

Biopesticides for Managing Diseases of Vegetable Crops

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Biopesticides are defined by EPA as pesticides derived from natural materials. There are three types. Biochemical pesticides contain naturally occurring substances that control pests. Substances that control diseases include potassium bicarbonate, hydrogen dioxide, phosphorous acids, plant extracts, and botanical oils. Microbial pesticides contain microorganisms that function as biocontrol agents, affecting the pathogen directly or indirectly through the compounds they produce. Plant-incorporated protectants or PIPs are the least common type of biopesticide. These are pesticidal substances produced by plants that contain genetic material added to the plant often through genetic engineering. The genetic material and the protein it encodes, but not the plant itself, are regulated by EPA. Examples are virus-resistant varieties producing the virus coat protein, which covers virus particles after infection preventing their replication. More information about biopesticides plus lists of active ingredients and products are on the web at <https://www.epa.gov/pesticides/biopesticides>. There are also biopesticides for managing weeds and insect pests.

Biopesticides have advantages. Their activity generally is targeted to pests and closely related organisms, and they are usually inherently less toxic than conventional pesticides, thus they do not have the same potential to affect birds, beneficial insects, and mammals (there are exceptions, so check the label when this is a major reason for choosing biopesticides). And thus they typically have short REI and PHI. They generally decompose fast and sometimes are effective in small quantities, thus exposure is lower and potential pollution problems are avoided. 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. To facilitate their registration, the Biopesticides and Pollution Prevention Division was established in the Office of Pesticide Programs in 1994. 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.

Limited data on efficacy of biopesticides can be considered their main disadvantage. Data documenting efficacy is not considered when making decisions about registration of pesticides in the USA. Many biopesticides are produced by small companies lacking the R & D funds to support field trials to obtain efficacy data by experienced university and other independent researchers. To help fill this gap, the IR-4 Biopesticide and Organic Support Program funds grants to obtain efficacy information for biopesticides in development as well as those already registered. These funded projects help the program meet its objective, which is to further the development and registration of biopesticides for use in pest management systems for specialty crops (which include all vegetables) or for minor uses on major crops. Information about this program, plus databases of labels and projects are at: <https://www.ir4project.org/bpos/>.

Several biopesticides have proven effective for diseases affecting vegetable crops. Powdery mildew is perhaps the easiest foliar disease to manage with biopesticides. It can be controlled

with several different biopesticides, including botanical oil (Organocide, Mildew Cure, etc), potassium bicarbonate (Kaligreen, MilStop), and microbes (Actinovate, Serenade, Sonata, etc).

Most biopesticides are approved for organic production and most products approved for organic production are biopesticides, thus they have a logical excellent fit for managing diseases in organic crops. However, some formulations are not approved, which can be due to inerts. For example, the potassium bicarbonate products EcoMate Armicarb O, Kaligreen and MilStop are approved whereas Armicarb is not. Also, some biopesticidal substances are not allowed under NOP (National Organic Program), for example phosphorous acids and genetically-engineered PIPs. Additionally, there are important organic fungicides that are not biopesticides, including mineral oils, copper, and sulfur. Biopesticides break down in the environment, thus there is no concern about build-up in soil as with copper, which is an element. However, biopesticides generally do not have the breadth of activity, efficacy, or residual activity of copper; thus it is important to obtain information about these factors and to know the target disease(s) when selecting biopesticides. The earlier in disease development that applications are started, the more effective the product will be. This is not unique to biopesticides. Fungicides cannot eradicate established lesions.

Some biopesticides, notably LifeGard, Regalia and Serenade, have induced plant resistance as a mode of action. These need to be applied before infection for this activity to be effective.

Biopesticides also have a place in conventional fungicide programs. Many have contact activity and could be used in place of conventional contact fungicides, which include chlorothalonil, copper, mancozeb and sulfur. There are several biopesticides labeled for bacterial diseases, for which there are few conventional fungicide options and the standard, copper plus mancozeb, is not highly effective because these are contact materials and bacteria are able to develop resistance to copper. Actigard, a plant defense activator, and phosphorous acid fungicides are biopesticides for conventionally-grown crops; their ingredients are synthetic and thus not acceptable for organic crops.

Please Note: The specific directions on fungicide labels must be adhered to -- they supersede these recommendations, if there is a conflict. If you are farming organically, 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.

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