

Biological Controls of Diseases

HOW CAN YOU MAKE USE OF THESE TINY CHEMICAL FACTORIES?

By A.R. Chase

When I started at the University of Florida in the early 1980s, we had no effective products for biological control of diseases. It was the time frame when many of our industry standard fungicides were being developed including chlorothalonil, benomyl and fosetyl-Al. This was the beginning of development of more targeted chemical fungicides which was in a way phase 2 of products for disease control. Phase 1 was the chemical revolution with the advent of broad-spectrum fumigants and fungicides (like captan and mancozeb) which allowed us to continue along on our merry way to producing huge monocultures without the very natural and predictable development of disease epidemics. We should recognize that without this revolution, there would be a lot fewer of us around due to food shortages.

The fact that by the end of the 1980s we had realized the broad-spectrum chemical approach was tough on the environment (all of it — not just us) led to development of more narrow-spectrum chemicals with fewer obvious side-effects. But the key here is obvious side effects. It takes a long time to find out what side effects may be since they are aptly named. They are side effects and we are looking at main effects of controlling a disease. We have a long list of possible bad side

effects that producers must evaluate now (from fish to quail to pollinators) before a new product is labeled at EPA. The list of tests may seem oppressive to manufacturers of new products. But we can never know what to look for if we have not seen something before. We cannot know what we don't know.

That time has come and gone for most of us and we are entering a time when true IPM will be practiced using biological, chemical, physical and cultural controls to manage diseases. Any way you look at it, growers must use every tool available to produce high-quality, sustainable crops. Our expectations for biological control products are sometimes not as high as for standard synthetic products. We have become reliant on what these narrow spectrum, highly active chemicals do in our monocultures produced in a protected greenhouse environment. How about incorporating biological control agents into effective plant production systems? Very few of us are still expecting to stop using simple synthetic chemicals entirely.

To be successful, you must agree to look at BCAs without preconceptions about what they do. One of the things I have been thinking about is chemistry as it relates to BCAs. Do you realize that even BCAs are made of chemicals — as are we — and they produce an array of chemicals? As chemical factories they affect pathogens like fungi and bacteria in

many ways (many of which we are not currently aware). This complexity available only from biological sources is what I am most interested in at this point.

Using BCAs successfully is becoming a more common story within the horticultural industry (see sidebar by Roger McGaughey, head grower at Pioneer Gardens Inc. in Deerfield, Massachusetts). There are some diseases that really are not well controlled with simple chemicals including Fusarium, *Cylindrocladium* and the majority of bacterial pathogens. I am actually starting to think that biologicals in their complexity may be the answer to controlling these tough diseases.

It also may be our best hope for re-establishing a background of beneficial/normal flora to make sure that pathogens do not invade the biological vacuums we create when we use non-soil, man-made products to grow our plants. I don't think going further into the "sterile" production of plants will work since they are not put into a sterile end-user environment. They can only fail to thrive if they are test-tube babies thrown into the wide world. While use of soil fumigants is on its way out, we really should try to repair some of the damage we have done to the bacteria, fungi and other microbes that create a healthy root system. Soil inoculants (hopefully mixtures) should be part of this remediation.

On the Horizon

A recent article by Ali and Norman (University of Florida plant pathologists) called biological controls a potential game changer. I could not agree more with this sentiment. The conclusions we made 30 years ago about how well biological control products worked are no longer valid. Many new products have been developed and brought to market and they work far better than some of us

thought they could. In addition of that, the market for biologicals is expanding with the change in societal attitudes toward agricultural production throughout the world.

The only thing that has not changed is that disease control is still hard and the products we use must work. Biological control products are still more difficult to use than standard chemistries. This is primarily because when a living organism is employed, whether it

