

**New York State
Integrated Pest Management Program**

**2000 - Cucurbit IPM Scouting
Procedures**

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CUCURBITS represent a very diversified group of plant species that form the plant family **CUCURBITACEAE**. Cucurbits include the major crops of cucumber (C), melon (M)(which includes muskmelon, cantaloupe, and honeydew), watermelon (W), summer squash (SS), winter squash (WS), pumpkin (P), and gourds (G). Because the various cucurbits can differ in their susceptibility to diseases and insects, the letters following each cucurbit shown above will be used to provide specific information throughout this document. Pest management information applicable to all cucurbits is presented in the front of this document, followed by separate sections for each crop highlighting problems and thresholds unique to that crop.

A. General Scouting Information

Cucurbit or vine crop fields should usually be scouted in a systematic manner that places sample sites throughout most of the field. However, some exceptions apply as indicated in the disease and insect sections below. Sampling patterns will vary depending on the shape of the field, but frequently a V-, W-, X-, or diamond shaped pattern adequately covers a field. These sampling patterns may not always be feasible because of difficulty of walking through a vine crop (i.e. pumpkin) and the extra amount of time that would be needed to follow a pattern. A compromise is to walk through the field down a row. Remember, you are attempting to sample **representative** sections of the whole field. Although the scouting procedures outlined here are rather rigidly structured, remain alert to possible pest problems that may not be detected by the systematic sampling plan and are noted as you walk from site to site. Unhealthy appearing plants (e.g. yellow foliage, wilting plants, or plants with obvious insect chewing damage) should be examined more closely.

If a scout has problems with a sampling scheme or thinks that data being recorded on a scout form is not reflective of the real field situation, please bring this to the attention of the County Extension Agent or Regional IPM Specialist with whom they are working, or with the Cornell Extension Plant Pathologist or Entomologist.

Spray Record: Always check the grower's spray record before entering the field. It is important to check whether or not a pesticide has been applied recently, and if the REI has passed. Make sure your growers keep these records up to date.

Pesticides and Bees: Cucurbit crops require bees for pollination. Be sure to caution growers not to use pesticides which may injure bees or inhibit their activity during pollination. Some publications recommend the use of one hive per field to promote pollination.

B. General Scouting Procedure:

Each time a field is scouted, chose 5 representative sites from which to make counts. The sites should vary from week to week to increase the probability that localized problems will be detected. The plant parts examined and sampling units will change as the plants grow, vine, and form fruit. Sampling sites should be chosen without bias, except in those disease cases where specific sites are important (for example, poorly drained areas of the field, portions of a field bordered by trees that might not dry off quickly following heavy dew or fog, etc.), and early in the season when scouting for striped cucumber beetle.

C. Insect Scouting Procedure

Begin scouting for insects (striped cucumber beetle) as soon as plants emerge or are transplanted. Overwintered striped cucumber beetle adults can colonize a field very quickly and cause direct damage to emerging or newly transplanted plants, in addition to possibly transmitting bacterial wilt. Twice weekly scouting may be necessary while overwintered striped cucumber beetle adults are colonizing fields. Pay particular attention to the edges of fields, where localized “hot spots” of heavy damage may be found. Before plants begin to vine, inspect each of 5 plants for general appearance and insect occurrence. After plants vine and individual plants are indistinguishable, inspect 10 leaves and 5 fruit at each of five plant areas (10 sq. ft.) in the field, recording insect presence and damage.

D. Disease Scouting Procedure (find crop specific procedures starting on page 11)

At the early part of the season as the plants begin to run (vine) or with bush types as they begin to flower, for each field scouted, chose 5 representative sites from which to make counts. At each site inspect 2 older leaves on each of 5 plants (one per hill if this applies) for presence of each disease (during a wet spring particularly note presence of Septoria, scab, and angular and bacterial leaf spot, **as subsequent fruit infection can occur**), and record how many plants are infected. In the case of bacterial wilt, note occurrence of cucumber beetles as noted in **Insect Section F**. A total of 50 leaves should be inspected for the field. After the rows close for the vining types (for bush types this time frame would correspond to plants with fruit set and enlarging), it is preferable to substitute 5 plant areas (10 sq. ft.), examining 10 leaves/area and 5 fruit at each location. To aid in finding the initial occurrence of powdery mildew, if summer squash is planted in the vicinity, inspect these plantings first for the presence of mildew to determine when weather conditions are appropriate for mildew colonization. Calculate and record the percent plants infected. In addition, give each field an overall disease severity rating for each disease present according to the following scheme:

- 1 = first occurrence of the season on leaves
- 2 = few leaves (1-3) of each plant infected
- 3 = moderate number of leaves (3-8) infected on each plant, first occurrence on stems and fruit
- 4 = each plant severely infected (9-all leaves), infected stems and fruit now common
- 5 = total vine destruction with heavy fruit infection

The presence of all diseases except Phytophthora blight, Fusarium crown and foot rot, Fusarium wilt, and sudden wilt will be evaluated on a percent plants infected basis. Phytophthora and Fusarium crown rot and the wilt diseases will be noted when present since they can be somewhat sporadic in their occurrence on a given farm. It is also important that the different crops be scouted separately for purposes of disease evaluation; however, cross-infection is common, especially if the different cucurbits are grown in close proximity to one another. (see the “Location of the Plant” table as an aid)

The following table provides some information of the generalized occurrence of diseases, and suggestions for systematic sampling and action thresholds.

