

## Cucurbit Virus Control Strategies for 2008

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With the losses to cucurbit viruses in 2007 still fresh in the minds of cucurbit growers in the Northeast, let's review the details of the viruses infecting cucurbits, and what steps could be taken to lessen damage for 2008. Since most of the virus diseases are not usually seedborne and we are not taking virus-infected transplants to the field or growing ornamental stock plants and vegetable transplants in the same greenhouse, we can assume that in 2008 we are starting with a clean slate. Having said this, we still need to be concerned with any carryover virus that can occur due to virus-infected weeds that may serve as virus reservoirs for 2008. Here are a series of questions and answers to address the virus diseases affecting cucurbits and measures for control.

### **Q: Which virus diseases affect cucurbits?**

A: Cucurbit viruses belong to three different virus groups:

*Potyvirus*es include (Watermelon mosaic virus = **WMV**, Papaya ringspot virus = **PRSV**, and Zucchini yellow mosaic virus = **ZYMV**);

*Cucumovirus*es (Cucumber mosaic virus = **CMV**);

*Comovirus* (Squash mosaic virus = **SqMV**). PRSV can occur in the Northeast, but ZYMV and SqMV are more rarely encountered.

### **Q: Which cucurbits are susceptible to viruses?**

A: Generally speaking, cucurbits that are grown in the NE are susceptible to all five of the listed viruses, but in reality cucurbits vary with regard to which viruses are most important. Many cucumber varieties (*Cucumis sativus*) are resistant to CMV and are generally not bothered by the other viruses. Muskmelon (cantaloupe) (*Cucumis melo*) is on rare occasion affected by seedborne SqMV, but more likely by CMV and WMV. Winter squash represented by butternut (*Cucurbita moschata*), and buttercup, Hubbard and kabocha (*Cucurbita maxima*) are not usually bothered by any of the viruses mentioned, although they may express symptoms on the foliage. By far the most susceptible cucurbits grown (*Cucurbita pepo*) and severely infected by viruses are all summer squash (yellow, zucchini and scallop types), pumpkins (all types) and winter squash (acorn, delicata, and spaghetti types).

### **Q: What determines why viruses are more of a factor for melons, summer squash, and pumpkins in any given year?**

A: Some virus infection probably occurs in these cucurbits every year, but what determines the severity of infection is the timing when plants are infected. The earlier that plants are infected, the greater the impact the virus will have on plant growth, the amount of symptoms produced on the fruit, and whether any fruit are even set. Thus, delaying the infection period by even a few weeks can have dramatic effects. In a wet

spring, potential aphid vector populations can be reduced, resulting in reduced virus spread.

**Q: How do these viruses get into the field?**

A: Migrant aphids (winged forms) in the spring are responsible for the introduction of four of the five viruses listed. Squash mosaic virus is occasionally seedborne in melons, and is vectored by cucumber beetles. The aphid-transmitted viruses (*Potyvirus*es and *Cucumovirus*es) are transmitted in a nonpersistent manner (also called stylet-borne), meaning that there is just enough virus on the stylets to infect 1 or 2 plants, after which time the aphid needs to find another infected plant in order to transmit the virus again. Migrant aphids probe the plant as a food source, testing by feeding less than 60 sec (often 10-30 sec), but this is sufficient time to infect (insert the virus) into a susceptible crop plant. Incidentally, aerial movement of powdery mildew and downy mildew spores works in the same way, but the spread occurs on air currents, resulting in infection on a wider, geographical scale.

**Q: Can insecticides be used to prevent or control virus spread by aphids?**

A: NO! Aphids can infect a plant in a matter of seconds, meaning that insecticides do not act quickly enough to prevent infection or control spread. Insecticides are used to prevent colonization of the crop, which would lead to sticky fruit (aphid honeydew) or sooty mold on fruit surfaces, both due to heavy colonization.

**Q: What are some methods that have been used to delay the infection of the crop and thus lead to a marketable fruit?**

A: 1) Although virus resistance only exists now in summer squash varieties (see below), choosing a resistant variety will slow down the spread of virus not only in squash, but potentially also in susceptible pumpkins if planted nearby. 2) Another method to reduce early infection is to cover the susceptible crop with floating row covers in the spring to prevent the early influx of viruliferous aphids (say in late May or early June). This has successfully been demonstrated in the NE, particularly with summer squash and melons. Crops that couldn't practically be covered, such as pumpkins, came down with virus while the protected crops remained essentially virus-free. 3) Use of reflective mulches (silver colored) can work to repel aphids with the reflectance of UV light, but we don't live in the desert where sunshine can be regularly expected. 4) The two most common viruses (CMV and WMV) have weed hosts reservoirs, which conceivably could be reduced at the beginning of the season. This has been shown to be effective on a case by case basis for other vegetable-virus complexes.

