Grower 101:

PREVENTION

Before Problems

Cleaning and disinfecting the greenhouse can save you money, prevent disease outbreak and help you grow quality crops.

By Rob MacMullin and Wes Martin

Profitability in the greenhouse industry relies on high yields, innovative methods of production, new plant varieties, structural design, environmental controls, marketing, shipping and much more. Integrated Pest Management (IPM) programs play a key part towards insuring continuous crop yields and profitability. Most growers practice some form of IPM with various results reported from one operation to the next. This leaves us to wonder, is IPM alone enough? Many growers have also turned to sanitation methods to try and control the spread of greenhouse bacteria, fungi and virus. And, as above, growers have reported mixed results.

VARYING RESULTS

Examination of a common greenhouse operation gives a good indication of where potential problems and pests tend to accumulate. In all instances, organic load or mineral deposits are the key contributing factor. Organics and minerals can be safe havens for bacteria, fungi and viruses, making it seem impossible to completely disinfect and stop the spread of disease from one crop to the next.

Disinfectants are developed to kill specific organisms in certain applications, and in most circumstances, they do their job well, provided the conditions are right. When disinfectants are tested they are trialed in sterile laboratories with perfect conditions. In general, disinfectants are tested on clean surfaces. Disinfectants have no tolerance for organic material and can be greatly affected by mineral deposits. The following is a partial list of some common disinfectants used in greenhouses today.

COMMON DISINFECTANTS

Steam. Although some growers still use steam, the numbers are thought to be limited and continue to diminish as new products and methods are discovered. The use of steam in a sanitizing process has limited applications. It is generally expensive, compared to alternatives, and it is difficult to regulate and monitor contact temperature and time. Furthermore, the byproducts of steam condensation can complicate cleaning in growing operations.

Bleach (Sodium Hypochlorite). Chlorine compounds are broad-spectrum germicides that act on microbial membranes, inhibit cellular enzymes involved with production of glucose, have a lethal effect on DNA and oxidize cellular protein. Chlorine has activity at low temperatures, is relatively inexpensive and leaves minimal residue or film on surfaces.

The major disadvantages of bleach are the corrosiveness to many greenhouse metal surfaces, especially at higher temperatures, and the activity of chlorine is dramatically affected by such factors as pH, mineral deposits and especially organic load. Employee health and safety is another major concern when working in confined areas, as skin irritation and mucous membrane damage are sometimes possible. At low pH (below 4.0) very toxic gases are given off.

Quaternary Ammonium Compounds (QACs). QACs are active and stable over a broad temperature range because they are surfactants; they have some detergency. This means they are less affected by organic soil load than other sanitizers, and in an industry of mostly organic soils this can prove to be a benefit. However, heavy soil can dramatically decrease the germicidal activity of QACs. Many different formulations of QACs are available today, yet it is important to use one that is hard water tolerant and developed for use in a greenhouse environment. QACs are effective against bacteria, yeast, algae, mold and viruses.

Hydrogen Peroxide (HP). While widely used in the medical field, HP has found only limited applications in the greenhouse industry. Approvals have been granted for HP use for sterilizing equipment, irrigation and hard surface applications. The primary mode of action for HP is through creating an oxidizing environment and generation of super oxide oxygen (SO). HP has a fairly broad spectrum with slightly higher activity against gram-negative than gram-positive organisms. Like bleach, HP has no tolerance to organic material and can be corrosive to structures and equipment. High concentrations of HP (5 percent and above) can be an eye and skin irritant.

CLEANING

The process of cleaning prior to disinfecting a greenhouse and equipment is often overlooked, leading to the buildup of soils and mineral deposits, which affect the germicidal activity of many disinfectants. Soil can be visible or invisible and acid or alkali. The primary source of soil comes from the products that are grown and handled within a given operation. Also, minerals from water residue, algae growth, nutrient solutions and cleaning compounds contribute to films left on surfaces and provide safe haven for insects, bacteria, fungi and viruses.

An example of this would be algae under benches. Algae holds moisture and attracts insects, which carry disease from one growing area to another. If the algae are removed with a cleaner while the greenhouse is empty and a ➧

Top to bottom: A clean, disinfected and ready-to-use greenhouse; growing blocks awaiting new seedlings in a sterile propagation house; poinsettias flourishing in a disease-free environment; clean and clear flood floor and gable wall. (Photos courtesy of Pace Chemicals Ltd.)

disinfectant with residual germicidal activity (QACs) is applied, the algae growth will be inhibited and the insect activity will be lessened in that area. However, if the algae are only sprayed with a disinfectant, the germicidal activity will be used up rapidly leaving spores behind to possibly infect the new crop.

Irrigation systems are another major source of contamination. Mineral deposits and organic growth contribute to the accumulation of bio-film contamination that is very difficult to remove with a disinfectant alone. Studies and trials have proven that cleaning and disinfecting the entire irrigation system is the only sure way to dissolve these deposits and kill the spores that hide within them.

Without proper cleaning and disinfecting procedures, pest pressure continues to grow and areas of infection need to be sprayed with fungicides, herbicides and insecticides. The chemical costs, labor and loss in crop yield are many times the cost of cleaning and disinfecting an area of the greenhouse.

HACCP

Over the past several years, Hazard Analysis and Critical Contact Point (HACCP) programs have been adopted and integrated in food manufacturing and the greenhouse vegetable industry. HACCP programs are tailored to systematically identify Critical Control Points (CCP) where pathogens have the best possibility of establishing and spreading. This should be the first and last step of any IPM program — controlling disease spread, improving crop health and enhanced worker safety. Once the areas in the greenhouse have been assessed for their ability to harbor disease, a cleaning then disinfecting procedure must be employed to prevent contamination.

Monitoring a HACCP program is almost as important as having one. When growers monitor the program and continually re-evaluate it, the program can then be revised until it is a system that best fits within the regular day to day operation of the greenhouse.

When we monitor the results from a HACCP-style cleaning and disinfecting program in a greenhouse, the results are clear. There is less disease accumulation, less organic loads such as algae, less build up of mineral deposits on equipment and structures, and in the irrigation there is less stagnant water for insects to lay larvae. Surfaces such as concrete, glass, aluminum, poly and wood stay cleaner longer when cleaned on a regular basis.

Disease problems or trouble spots are common to all horticultural operations, and implementation of a HACCP style program in ornamentals, potted plants, vegetables or nursery stock can prove to be a fast, affordable way to lessen disease pressure, increase worker safety and ultimately ship a healthier, better product to market. GPN

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