| <u>Initially at Border Rows</u> | <u>Localized</u> | <u>Systematic Sampling & Action Thresholds¹</u> |
|---|---|---|
| Viruses, especially CMV introduced by aphids (other viruses may be more randomly distributed) | Fusarium crown and foot rot; Phytophthora blight; poorly drained areas of field | Angular leaf spot ^a , Bacterial leaf spot ^a & Bacterial wilt ^d , Scab ^{a c} & Septoria leaf spot ^{a c} , Powdery ^a & Downy mildew ^a , Alternaria leaf blight ^b , Gummy stem blight ^b & Anthracnose ^b , Plectosporium blight (formerly Microdochium blight) ^b & Ulocladium leaf spot ^b (Fusarium crown and foot rot, Fusarium wilt & Sudden wilt can be scouted for, but no controls are available). |

¹Action thresholds

^a = symptoms on one leaf of 25-50 examined.


^b = preventative when fruit begin to develop (GSB)or if symptoms are present.




^c = mean temperatures (58-64F for Septoria) (63-70F for Scab) with wet weather for spore dispersal and infection.

^d = monitor insect vectors to initiate treatment.

The following table can be used as an indication of where to look on the plant for a particular disease for signs or symptoms. Note the generalized occurrence on leaves as follows: early season (June); mid-season (mid-July to mid-August; late season (September).

Location on the Plant

| Disease | Leaves | Stems | Roots | Fruit |
|--|---|---|---------------------------|---------------------------------------|
| Angular l. s., Bacterial l. s. | Small (1-3mm) brown spots, angular (ALS) or circular (BLS), possible tear-drop exudate, yellow halo, shot hole in late stage (early and mid-season) | Water-soaked, white crust | - | Sunken crater, white crust |
| Bacterial wilt | Flaccid, collapse of runners (early to mid-season) | Sticky strands | - | - |
| Alternaria l. b. | Target lesion (mid-season) | Lesions less common | - | - |
| Anthracnose  | Circular spots, short blk stubble on edge of lesion (mid- to late season) | Lesions present | - | Sunken, pink spore mass |
| Fusarium crown and fruit rot of Pumpkin and SS | Yellowing & wilt (early, mid, and late season) | Whitish/pink fungal growth at soil line | No internal discoloration | Sunken crater, may have fungal growth |
| Fusarium wilt of melon | Yellowing & wilt (mid-season) | Gumming, vascular discoloration | Internal discoloration | Infection can occur |

| Disease | Leaves | Stems | Roots | Fruit |
|---|---|------------------------------------|--------------|--|
| Downy mildew  | Chlorotic to bright yellow areas upper, with "apple trees" and blk sporulation on lower surface (mid- to late season) | Present when advanced | - | - |
| Gummy Stem (Black rot)  | Variable, blk dots in some lesions (mid- to late season) | Gumming, black dots within lesions | - | Black dots within rotted area |
| Phytophthora (crown) blight | Dark spots occur rarely (mid- to late season] | General decline | Rot | Water-soaked or sunken spots, yeasty fungal growth |
| Powdery mildew | Talc-like, upper & lower of old leaves first (mid-season, summer squash earlier) | Talc-like | - | Mildew appears on handles |
| Plectosporium blight | Bleached, sunken, & spindle-shaped, main veins (mid- to late season) | Same but on stems & petioles | - | Same but on handle & rind |
| Scab | Yellow halo, shot hole (early, mid- to late season) | Beige lesions | - | Sunken or scabby lesions |
| Septoria l. s.  | Sm (1-2mm) watersoaked or white spots with blk dots (early, mid- and late season) | - | - | White pimples as rash |
| Sudden wilt (primarily of melon) | Flaccid, yellowing, collapsing (mid- to late season) | - | - | Occurs when plants have heavy fruit load |
| Ulocladium l. s. of cucumber | Spots with beige centers, with brown ring & circular br. halo (mid- to late season) | Lesions can occur | - | - |
| Viruses | Mosaic and distortion (early, mid- to late season) | - | - | Color breaking (all), also distortion with ZYMV & PRSV |



This symbol indicates that a hand lens of at least 10x is needed to diagnose this disease in the field.

E. Varietal Resistance

It is extremely important to note the variety of the crop for disease evaluation. Some varieties of several cucurbit crops are significantly more susceptible to certain diseases than other varieties. This is particularly true for virus diseases, and their occurrence, degree of damage, and control can be influenced by the variety chosen. This currently only applies to the following summer squash varieties.

| Variety | Reaction |
|--|---|
| <u>Yellow Str. Neck</u> | Foliar symptoms occur, but no greening, of fruit (color- breaking) |
| Multipik, Superpik, Gen. Patton, Fortune, Seneca Supreme Sunbar, Precious | if infected with CMV or WMV. More severe foliar symptoms occur together with fruit greening and distortion if infected with PRSV or ZYMV. |
| <u>Yellow Crk. Neck</u> | |
| Supersett | Same as above |
| <u>Yellow Str. Neck</u> | |
| XPHT 1816 | Resistant to CMV, PRSV, WMV, and ZYMV |
| Liberator III | Resistant to CMV, WMV, and ZYMV |
| <u>Yellow Crk. Neck</u> | |
| Freedom II, Prelude II | Resistant to WMV and ZYMV |
| Destiny III | Resistant to CMV, WMV, and ZYMV |
| <u>Zucchini</u> | |
| Jaguar, Tigriss, Decla- ration II, Independence II | Resistant to WMV and ZYMV |
| Dividend, Revenue | Resistant to CMV, WMV, and ZYMV |

F. Managing Fungicide Resistance for Powdery mildew, Gummy stem blight, and Downy mildew

Among cucurbit diseases, fungicide resistance is a concern especially for powdery mildew and gummy stem blight/black rot, and potentially for downy mildew. Systemic fungicides are typically at risk for resistance development because they usually have single site mode of action.