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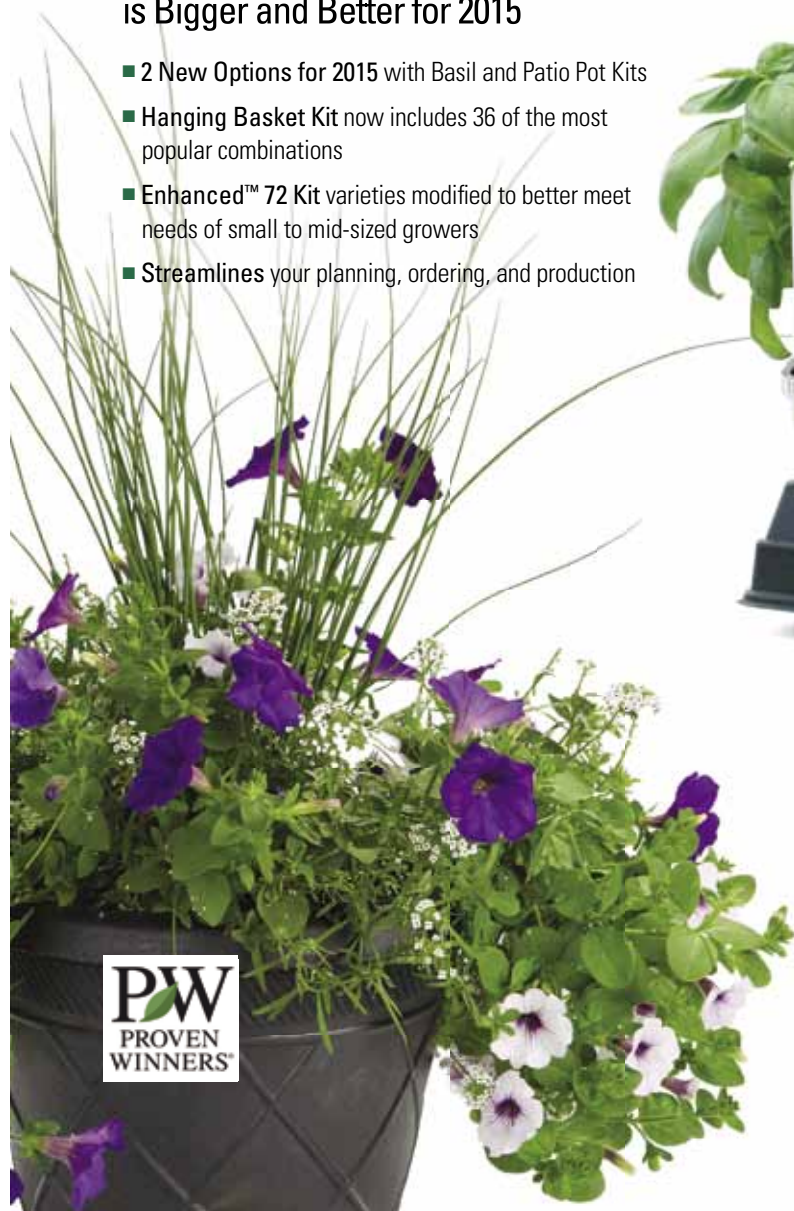
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GROWING BIOLOGICALLY

by Roger McGaughey, Head
Grower, Pioneer Gardens

Crops can be grown successfully the biological way. I have been doing it for almost six years, obtaining consistent results with each crop. There are so many advantages to this method, safety being an important one. Everything we do involves people and if growing quality crops can be achieved this way then that seems the obvious way to go.

There are some important factors that need to be considered before embarking on a biological program. The business owner(s) must be in full support. The grower must avoid using chemicals which will be harmful to the biological control agents needed to make the program successful, and there must be trust and patience while the process unfolds.

In my early biological years, I was growing ornamental annual crops. In September 2012 I embarked on a new venture, growing perennial young plants. My bosses, Jaap and Arjen, totally embraced the biological concept and gave me complete backing to change the way things were done at Pioneer Gardens.

When I first arrived there were root quality issues and the ebb/flood tables were not being used to their full potential. We decided to go back to basics in order to establish a good white root system — fast. I stopped using the ebb/flood system and we applied Root-Shield Wettable powder by hand over the top of every table in the facility. It only took about 48 hours for new white roots to appear everywhere. Here is where the first safety aspect came in. RSWP has a zero REI and no protective clothing is needed in the application process. All other nursery activities continued without a hitch.

These positive results reinforced the trust my bosses had in me. It was imperative that all new product on our growing tables have an efficient application of RSWP before going into the propagation department. So when I asked for a stationary boom to be installed in our planting area, it was built and installed with all due speed. We changed over to RSWP Plus

is a fungus or bacterium, you have to be concerned with its welfare. Using a BCA for disease management means understanding the plant and its needs, the pathogen that causes the disease and finally the biological agent and its needs. Using BCAs for disease control successfully will end up making us better growers.

We are more able than ever to find, characterize and develop new BCAs. Until the last few years, we did not

know immediately what we were looking at when a new BCA was found. Now we can run them through DNA analysis and tell very quickly if this is a new organism and what it is most closely related to. We also need to pursue mixtures of micro-organisms. It is unlikely that a single pure culture of a BCA will have the type of impact that a mixture will have. I foresee a time when we will be able to sample our soil that will tell us exactly what combination

a year ago which provides more protection and results in an even whiter root system.

Another benefit of using RSWP Plus is we are now successfully using the ebb/flood system. Before I arrived, the procedure for cleaning the mixture in the ebb/flood fertilizer tanks involved injecting a chemical into the tanks via a computer system, based on daily water analysis. Since in my experience RootShield on the crops is sufficient, I aborted this procedure, pumped out all the old fertilizer mixture and started with a fresh batch. During the past year, two batches of pathological tests of the ebb/flood system, six months apart, have shown no signs of damaging organisms. Also, we can now grow crops that had experienced some foliar phytotoxicity with the old method ... Major cost savings here!

Weekly applications of Nematodes are the other main part of my arsenal. These help in the battle against fungus gnats and do a really great job controlling thrips to an acceptable level. Some soft chemicals often have to be incorporated into the BCA program in response to scouting results but these have low REIs, and generally nursery operations are uninterrupted.

There are lots of winners with this type of program and the end consumers, and in our case other growers who receive young plants with healthy root systems free of insects, are one of them. All our employees are happy they work in a kid-safe environment. Also the owners are happy because the plant quality has improved and they don't have to spend money on chemicals that are beginning to show resistance to the insects and diseases they are designed to control.




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of microbes is needed to produce particular crops. Agriculture will hopefully become more complicated again and thus approach nature as managed by humans. There are probably many years of research and trial and error ahead of us but the process is currently under way. 

A.R. Chase is plant pathologist at Chase Agricultural Consulting LLC and can be reached at archase@chaseresearch.net.