**Q: What are some common weed host reservoirs of virus diseases?**

A: The host range for CMV is extensive (at least 800 species), but most common sources for either or both CMV and WMV are the following: Shepherds purse (winter annual, both); Virginia pepper weed (occasionally biennial, WMV); field bindweed (perennial, both); dandelion (perennial, both); purple deadnettle (winter annual and flowers in spring, both); Canadian goldenrod (perennial, both). (see

<http://vegetablemdonline.ppath.cornell.edu/Tables/WeedHostTable.html> for a more complete list)

**Q: Are there any varieties that are resistant to virus diseases?**

A: YES! Accompanying this article is a list of summer squash varieties which carry resistance/tolerance to the four major virus diseases. The degree of resistance is as follows: Genetically engineered (GE, also called transgenic) is the highest level of resistance present. This is followed by intermediate resistance (IR) added to the plant by conventional plant breeding. Yellow squash varieties can have the presence of the precocious gene, which acts to mask color breaking in squash (turning from normal yellow to green) when the plant is infected with either CMV or WMV, alone or in combination. The feature does not work if the plant becomes infected with either PRSV or ZYMV. Some of these varieties also carry intermediate resistance to the fungus powdery mildew.

**Q: Is there an advantage of growing either transgenic or intermediate resistant squash or both, along with squash without resistance (susceptible)?**

A: Yes, since infection at the beginning of the season is a numbers game, the more opportunity for a viruliferous aphid (one carrying virus) to loose the virus on a resistant plant, the less likely it would retain virus to infect the susceptible plants, which would ultimately leading to a virus epidemic.

**2008 Summer Squash Varieties by Category for virus resistance (GE), intermediate resistance (IR), Precocious gene (Yellow types) and Powdery mildew tolerance (IR)**

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**1.) Yellow Straightneck** (Developer), (Details), (Seed Source)

Cougar (HM) (**Prec.** For CMV, WMV, **IR** for PRSV, ZYMV) (Har)

Lioness (HM) (**IR** for CMV, WMV, PRSV, ZYMV) (Har, SW)

Multipik (HM) (**Precocious gene**, masks fruit symptoms of CMV, WMV) (Har, Joh)

Superpik (HM) (**Precocious gene**, masks fruit symptoms of CMV, WMV) (Har)

Conqueror III (S) (**GE**, CMV, WMV, ZYMV, **IR** for PRSV) (SW)

Daisy (S) (**IR** PM) (Rup)

EX 1832 III (S) (**GE** & **Precocious gene** for WMV, CMV, ZYMV) (Rup, SW)

Gen. Patton (S) (**IR** PM, **Prec.**, masks fruit symptoms of CMV, WMV) (Rup, Sto)

Liberator III (S) (**GE** res. for CMV, WMV, ZYMV) (Rup, SW)

Patriot II (S) (**GE** res. for WMV, ZYMV, **IR** for PM) (Joh, Rup, Sie)

Seneca Supreme (S) (**Precocious gene**, masks fruit symptoms of CMV, WMV)

Sunbar (S) (**Prec.**, masks fruit symptoms of CMV and WMV) (Rup)

Sunray (S) (**Prec.**, masks fruit symptoms of CMV and WMV; **IR** PM). (Har, Joh, Rup, Sie, Sto, SW)

Fortune (RS) (**Prec.**, masks fruit symptoms of CMV, WMV) (Rup, Sie, Sto, SW)

Precious II (AC) (**Precocious gene**, masks fruit symptoms of CMV, WMV) (AC)

Zephyr (J) (**green-tip**) (**Precocious gene**, masks fruit symptoms of CMV, WMV) (Joh)

**Other Straightneck Yellow** (Developer), (Details), (Seed Source)

Early Prolific Str. Neck (H) (None) (Rup, SW)

Enterprise (RS) (None) (Rup, Sie, SW)

Goldbar (S) (None) (Rup, Sie)

Saffron (H) (None) (Rup)

2.) **Yellow crookneck** (Developer), (Details), (Seed Source)

Destiny III (S) (**GE**, CMV, WMV, ZYMV) (Rup, SW)

Gold Star (RS) (**IR**, PM, CMV) (Sie, SW)

Prelude II (S) (**GE**, WMV, ZYMV, **IR** PM) (Rup, SW)

Prelude (S) (**IR** PM)

Supersett (HM) (**Prec.**, masks fruit symptoms of CMV, WMV) (Har)

**Other Yellow Crookneck Squash** (Developer), (Details), (Seed Source)

Dixie (S) (None) (SW)

Gentry (RS) (None) (Joh, Sie, SW)

Horn of Plenty (H) (None) (Rup)

Medallion (AC) (None) (AC)

Sunbrite (RS) (None) (SW)

Sunglo (RS) (None) (Rup)

3.) **Specialty Summer Squash** (Color & Shape - Globe, Scallop)

One Ball (H) (**Yellow** [occasional **green**], globe) (**IR**, WMV, ZYMV) (Rup, SW)

Cue Ball (H) (**Lite green zucchini**, globe) (**IR**, WMV, ZYMV) (Rup, SW)

Eight Ball (H) (**Green zucchini**, globe) (None) (Har, Joh, Rup, Sie, Sto, SW) (**Note: Very susceptible to bacterial wilt. Cucumber beetle control very important.**)

Sunny Delight (S) (**Yellow**, Scallop) (**Prec.** to mask fruit sym. of CMV and WMV) (Sto)