Strains of the powdery mildew fungus resistant to triadimefon (active ingredient in Bayleton and Reach) and/or to benomyl (Benlate) have been found throughout the United States, including New York. Strains resistant to benomyl most likely are resistant to other fungicides in this chemical group (e.g. Topsin M). Where examined in 1996-1998, resistant strains were sufficiently common before treatment that these fungicides would have been marginally effective or ineffective. Therefore growers should switch to new systemic fungicides when they become registered. Azoxystrobin (Quadris) was registered in 1999, and now may also be used on Long Island. Another strobilurin, Flint (trifloxystrobin), is now registered on cucurbits and should be available for use in New York this summer. Similarly, myclobutanil (Nova) should be registered for use in 2000.

Strains of the gummy stem blight fungus resistant to both benomyl and thiophanate-methyl (Topsin M) have been identified recently in New York and elsewhere in the eastern United States. Azoxystrobin is effective for this disease.

Strains of the downy mildew fungus resistant to metalaxyl (Ridomil) have been found in Israel. For this reason, Ridomil for foliar usage is formulated as a mixture with protectant fungicides that have a low risk of resistance development (Bravo, mancozeb [Ridomil Gold MZ], or copper). Quadris and Flint are also labeled for downy mildew control, and are suitable alternative products. This disease is more likely to occur on Long Island and the lower Hudson Valley.

The following resistance management strategies should be used:

1. Reduce the need for fungicides by using other management practices (e.g. resistant varieties).
2. Apply systemic fungicides at-risk for resistance only when FIRST needed. Scout weekly for symptoms to ensure applications are made at the critical time, which is the start of disease development.
3. NEVER apply systemic fungicides like Benlate and Nova ALONE. Use systemic fungicides in combination with a contact protectant fungicide (chlorothalonil [Bravo] or other labeled formulation [OLF]).
4. Alternate between systemic fungicides (Quadris and Flint)

with a product of different active ingredient. 5. Maximize spray coverage on leaf undersurfaces if possible. 6. Limit the number of applications of systemic fungicides by using contact fungicides at less critical times. Each systemic fungicide should be used in no more than one-third of the total fungicide applications. For powdery mildew, apply myclobutanil plus a contact fungicide in alternation with azoxystrobin or trifloxystrobin. For gummy stem blight, apply azoxystrobin in alternation with benomyl or thiophanate-methyl plus a contact fungicide. For downy mildew, apply a metalaxyl combination product in alternation with fosetyl-Al (Aliette) plus maneb, or choose one of the strobilurin fungicides (Quadris or Flint).

G. General Insect Scouting Procedures (find crop specific procedures starting on page 11)

The following insects will be monitored in the 2000 cucurbit program, and are listed in order of importance:

- Striped Cucumber Beetle
- Spotted Cucumber Beetle
- Aphids
- Seed Maggot
- Western Corn Rootworm
- Squash Bug
- Squash Vine Borer (occasional pest in commercial cucurbits in NY)

Start scouting as soon as seedlings start to emerge or when plants are set out in the field. Inspect five plants at each of five locations in the field and record the number of striped cucumber beetles per plant. Later in the season as plants vine and cannot be distinguished, at five different locations in the field, examine 10 leaves and five fruit for insects and signs of feeding damage.

Seed maggot:

Areas in the field where seedling emergence is poor may indicate seed maggot injury. Examine 5 to 10 seedlings in these areas and note if heavy root feeding is apparent. Growing tips can be destroyed. Record percentage of plants damaged.

Cucumber beetles and western corn rootworms:

The striped cucumber beetle can infest cucurbits shortly after transplanting or as plants emerge from the soil. Infestation levels will continue to increase for about two weeks. It is important to carefully monitor the crop at this time, twice a week if possible, because this is when plants are most susceptible to feeding damage and disease transmission. It is important to examine all plant surfaces. Beetles most often feed on the undersides of cotyledons, young leaves, and the stem. When on the undersides of cotyledons, feeding damage is typically limited to the leaf surface, however they will occasionally feed through the leaf, leaving holes. Heavy feeding on older leaves results in leaves appearing net-like, with only the veins remaining. Some beetles (ca. 20%) will also be found hidden in cracks in the soil and under rocks and debris. Beetles may occur in concentrated "hot spots" at field edges.

Second generation striped cucumber beetles, spotted cucumber beetles, and western corn rootworms infest cucurbits beginning in mid-summer. These insects are less likely to cause economic damage directly to the plants because by the time they appear plants are relatively mature and are more tolerant of damage. Mid- to late-season infestations can damage blossoms. If fruit set is still occurring, treat if blossom damage is excessive. All species have been reported causing damage to fruit late in the season.

Thresholds: see individual crop sections below for striped cucumber beetle adult thresholds.

Root infestations: Striped and spotted cucumber beetles lay their eggs at the base of plants and the larvae feed on roots. Little is known about the importance of larval cucumber beetle feeding on growth and development of cucurbits. Roots of small plants that appear stressed should be

examined for cucumber beetle larvae. The larvae are creamy white with a black head and "tail" and up to 3/8 inches long.

