2 pt 6F/A, or
Tanos--8.0 oz 50WDG/A, or
Gavel--1.5-2.0 lb 75 DF/A (Gavel contains mancozeb, which is a protectant, and does not need a tank-mix partner.), or
Curzate--3.2 oz 60DF/A

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

Sprays should be applied on a 7-day schedule. Under severe disease conditions spray interval may be reduced if label allows.

Plectosporium Blight (Microdochium blight)

A three year rotation with crops other than cucurbits is advised. It is important to achieve maximum foliage coverage with the fungicide application. Once symptoms appear on petioles or after fruit form, apply one of the following and repeat every 7 to 10 days:

chlorothalonil--2.0-3.0 pt 6F/A, or OLF
Mancozeb--2.0-3.0 lb 75DF/A, or
maneb (Manex)--1.2-1.6 pt 4F/A

A spray schedule that rotates Cabrio or Flint with chlorothalonil will also provide control.

Blossom Blight

This is a serious problem in some years. The fungus becomes established in senescent blossoms and grows into young fruit. Improve aeration through wider plant spacing and good weed control.

Scab

Use resistant varieties when possible. Scab develops during cool periods. Begin sprays as true leaves form and repeat every 5 to 7 days:

chlorothalonil--2.0-3.0 pt 6F/A or OLF

Phytophthora Blight

Rotate with crops other than peppers, eggplants, tomatoes, lima and snap beans, and other cucurbits. Fields should be adequately drained to ensure that water does not accumulate around the base of the plant. Mefenoxam (Ridomil Gold or Ultra Flourish) or metalaxyl (MetaStar) should be applied pre-plant for early season control. Once the canopy closes, subsoil between the rows to allow for faster drainage following rainfall. When conditions favor disease development, apply one of the the following for suppression only and always tank-mix with fixed copper:

Forum--6.0 oz 4.18SC/A , or
Gavel--1.5-2.0 lb 75DF/A, or
Tanos--8.0-10.0 oz. 50WDG/A, or
Ranman--2.75 fl. oz. 400 SC/A *plus* an adjuvant, see label for details.