Barq (HM) (**Lite Green, Zucchini**) (none)

Flying Saucer (HM) (**Multi** color, Scallop) (None) (Har, Joh)

Papaya Pear (S) (**Yellow**, pear) (None) (Har, Rup, Sto)

Peter Pan (**Lite green**, Scallop) (None) (Har, Sie, SW)

Starship (RS) (**Green**, Scallop) (None) (Joh, Sto)

Sunburst (RS) (**Yellow**, Scallop) (None) (Har, Joh, Rup, Sie, SW)

(See also Golden and Grey Zucchini)

4.) **Zucchini Green Squash** (Developer), (Details), (Seed Source)

Bobcat (HM) (**IR**, WMV, PRSV, ZYMV) (Sto)

Elegance (HM) (**Dark green**) (**IR** PM, WMV, ZYMV)

Felix (HM) (**IR**, PM, PRSV, ZYMV) (Har,

Jaguar (HM) (**Dark green**) (**IR**, WMV, ZYMV) (Har)

Leopard (HM) (**IR**, PRSV, ZYMV) (Har, Sto, SW)

Lynx (HM) (**IR**, PRSV) (Sto, SW)

Prestige (HM) (**Dark green**) (**IR**, PM)

Reward (HM) (**IR**, PM, CMV, WMV, ZYMV) (SW)

Tigress (HM) (**IR**, WMV, PRSV, ZYMV) (Har, Joh)  
Wildcat (HM) (**IR**, PM, PRSV, ZYMV) (SW)

CashFlow (RS) (**IR**, ZYMV) (Joh, Rup, Sie, Sto, SW)  
Contender (RS) (**Dark green**) (**IR**, WMV, ZYMV) (Sie)  
Dividend (RS) (**IR**, CMV, WMV, ZYMV) (Rup, Sie, SW)  
Envy (RS) (**IR**, PM, ZYMV) (Sie)  
Equinox (RS) (**Dark green**) (**IR** PM, WMV, ZYMV)  
Payroll (RS) (**IR**, PM, WMV, ZYMV) (Rup, Sie, Sto, SW)  
Noche (RS) (**Dark green**) (**IR**, WMV, ZYMV) (Sto)  
Revenue (RS) (**IR**, CMV, WMV, ZYMV) (Sto)

Declaration II (S) (**GE**, WMV, ZYMV) (Rup)  
Independence II (S) (**GE**, WMV, **Int.** ZYMV) (Rup, Sie)  
Judgement III (S) (**GE**, CMV, WMV, ZYMV) (Sie, SW)  
Justice III (S) (**GE**, CMV, WMV, ZYMV) (Rup, Sie)  
Magnum (**IR** WMV, ZYMV) (SW)  
Quirnal (S) (**IR**, PM, WMV, ZYMV)  
Radiant (S) (**IR**, PM, CMV, ZYMV) (Sto)  
Zucchini 718 (**IR** CMV, ZYMV) (SW)

#### **Other Green Zucchini (no resistance)** (Developer), (Details), (Seed Source)

Agriset 843 (None) (SW)  
Ambassador (S) (None) (Rup, Sto)  
Black Zucchini (None) (Rup)  
Dark Green Zucchini (None) (Rup)  
Embassy (S) (None) (Rup)  
Green Eclipse (None) (SW)  
Senator (S) (None) (Rup, Sto)  
Spineless Beauty (RS) (None) (Har, Rup, Sie, Sto, SW)  
Zucchini Elite (HM) (None) (Har, Joh)

#### 5.) **Zucchini Grey (Middle East types, Lebanese)**

Cancun (H) (**IR**, PRSV, ZYMV) (Rup)  
Citlali (HM) (**IR**, PM, ZYMV)  
Ishtar (H) (**IR**, WMV, ZYMV) (Sie, SW)  
Terminator (S) (**IR**, WMV, PRSV, ZYMV)  
Clarita (None) (Sto)  
El Capitan (None) (Rup)  
Magda (None) (Joh, Rup)

#### 6.) **Zucchini Yellow or Golden** (Developer), (Details), (Seed Source)

Golden Arrow (HM) (**IR**, WMV, PRSV, ZYMV)  
Golden Delight (RS) (**Dark yellow**) (**IR**, WMV, ZYMV) (Rup, Sto, SW)  
Golden Rod (HM) (**Golden yellow**) (**Precocious** gene) (Har)  
Sebring (H) (Golden) (**IR**, PM) (Joh, SW)

**Other Yellow Zucchini (no resistance or tolerance)**

49er (**Deep gold**) (None) (Rup)

Golden Dawn III (RS) (**Dark yellow**) (None) (Rup, Sto)

Goldfinger (None) (Sto)

Gold Rush (S) (None) (Har, Joh, Rup, Sto)

Sources of resistance: AC = Abbott & Cobb; H = Hollar; J = Johnny's; HM = (Harris Moran); RS = Rogers Seed; S = Seminis.

Sources of seed: AC = Abbott & Cobb; Har = Harris, Joh = Johnny's; Sie = Siegers, Sto = Stokes, SW = Seedway