Squash bugs:

While generally not a problem on young plants, if the infestations are severe and feeding excessive, leaves on mature plants will appear "blackened" as if burned. Adults and nymphs feed on leaves and stems with piercing mouthparts. In the process, toxins are introduced into the plant, which interfere with normal physiological activities. Record if plants have been damaged by squash bugs. There are no specific treatment thresholds for squash bugs.

Watch for the orange-reddish squash bug eggs that are laid in clusters on the upper leaf surfaces. Nymphs will occur in aggregations on leaves, blossoms or elsewhere on the plants. It is best to sample plants early in the day while relatively cool, as squash bugs are very skittish when temperatures are hot. Aggregations occur under live and dead leaves that are in contact with the soil. Adults are often found at the base of the plant near the soil line or between large stems. They also can be found under dirt clods and other debris. Wooden boards (ca. 12 in. X 12 in.) placed under plants can act as "indicator traps". Bugs will crawl under the boards for protection and can easily be counted. Although some bugs will be trapped, the number captured probably represents only a small percentage of the infestation present.

***Squash vine borer:**

While the squash vine borer is generally not a problem in commercial plantings of cucurbits some damage has been observed in recent years. The larvae bore into the stems of squashes, pumpkins, gourds, cucumbers and muskmelons. Winter squash, (in particular Hubbard), pumpkins, and zucchini are quite susceptible to borer damage. Infested vines at first exhibit wilting and later may be completely girdled and rot beyond the point of attack. An infestation may be detected by the presence of coarse, yellowish grains of frass (fecal matter) that collect at the base of stems or on the ground under the vines. Later the frass becomes moist and shiny, and may be seen oozing from holes in the stems.

Begin scouting fields in mid June. Fields heavily infested last year, are more likely to have infestations this year. If frass is seen, stems should be cut open to confirm the presence of borer larvae. There are no specific treatment thresholds for this pest, but if needed, two insecticide applications 5 to 7 days apart should control newly hatched larvae. Several registered insecticides including Thiodan 50WP, Asana XL and Ambush should provide adequate control. It is important to control larvae before they enter the stem, because once they enter the stem, insecticides have little effect. If possible, direct the spray to the stems of the plants near the base for good control.

Aphids: Several species of aphids attack cucurbits, in particular melons and cucumbers. They are the principal vectors of virus diseases and it only takes a few to introduce the virus into the crop. Virus resistant varieties should be used whenever available. See above disease section for information about viruses.

Sampling: Aphids are typically found on the undersides of leaves and natural enemies (parasitoids, predators, and fungal diseases) are frequently associated with aphid colonies. If aphids are present in adequate number, infested leaves will curl downward, turn brown and die. Looking for wilted leaves is one way of sampling for aphid infestations. Aphids typically do not cause significant direct damage until plants have started to produce runners. Initial infestations occur as isolated "hot spots".

Threshold: Examine ten leaves at each of five sites and record the number of leaves with five or more aphids per leaf. If more than 20 percent of the leaves have five or more live aphids per leaf, a treatment may be warranted. Consider however, the presence of natural enemies. If many of the aphids are infected with fungal pathogens or are parasitized (mummies), then treatment may not be needed.

If any questions arise, call your local Extension Agent, Regional IPM Specialist or Cornell Extension Entomologist.

The following table can be used as a guide for where to look on the plant for an insect pest or its damage.

| Insect | Location on the Plant | | | | |
|-------------------------|-----------------------|-------|------------|----------|-------|
| | Leaves | Stems | Roots | Blossoms | Fruit |
| Seed Maggot | - | - | X | - | - |
| Striped Cucumber Beetle | X | X | X (larvae) | X | X |
| Spotted Cucumber Beetle | X | X | | X | X |
| Western corn rootworm | X | X | - | XX | X |
| Squash Bug | X | X | - | X | X |
| Aphids | X (underside) | - | - | - | - |

H. Weed Scouting Procedures:

Making a Weed Map. Weeds or weed species may not be evenly distributed over a field. Where localized areas of severe infestations are found or atypical conditions exist (poorly drained area, high spots, field edges), weed infestations may be recorded on a weed map. A weed map illustrates problem areas and provides information for future control decisions. When weed maps are kept over a period of years for a given field, changes in location and population can be noted and control decisions adjusted accordingly. Areas of severe infestations can be targeted for specific control practices, rather than treating a larger area needlessly or failing to control problems at all.

First, make a rough sketch of the field, including landmarks, boundaries, crop row direction, compass directions, roads, planting date, date of map preparation, and any other important details. Then the following information should be indicated on the map:

Weed species, or if this is unknown, some effort should be made to distinguish annuals from perennials, and broadleaf species from grasses and from yellow nutsedge.

Abundance of each species estimated according to the following system: 0 = None; 1 = Scattered, few weeds; 2 = Slight, 1 weed /6 row feet; 3 = Moderate, 1 weed/3 row feet; 4 = Severe, > 1 weed/3 row feet

Distribution of weeds in the field is important and can be rated as follows: SPOTTY - found in a few places around the field; LOCAL - found in a small portion of the field; GENERAL - found throughout the field

Weed size - The following size ratings can be used: WHITE SPROUTS - seeds are just germinating or emerging; TINY - weeds show only cotyledons or first true leaf; SMALL - weeds less than 1" tall or less than the diameter of a quarter; LARGE - weeds more than 1" tall or more than the diameter of a quarter.

