

## **New Developments in Organic Plant Disease Management**

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New resistant varieties and organic fungicides have become available recently for managing diseases in vegetable crops. These tools can be valuable additions to a foundation disease management program of practices with less potential for change, including land rotation and crop health. While these new developments are almost always useful, occasionally an important new development to be aware of is loss of effectiveness of resistant varieties due to pathogen evolution.

Several new resistant varieties are now available. More companies are marketing organic seed, and non-treated seed is now more readily available especially when requested well in advance of the growing season. Thus with more resistant vegetable varieties and greater availability, this important tool is becoming more usable for organic producers. Lists of resistant vegetable varieties are at: <http://vegetablemendonline.ppath.cornell.edu/Tables/TableList.htm> . Selections of new varieties are listed below.

Tomato varieties with resistance to late blight are Defiant (Johnny's Seeds), Mountain Magic (Seedway), and Plum Regal (Seedway). This is an especially valuable development considering this disease has been occurring more often in the northeast, and it is the most destructive and most difficult disease to manage. These varieties have exhibited a high level of resistance to pathogen strains present recently in the northeast. Developing new late blight resistant varieties is a focus of several breeding programs. The focus at Cornell University is to develop varieties that are also resistant to early blight and Septoria leaf spot.

High Mowing Seeds has several new resistant varieties: Jade bean (resistant to BCMV, curly top virus, rust), Coban bean (anthracnose, BCMV), Capture F1 cabbage (black rot, Fusarium yellows), Tipoff F1 romanesco cauliflower (Fusarium yellows), Calypso F1 celery (Fusarium wilt), Socrates F1 cucumber (powdery mildew, scab), Adam F1 and Calypso F1 cucumber (powdery mildew, downy mildew, CMV; also anthracnose and angular leaf spot for Calypso), Caribbean Gold F1 melon (powdery mildew, Fusarium wilt races 0,1,2), Olympus F1 pepper (bacterial leaf spot races 1-3), Catriona F1 pepper (TMV races 1-3), Milena F1 pepper (potato virus Y, TMV race 0, TSWV), Dunja F1 zucchini (powdery mildew, ZYMV, WMV, PRSV), Montesino F1 tomato (Fusarium wilt race 0, TMV), Toronjino F1 tomato and Sakura F1 tomato (Fulvia fulva races 1-5, Fusarium wilt races 0,1, TMV). Also there are several varieties resistant to multiple races of downy mildew of lettuce (Bolsachica, Boulder, Defender, Gaviota, Lovelock, Spock, Spretnak, and Sulu) and of spinach (Regiment F1, Palco F1, Pigeon F1, and Corvair F1).

Outstanding Seeds has several new pumpkin varieties with homozygous\* resistance to powdery mildew (\* resistance from both parents), which generally provides better suppression of this common disease than heterozygous or intermediate resistance. This company markets only non-treated seed.

New resistant varieties from Seedway include: Ambition, Opportune and Wyatt bean (resistant to BCMV; Wyatt is also resistant to 3 bacterial diseases); Expat and Typhoon YR cabbage (Fusarium yellows); Pay Dirt, Profit, Ka-Ching, and Silver Duchess sweet corn (Stewart's wilt and common rust; most also northern corn leaf blight); Python cucumber (several diseases); Ashley and Rakaia spinach (downy mildew, white rust); Napoli Tuscan, Fantasia and Samoa (harper type) melon (Fusarium wilt and powdery mildew; Podi virus also for Napoli); Dewlightful honeydew (powdery mildew); Archimedes bell pepper, Natasha sweet banana pepper and Ciclon jalapeno (bacterial spot; Phytophthora blight also for Archimedes), Delirio orange bell pepper (TSWV); Apollo, Cougar and Earlipack pumpkin (powdery mildew); Bigdena (greenhouse tunnel), BSS 832, Red Deuce, Monticello roma, Red Bounty, Solid Gold yellow grape, Sweet Treats pink cherry, Tachi roma, Volante tomato (Fusarium wilt; most have several other diseases as well); Dynasty diploid allsweet, Valentino diploid allsweet and Distinction triploid crimson watermelon (anthracnose and Fusarium wilt).

New resistant varieties from Siegers include: Dominator and Mongoose cucumber (several diseases); Archimedes and Intruder bell pepper (bacterial spot; Phytophthora blight); numbered pepper lines (10 bacterial spot races and TSWV); 7143 sweet corn (high resistance to common rust, Stewart's wilt, northern corn leaf blight); Charger and Tachi roma tomato (several diseases including Fusarium and Verticillium wilt); Sweet Polly and Super Pollenizer-5 watermelon (anthracnose and Fusarium wilt); Spineless Perfection zucchini (powdery mildew and virus).

