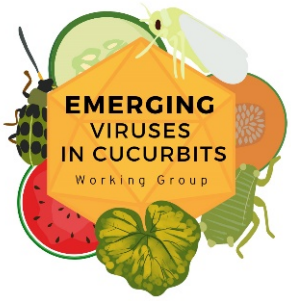
Reducing Virus Spread in Cucurbits: Recommended Practices for the Seed and Transplant Industry



Numerous cucurbit-infecting viruses can negatively impact cucurbit seed and transplant production by reducing outputs. The need for rigorous phytosanitary protocols, disease management programs, and seed testing to limit virus spread, effectively manage diseases and insect vectors of viruses, and meet virus-free certification standards increases labor needs and production costs. While seed- and mechanically-transmitted viruses are generally the primary production and trade concerns in the seed and transplant industry, insect-transmitted viruses also pose significant risks. For example, transplants infected with the sweetpotato whitefly (*Bemisia tabaci*)-transmitted viruses cucurbit chlorotic yellows virus (CCYV), cucurbit yellow stunting disorder virus (CYSDV), and watermelon chlorotic stunt virus (WmCSV) may not exhibit symptoms until two to three weeks after infection. Low virus titer in newly infected plants may also result in false negatives. During the latent period between infection and symptom expression, infected seeds or transplants could easily be shipped, sold, and planted in production fields, resulting in potentially detrimental losses for farmers and/or introduction of viruses into production fields, regions, or countries where they did not previously exist. Since these scenarios impact the entire cucurbit industry, from growers and consumers to breeders and seed/transplant production companies, it is in the industry's best interest to diligently follow production and virus/vector management practices that reduce the risk of virus spread and introduction to new areas.

Be familiar with the cucurbit-infecting viruses that occur in areas where cucurbit seeds and transplants are produced.

Knowledge is power! Learn about the endemic and established viruses of concern in a production area. Be able to recognize the symptoms caused by those viruses. Know how those viruses are spread (mode of transmission; e.g., seeds, mechanically, vectors) and how they survive from planting to planting or season to season (e.g., reservoir hosts, infested soil, contaminated tools). Be able to identify their vectors and the reservoir hosts that occur in the production area.

Be familiar with exotic cucurbit-infecting viruses that are potential threats for introduction.

Ignorance is *not* bliss! Plant material, including non-cucurbit crops, frequently moves across state, regional, and national borders; sufficient requirements for movement of these materials may not be in place to properly prevent the movement of viruses or their viruliferous vectors from moving along with that material. Furthermore, vectors are not restricted by borders. Learn about viruses of concern in locations from which plant material is received. Be able to recognize the symptoms caused by those viruses. Know how those are viruses spread and how they survive from planting to planting or season to season. Be able to identify their vectors and the reservoir hosts that occur in the production area.

Scout regularly for virus symptoms in seed production fields and transplant production facilities.

Depending on the virus, symptoms may take two to three weeks to develop in infected plants. Regularly scout plants in production fields and transplant facilities for virus symptoms. Scout at least twice weekly; increase scouting frequency when insect vectors or potential virus symptoms are observed.

Routinely screen/test for viruses of concern during seed and transplant production.

Target appropriate viruses for testing. Routinely screen/test plants for the cucurbit viruses known to occur in the seed/transplant production area. Test symptomatic plants, but consider random screening of asymptomatic plants, particularly if insect vectors have been observed, to increase capacity for early detection and improve response time. Be prepared – have the appropriate assays and positive controls on hand – to test for the viruses most likely to be introduced.

Use appropriate diagnostic assays for virus screening/testing. Sensitivity, specificity, reliability, and efficiency are critical when choosing a diagnostic assay for virus screening/testing. Be aware of the limitations for each diagnostic assay, and choose an assay that is appropriate for each target virus. Secondary confirmation using a different assay or DNA sequencing may be necessary.

Consider the possibility of mixed infections. Mixed infections can occur and are becoming increasingly common, with some plants being infected by three or more viruses. Because many viruses cause similar symptoms, it is not possible to determine how many viruses may be present in a plant based on symptoms alone. Diagnostic assays that can simultaneously detect multiple viruses in a sample should be used whenever possible to streamline screening/testing. However, multiple independent diagnostic assays may be necessary depending on the viruses being targeted.

Use appropriate virus and vector management practices in seed production fields and transplant production facilities.

Integrated pest management (IPM), which uses a combination of pest management practices along with scouting, action thresholds, and evaluation, should be implemented for virus and vector management.

Choose appropriate planting times and locations. Adjust planting times (e.g., early planting or shifting seasons) to avoid large vector populations and high virus pressure. Avoid planting production fields next to crops that are known virus or vector reservoirs. Avoid planting new production fields next to existing fields with known virus or vector infestations. If viruses are not known to be present, but insect vectors are present, treat the existing field, when possible, with an appropriate insecticide to suppress the vector populations prior to installing the new planting. Provide temporal separation between early- and late-planted fields to reduce overall virus pressure.

Practice strict phytosanitary protocols. Mechanically-transmitted viruses pose a unique threat for production facilities where hands-on production practices can easily spread viruses among planting material and throughout facilities. Develop appropriate handling, cleaning, and sanitation protocols; ensure employees receive appropriate protocol training; and promote strict adherence to protocols. Keep detailed records; practice routine virus testing; and design an action response plan that all employees are familiar with and can implement quickly should the need arise.

Suppress insect vector populations. Vector presence and prevalence influence virus incidence and spread. Use appropriate management practices to suppress insect vector populations. Effective practices may target exclusion (e.g., use of row covers, use of insect-proof mesh on indoor transplant facilities), eradication (e.g., removal of non-target hosts), avoidance (e.g., use of reflective mulch), and/or protection (e.g., production in indoor facilities, use of effective insecticides). Follow local insecticide recommendations that consider known resistance issues, and practice insecticide resistance management.

Manage volunteer cucurbits and weeds. Volunteer cucurbits or other agricultural crops as well as many common weeds can serve as virus or vector reservoirs. Rogue potential reservoir hosts from within and near production fields to reduce primary sources of viruses and insect vectors.

When possible, shift transplant facilities to the region where plants will be grown for production.

Producing transplants in the region where they will be grown for production can help reduce the risk of introducing a virus into a region where it currently does not exist.

Inspect transplants for virus symptoms and insect vectors prior to shipment or export.

Transplants should be visibly free of virus symptoms and insect vectors prior to shipment or export. Do not ship or export transplants if viruses have been detected in transplant facilities or if transplants exhibit symptoms without first performing sufficient virus detection assays to confirm that transplants intended for shipment or export are free of viruses.

Encourage growers to monitor plants for virus symptoms the first few weeks after planting/transplanting and submit suspect samples for testing.

Screening/testing is necessary to reduce the risk of virus spread through seeds and transplants. However, even with robust screening/testing, it may still be possible for viruses to escape detection, especially if a virus is not being targeted with testing. Encourage growers to inspect transplants upon receipt, monitor plants for potential symptoms the first few weeks after seedling emergence and/or transplanting, submit suspect samples for diagnostic testing, and immediately notify suppliers of virus or vector issues so that appropriate investigation and action may be taken to prevent further virus spread.

Maintain good relations with fellow producers and industry partners, and regularly discuss observations and production concerns.

We are ONE industry! Regular communication with fellow producers and industry partners, including research scientists and Extension specialists, can help increase widespread awareness and knowledge of cucurbit virus threats and best management practices for success. The goal is to reduce the rate of virus spread, improve virus disease and vector management, and be successful in cucurbit production. Each component is necessary for sustainable cucurbit production.

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