Throughout the season, at least two weed maps should be prepared. Timing should be as follows:

1. Early - soon after planting: Purpose: to evaluate the success of the current season program.
2. After Harvest. Purpose: to evaluate next season's weed control needs.

SCOUTING PROCEDURES AND THRESHOLDS FOR CUCUMBERS

Diseases to be Scouted

The importance of each disease for a particular cucurbit crop is given, where **NA** = not applicable (resistant varieties exist, as noted, or plants are not susceptible); **X** = occurs, but not damaging levels; **XX** = moderate susceptibility; **XXX** = severe.

* = Can occur every season in New York

Bacterial

NA, Res. Angular leaf spot - Most cucumber varieties are resistant, so if leaf spots occur on cucumber, the disease could be *Ulocladium* leaf spot (see below); ALS is most common still on WS.

* **XXX Bacterial wilt** – Can infect all cucurbits except watermelon and gourds - Control is based upon control of the cucumber beetle vector. (see Insect Section)

Fungal

X Downy mildew - Infects all cucurbits, but pathotypes vary - Inoculum introduced into the area; requires warm and moist conditions for infection and subsequent spread; most common on Long Island and the lower Hudson Valley

* **XX Ulocladium leaf spot** – Only infects C - Choose resistant varieties; not to be confused with angular leaf spot which requires different spray strategies

Insect Scouting and Thresholds

Emergence to four-leaf-stage: This is the most critical time for monitoring and decision-making for these pests. For each field, choose 5 representative sites from which to make counts. At each site inspect 5 plants (one plant per hill) and record the number of beetles observed. A total of 25 plants should be inspected for the field. Calculate the average number of beetles per plant. Watch for distinct "hot spots", and if detected, consider spot treatments. The following recommendations are based on work at Cornell and at Purdue University.

Cucumber beetle thresholds:

Cucumbers are susceptible to bacterial wilt which is vectored by cucumber beetles. When scouting, pay particular attention to field edges while plants are small.

Cotyledon to 4 leaf stage: If plants along the edge are heavily damaged or have ≥ 10 beetles/plant an insecticide should be applied within 24 hours. Thereafter, the fields only need to be treated if the average number of beetles per plant is ≥ 1 .

Fifth leaf stage to harvest: Because it is very difficult to accurately assess cucumber beetle and rootworm infestations in cucurbits once plants have several leaves, it is simplest to give the field an overall subjective rating. If feeding damage to leaves is very apparent throughout the field or blossoms are heavily infested and being damaged during peak bloom or young fruit are being feed upon, a treatment may be necessary. If the infestation occurs after most fruit is set, then the need to control is not as important. Late infestations can occasionally cause damage to mature fruit, but this is readily observed when walking the field. If feeding on mature fruit or fruit handles is noted and is of concern, a treatment may be warranted.

SCOUTING PROCEDURES AND THRESHOLDS FOR MELONS

Diseases to be Scouted

The importance of each disease for a particular cucurbit crop is given, where **NA** = not applicable (resistant varieties exist, as noted, or plants are not susceptible); **X** = occurs, but not damaging levels; **XX** = moderate susceptibility; **XXX** = severe.

* Can occur every season in New York

Bacterial

* **XX Bacterial wilt** – Can infect all cucurbits except watermelon and gourds - Control is based upon control of the cucumber beetle vector. (see Insect Section).

Fungal

* **XX Alternaria leaf blight** - M - Can be a problem if short rotations are used (less than 2 years). Fungus is seedborne, so could occur any season.

XX Anthracnose – Can infect all cucurbits including M, but pathotypes vary - A problem during warm (hot) seasons with adequate rainfall and high relative humidity.

X Fusarium crown and fruit rot – More for P and WS - A soilborne pathogen, it can cause a crown or foot rot of many cucurbit seedlings, or a fruit rot of pumpkin and winter squash; control based on 3 year rotation.

* **XXX Fusarium wilt** - M - This soilborne pathogen is specific to melon (other species affect cucumber and watermelon but are not of concern in NYS); Previous history of farm reporting loses is important; choose varieties resistant to races 0, 1, and 2 and a 5-7 year rotation.

XX Downy mildew - Infects all cucurbits, but pathotypes vary - Inoculum introduced into the area; requires warm and moist conditions for infection and subsequent spread; most common on Long Island and the lower Hudson Valley.

* **XX Gummy stem blight (black rot on fruit)** – All cucurbits including M - Symptoms can be variable on leaves, often without characteristic fruiting bodies which appear as black dots (pycnidia or perithecia of fungus).

* **X Phytophthora blight** – All cucurbits including M - Soilborne disease dependent on excess moisture (rainfall or irrigation) to spread inoculum in poorly drained areas of the field.

* **X Powdery mildew** – All cucurbits including M - Occurs every season, beginning first on older leaves in crown of plant. Some melon varieties have resistance to certain races of PM.

X Scab – Most cucurbits including M - Important at beginning and during a cool and wet season.

X Septoria leaf spot – M, plus other cucurbits- Important at beginning and during a cool and wet season; scout for 1-2 mm whitish spots with black pycnidia (or water-soaked spots if frequent rains have occurred). Rarely a serious problem on foliage, and no fruit infection has been noted in melons.

XXX Sudden wilt complex - M only - Influenced by late season virus infection (any of the four mentioned below), inadequate root systems caused by root-pruning effects of soil fungi, and stress brought on by heavy fruit load and cool evenings and warm days.