There are new organic copper fungicides effective at lower rates of metallic copper equivalent than products developed previously. This is important considering concerns about copper effects on beneficial organisms and copper accumulation in soil. Badge X2 (Isagro-USA) is 23.8% copper oxychloride and 21.5% copper hydroxide in a dry flowable formulation; metallic copper equivalent is 28% by weight. It was registered and OMRI listed in 2009. A liquid formulation is not OMRI listed yet. The rationale behind having a combination is that copper oxychloride has better longevity and crop safety while copper hydroxide has faster action. Cueva (Certis USA) is 10% copper octanoate; metallic copper equivalent is 1.8% in a liquid flowable formulation. Nordox 75 WG (Brandt Consolidated) is 84% cuprous oxide; metallic copper equivalent is 75%. Nu-Cop HB (Agri Star) is 77% copper hydroxide; metallic copper equivalent is 50%. Rate range for tomato in lb product/A (lb metallic copper equivalent) is 0.75-1.75 (0.21-0.49) for Badge, 1-2 (0.5-1) for NuCop HB, and 2-4 (1-2) for NuCop 50WP.

There are new microbial fungicides and biochemical fungicides containing naturally occurring substances now available or expected in the near future. Most products of these types are defined by EPA as biopesticides because they are derived from natural materials. Recognizing that biopesticides tend to pose fewer risks than conventional pesticides, EPA has been encouraging their development and use. EPA generally requires less data to register a biopesticide than a conventional pesticide, but enough data about the composition, toxicity, degradation, and other characteristics of the pesticide to ensure that the product will not have adverse effects on human health or the environment. EPA can conduct the registration process more quickly with biopesticides, often taking less than a year, compared with an average of more than 3 years for conventional pesticides. Some biopesticides are defined as minimum risk pesticides through FIFRA Section 25(b) rule because their active and inert ingredients are generally recognized as safe (GRAS). These consequently are exempted from the regulation

requirements of FIFRA and thus can be used on any labeled crops for any target since they do not need to be registered as a pesticide. 'Exempt from EPA registration' is stated on the label of these products. A description of some new products follows.

Regalia (developed by Marrone Bio Innovations) has a unique mode of action that induces disease resistance to several fungal and bacterial diseases in treated foliage. The active ingredient is an extract of *Reynoutria sachalinensis* (giant knotweed). The organic formulation, the only one now being sold in the US, was introduced in early 2010. New uses under recently issued 2ee label amendments include using Regalia applied in the transplant water or as a soil drench when transplanting tomatoes, peppers and cucurbits. A new label is expected in spring 2012 that will include drip irrigation applications.

Tenet (developed by Isagro and marketed by Sipcam) contains two beneficial fungi (*Trichoderma asperellum*, *Trichoderma gamsii*) with different modes of action against soil-borne pathogens (*Phytophthora capsici*, *Rhizoctonia*, *Pythium* and *Verticillium*) to control root and crown rot diseases.

Serenade Soil (developed by AgraQuest) is a new formulation of Serenade for application to field soil to manage soil-borne and seedling diseases caused by fungal pathogens (*Rhizoctonia*, *Pythium*, *Fusarium*, *Verticillium*, and *Phytophthora*).

MeloCon WG (developed by Certis USA) is a biological nematicide. The active ingredient (*Paecilomyces lilacinus* strain 251) is a naturally occurring beneficial soil fungus that attacks many species of plant parasitic nematodes at all stages, including eggs, nymphs, and adults. It is labeled for use in many different vegetable crops and can be applied to the soil in several ways, including plant hole drench, through drip irrigation, or sprayed onto the surface of the soil and incorporated. There is no restriction on the number of applications applied per crop.

TriTek (developed by Brandt Consolidated) is a new formulation of Saf-T-Side. Active ingredient is petroleum oil. It is a spray oil emulsion that functions as a fungicide, insecticide, and miticide.

AgriPhage is an interesting biological approach to managing bacterial diseases using bacterial viruses (aka bacteriophage or phage) that attack these pathogens. The organic product for tomato bacterial speck and spot is anticipated to be available before year end. The registration package for a product for black rot in cruciferous crops will be submitted soon. New formulations are more general than in the past when the company would use diseased tissue from the crop to be treated to develop a targeted product for the pathogen strain(s) present. AgriPhage is recommended applied once a week, more often (2 to 3 times) when disease pressure is high. It can be tank mixed with most organic fungicides and insecticides except copper or Oxidate as these will kill the virus. OmniLytics, Inc. is the company developing and directly marketing these products.

Please Note: The specific directions on fungicide labels must be adhered to -- they supersede these recommendations, if there is a conflict. Before purchase, make sure product is registered in your state and approved by your certifier. Any reference to commercial products, trade or brand names is for information only; no endorsement is intended.