Viral

* **XXX Cucumber mosaic** – All cucurbits including M – Usually the first virus infecting melons; wide host range including lettuce, pepper, and tomato. Use of early season row covers may exclude aphids transmitting virus.

* **XXX Watermelon mosaic** – All cucurbits including M – Usually the second most important virus infecting melon in NY.

XX Papaya ringspot-type W – All cucurbits -.

XX Zucchini yellow mosaic - All cucurbits.

Insect Scouting and Thresholds

Monitoring and thresholds for cucumber beetles:

Emergence to four-leaf-stage: This is the most critical time for monitoring and decision-making for these pests. For each field, choose 5 representative sites from which to make counts. At each site inspect 5 plants (one plant per hill) and record the number of beetles observed. A total of 25 plants should be inspected for the field. Calculate the average number of beetles per plant. Watch for distinct "hot spots", and if detected, consider spot treatments. The following recommendations are based on work at Cornell and at Purdue University.

Cucumber beetle thresholds: Melons are susceptible to bacterial wilt which is vectored by cucumber beetles. When scouting, pay particular attention to field edges while plants are small.

Cotyledon to 4 leaf stage: If plants along the edge are heavily damaged or have ≥ 10 beetles/plant an insecticide should be applied within 24 hours. Thereafter, the fields only need to be treated if the average number of beetles per plant is ≥ 1 .

Fifth leaf stage to harvest: Because it is very difficult to accurately assess cucumber beetle and rootworm infestations in cucurbits once plants have several leaves, it is simplest to give the field an overall subjective rating. If feeding damage to leaves is very apparent throughout the field or blossoms are heavily infested and being damaged during peak bloom or young fruit are being feed upon, a treatment may be necessary. If the infestation occurs after most fruit is set, then the need to control is not as important. Late infestations can occasionally cause damage to mature fruit, but this is readily observed when walking the field. If feeding on mature fruit or fruit handles is noted and is of concern, a treatment may be warranted.

SCOUTING PROCEDURES AND THRESHOLDS FOR WATERMELON

Diseases to be Scouted

The importance of each disease for a particular cucurbit crop is given, where **NA** = not applicable (resistant varieties exist, as noted, or plants are not susceptible); **X** = occurs, but not damaging levels; **XX** = moderate susceptibility; **XXX** = severe.

* Can occur every season in New York

Fungal

X Anthracnose – All cucurbits, but pathotype varies - A problem during warm (hot) seasons with adequate rainfall and high relative humidity.

X Downy mildew - All cucurbits, but pathotype varies - Inoculum introduced into the area; requires warm and moist conditions for infection and subsequent spread; most common on Long Island and the lower Hudson Valley.

* **XX Gummy stem blight (black rot on fruit)** – All cucurbits, including W - Symptoms can be variable on leaves, often without characteristic fruiting bodies which appear as black dots (pycnidia or perithecia of fungus).

* **X Phytophthora blight** - All cucurbits including W - Soilborne disease dependent on excess moisture (rainfall or irrigation) to spread inoculum in poorly drained areas of the field.

Note: a new strain of powdery mildew that can infect watermelons was found in Maryland during the 1998 growing season. If powdery mildew is found on watermelons, please contact your local extension specialist or plant pathologist.

INSECT SCOUTING AND THRESHOLDS

Monitoring and thresholds for cucumber beetles:

Emergence to four-leaf-stage: This is the most critical time for monitoring and decision-making for these pests. For each field, choose 5 representative sites from which to make counts. At each site inspect 5 plants (one plant per hill) and record the number of beetles observed. A total of 25 plants should be inspected for the field. Calculate the average number of beetles per plant. Watch for distinct "hot spots", and if detected, consider spot treatments. The following recommendations are based on work at Cornell and at Purdue University.

Cucumber beetle threshold: Watermelons are not highly susceptible to bacterial wilt and can withstand feeding damage. The likelihood that feeding damage will affect yield decreases as plants mature.

Watermelon: ≥ 5 beetles/plant

Fifth leaf stage to harvest: Because it is very difficult to accurately assess cucumber beetle and rootworm infestations in cucurbits once plants have several leaves, it is simplest to give the field an overall subjective rating. If feeding damage to leaves is very apparent throughout the field or blossoms are heavily infested and being damaged during peak bloom or young fruit are being feed upon, a treatment may be necessary. If the infestation occurs after most fruit is set, then the need to control is not as important. Late infestations can occasionally cause damage to mature fruit, but this is readily observed when walking the field. If feeding on mature fruit or fruit handles is noted and is of concern, a treatment may be warranted.

SCOUTING PROCEDURES AND THRESHOLDS FOR YELLOW SUMMER SQUASH AND ZUCCHINI

Diseases to be Scouted

The importance of each disease for a particular cucurbit crop is given, where **NA** = not applicable (resistant varieties exist, as noted, or plants are not susceptible); **X** = occurs, but not damaging levels; **XX** = moderate susceptibility; **XXX** = severe.

* Can occur every season in New York

Bacterial

* **X Bacterial wilt** - Less common for SS - Watermelon and gourds are immune; control is based upon control of the cucumber beetle vector. (see Insect Section).

Fungal

X Fusarium crown and fruit rot – A factor for SS and other cucurbits - A soilborne pathogen, it can cause a crown or foot rot of many cucurbit seedlings; control based on 3 year rotation.

X Downy mildew - Infects all cucurbits, but pathotypes vary - Inoculum introduced into the area; requires warm and moist conditions for infection and subsequent spread; most common on Long Island and the lower Hudson Valley.

* **X Phytophthora blight** – All cucurbits including SS - Soilborne disease dependent on excess moisture (rainfall or irrigation) to spread inoculum in poorly drained areas of the field.

* **XX Powdery mildew** – All cucurbits including SS - Occurs every season and first on older leaves, especially when fruit are beginning to set. Some SS varieties are resistant to PM.

XX Scab – SS and other cucurbits - Important at beginning and during a cool and wet season; early control will reduce fruit infection which can be serious for SS.

Viral

* **XXX Cucumber mosaic** – All cucurbits including SS – Choose yellow squash varieties that mask color-breaking, and zucchini varieties that are resistant; wide host range including lettuce, pepper, and tomato.

* **XXX Watermelon mosaic** – All cucurbits including SS – Choose yellow squash varieties that mask color-breaking, and zucchini varieties that are resistant.

XX Papaya ringspot-type W – All cucurbits – Select yellow straight neck variety resistant.

XX Zucchini yellow mosaic – All cucurbits – Select yellow and zucchini varieties that are resistant.

INSECT SCOUTING AND THRESHOLDS

Monitoring and thresholds for cucumber beetles:

Emergence to four-leaf-stage: This is the most critical time for monitoring and decision-making for these pests. For each field, choose 5 representative sites from which to make counts. At each site inspect 5 plants (one plant per hill) and record the number of beetles observed. A total of 25 plants should be inspected for the field. Calculate the average number of beetles per plant. Watch for distinct "hot spots", and if detected, consider spot treatments. The following recommendations are based on work at Cornell and at Purdue University.

Cucumber beetle threshold: Summer squash are not highly susceptible to bacterial wilt and can withstand some feeding damage. Crops grown under row cover are particularly attractive when the row cover is removed because of the early flowering. While no formal threshold exists, control may be necessary in this situation. The likelihood that feeding damage will affect yield decreases as plants mature. The beetle's preference for varieties of summer squash (in 1992), and summer squash, winter squash, and pumpkin (in 1995) are shown in tables provided in the appendix.

Note: During the past two seasons, bacterial wilt has been found infecting crops that were previously considered not highly susceptible. Until we learn more about this situation we recommend using the 1 beetle/leaf threshold for all cucurbits except watermelon.

Summer squash: ≥ 1 beetle/plant

Fifth leaf stage to harvest: Because it is very difficult to accurately assess cucumber beetle and rootworm infestations in cucurbits once plants have several leaves, it is simplest to give the field an overall subjective rating. If feeding damage to leaves is very apparent throughout the field or blossoms are heavily infested and being damaged during peak bloom or young fruit are being feed upon, a treatment may be necessary. If the infestation occurs after most fruit is set, then the need to control is not as important. Late infestations can occasionally cause damage to mature fruit, but this is readily observed when walking the field. If feeding on mature fruit or fruit handles is noted and is of concern, a treatment may be warranted.

SCOUTING PROCEDURES AND THRESHOLDS FOR WINTER SQUASH, PUMPKINS, AND GOURDS

The importance of each disease for a particular cucurbit crop is given, where **NA** = not applicable (resistant varieties exist, as noted, or plants are not susceptible); **X** = occurs, but not damaging levels; **XX** = moderate susceptibility; **XXX** = severe.

* = Can occur every season in New York

Diseases to be Scouted

Bacterial

X Bacterial leaf spot - P, WS, G, and perhaps other cucurbits - Disease occurred on these crops in 1995, and was readily spread by overhead irrigation. Early diagnosis can therefore be important to prevent fruit infection. Symptoms on foliage may easily be overlooked.

* **XX Bacterial wilt** – Most cucurbits including P – Watermelon and gourds are immune; control is based upon control of the cucumber beetle vector. (see Insect Section)

Fungal

* **X Anthracnose** – Can infect all cucurbits including P, WS, but pathotypes vary - A problem during warm (hot) seasons with adequate rainfall and high relative humidity.

X Fusarium crown and fruit rot – Most common on P and WS - A soilborne pathogen, it can cause a crown or foot rot of many cucurbit seedlings, or a fruit rot of pumpkin and winter squash; control based on 3 year rotation

XX Downy mildew - Infects all cucurbits, but pathotypes vary - Inoculum introduced into the area; requires warm and moist conditions for infection and subsequent spread; most common on Long Island and the lower Hudson Valley.

* **XX Gummy stem blight (black rot on fruit)** - P, WS, G (primarily) - Symptoms can be variable on leaves, often without characteristic fruiting bodies which appear as black dots (pycnidia or perithecia of fungus).

* **XX Phytophthora blight** – All cucurbits affected - Soilborne disease dependent on excess moisture (rainfall or irrigation) to spread inoculum in poorly drained areas of the field.

X Plectosporium blight (formerly Microdochium) – P are vulnerable - Not yet reported in NYS, but present in surrounding states

* **XXX Powdery mildew** – All cucurbits - Occurs every season beginning first on older leaves in crown of plant. Some pumpkin varieties have good levels of resistance.

XX Scab – All cucurbits including WS, P, G - Important at beginning and during a cool and wet season; early control will reduce fruit infection which can be serious for SS, P, WS, and G.

XX Septoria leaf spot - WS, P - Important at beginning and during a cool and wet season; scout for 1-2 mm whitish spots with black pycnidia (or water-soaked spots if frequent rains have occurred); control in the foliar phase will reduce chance of fruit infection

Viral

* **XX Cucumber mosaic** – All cucurbits are susceptible – Usually the first virus infecting pumpkin.

* **XX Watermelon mosaic** – All cucurbits including WS, P, and G. Especially common on mini-pumpkins where it causes color-breaking.

X Papaya ringspot-type W – All cucurbits -

X Zucchini yellow mosaic - All cucurbits -

Insect scouting and thresholds

Monitoring and thresholds for cucumber beetles:

Emergence to four-leaf-stage: This is the most critical time for monitoring and decision-making for these pests. For each field, choose 5 representative sites from which to make counts. At each site inspect 5 plants (one plant per hill) and record the number of beetles observed. A total of 25 plants should be inspected for the field. Calculate the average number of beetles per plant. Watch for distinct "hot spots", and if detected, consider spot treatments. The following recommendations are based on work at Cornell and at Purdue University.

Cucumber beetle thresholds: These cucurbits are not highly susceptible to bacterial wilt and can withstand feeding damage. Research has shown that pumpkin can tolerate 80% leaf loss when plants have <5 leaves, without a yield loss. In contrast, winter squash is sensitive to leaf feeding damage. If distinct "hot spots" are detected, spot treat if possible. The likelihood that feeding damage will affect yield decreases as plants mature. The preference of summer squash (in 1992), and summer squash, winter squash, and pumpkin (in 1995) by beetles are shown in tables provided in the appendix.

Note: During the past two seasons, bacterial wilt has been found infecting crops that were previously considered not highly susceptible. Until we learn more about this situation we recommend using the 1 beetle/leaf threshold for all cucurbits except watermelon.

Pumpkin: ≥ 1 beetles/plant

Winter squash: ≥ 1 beetles/plant

Fifth leaf stage to harvest: Because it is very difficult to accurately assess cucumber beetle and rootworm infestations in cucurbits once plants have several leaves, it is simplest to give the field an overall subjective rating. If feeding damage to leaves is very apparent throughout the field or blossoms are heavily infested and being damaged during peak bloom or young fruit are being feed upon, a treatment may be necessary. If the infestation occurs after most fruit is set, then the need to control is not as important. Late infestations can occasionally cause damage to mature fruit, but this is readily observed when walking the field. If feeding on mature fruit or fruit handles is noted and is of concern, a treatment may be warranted.

Cornell University
IPM Program
5/00

Appendix:

Ranking of preferences by cucumber beetles.

Ranking of cucurbits by cucumber beetle preference. The higher the number the more preferred the variety. Rankings: 1-14 non-preferred, >45 highly preferred.

| | | | |
|--|----|--|------------|
| Sunbar (SS, yellow) | 1 | | Rocket (P) |
| Slender Gold (SS, yellow) | 2 | Goldie Hybrid (SS, yellow) | 32 |
| Scallop (SS) | 3 | Sundance (SS, yellow) | 33 |
| Seneca Prolific (SS, straightneck) | 4 | Sundance (SS, crookneck) | 34 |
| Gold Bar (SS, straightneck) | 5 | Frosty (P) | 35 |
| Table Ace (WS, acorn) | 6 | Spookie (P) | 36 |
| Carnival (WS, acorn) | 7 | Multiplik (SS, straightneck) | 37 |
| Yellow Crookneck (SS, crookneck) | 8 | Connecticut Field (P) | 38 |
| Peter Pan (SS, scallop) | 9 | Gold Rush (SS, zucchini) | 39 |
| Baby Pam (P) | 10 | Zucchini Select (SS, zucchini) | 40 |
| Munchkin (P) | 11 | Ambassador (SS, zucchini) | 41 |
| Table King (WS, bush acorn) | 12 | Happy Jack (P) | 42 |
| Zenith (WS, butternut) | 13 | Honey Delight (WS, buttercup) | 43 |
| Tay Belle (WS, bush acorn) | 14 | Buttercup Burgess (WS, buttercup) | 44 |
| Seneca Harvest Moon (P) | 15 | President (SS, zucchini) | 45 |
| Butternut Supreme (WS, butternut) | 16 | Black Jack (SS, zucchini) | 46 |
| Jack-Be-Little (P) | 17 | Big Max (P) | 47 |
| Jackpot (P) | 18 | Cocozelle (SS) | 48 |
| Tom Fox (P) | 19 | Black Jack Zucchini | 49 |
| Early Prolific Straightneck (SS, yellow) | 20 | Green Eclipse (SS, zucchini) | 50 |
| Baby Bear (P) | 21 | Seneca Zucchini (SS, zucchini) | 51 |
| Howden (P) | 22 | Senator (SS, zucchini) | 52 |
| Spirit (P) | 23 | Baby Boo (P) | 53 |
| Wizard (P) | 24 | Super Select (SS, zucchini) | 54 |
| Early Butternut (WS, butternut) | 25 | Ambercup (WS, buttercup) | 55 |
| Ghost Rider (P) | 26 | Dark Green Zucchini (SS, zucchini) | 56 |
| Big Autumn (P) | 27 | Embassy Dark Green Zucchini (SS, zucchini) | 57 |
| Waltham (WS, butternut) | 28 | Caserta (SS) | 58 |
| Autumn Gold (P) | 29 | Classic (M) | 59 |
| Jack-of-All-Trades (P) | 30 | | |

C = cucumber; M = melon; P = pumpkin; SS = summer squash; WS = winter squash; W = watermelon