GROWERTALKS

Growers Talk Production

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Biological Black Holes

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One of my earliest observations about biological control was a similarity with the nature of black holes. In physics, we can observe the effects of black holes on the surrounding space, but all matter and information disappears beyond the event horizon without any hope of recovery.

My path had taken me from studying physics into practicing horticulture and I began to work with biological controls in 1983—long before most growers had even heard of the concept. Back in those days we were releasing biological controls into the greenhouse based on little more than a hunch, and our good bugs disappeared in the crops never to be seen again. We knew that they did something, but they'd completely disappeared from view. There was no information coming back to us about the well-being of these agents and any attempt at monitoring them was futile.

Such lack of observability remains one of the most serious obstacles to success for those growers who are new to biological pest control. Growers have spent decades looking for pests, applying pesticides when they find them and checking the effect after the treatment. Pest insects and mites are either dead or they're not. Pest control monitoring has been a straightforward affair.

In comparison, biological control requires a paradigm shift. We don't have the luxury to wait for any pest before we treat; if pests become easily detectable, our control has already failed. Nonetheless, we cannot tell with any certainty which (if any) of our controls are working, even if we cannot find any pests. We'll happily accept a clean crop, but we simply cannot be certain why it stayed clean and whether any of our BCAs were effective. This is another analog to physics: We don't know for certain whether Schrödinger's cat is dead or alive. We just hope for the best.

Biological control requires management of very complex systems and each of our control activities modifies the entire system. This creates our problem with observation. We no longer target a single pest with individual applications; instead, we create controlled ecosystems in our greenhouse, in which we actively change the equilibrium between predators and prey. We shift the balance all the way to the side of the predators. We inundate these ecosystems with BCAs before any pest is detectable, just so that any budding pest population is overwhelmed by the controls that are waiting for them. We have to do this for all pests that could realistically affect any crop in each of these ecosystems.

With biological control, we can no longer think about controlling individual pests. Instead, we have to think about preemptively protecting each of our crops from all of the pests that could potentially become a problem. This, in itself, will be a completely new concept for most growers who are used to chemical pest control.

The novelty is compounded by the unnerving lack of observability. We simply have no way of knowing the effect of any of our biologicals on any specific pest at any specific time. We can only wait to observe the effects of our biological black hole: either the crop remains clean or it doesn't.

Everybody who works in this field has opinions as to which predator "is best" in a given situation. Most of these statements, however, are really nothing more than speculation based on experience and accumulated casual observation. Research has created a plethora of answers to narrow questions and established the behavior, efficacy and limitations of individual BCAs in individual crops against individual pests. However, much of this data is impractical or it disagrees with experience when we apply it to our complex, multi-dimensional greenhouse production systems.

Our knowledge would be more applicable if researchers could study the effect of BCAs on systems rather than assessing individual products in isolation. The understanding of complex systems, however, doesn't lend itself to being sliced into chunks that fit the scope of a master thesis, which is a roadblock for progress. I'll explain with an analogy: If we want to improve the fuel consumption of a car, then we need more than a collection of individual analyses of long-term viscosity properties for lubricants that we may pour into the oil-pan.

Agricultural research has to fit into the thesis model or it becomes all but unattainable. This is a fallacy in my opinion. Our lack of understanding cannot be addressed by clusters of simple yes/no questions and answers. Society has decided that large, publicly funded research stations with the capacity to analyze complex problems are a waste of money and don't serve public interest.

The advent of ever more complex production systems, however, would suggest that it might be worthwhile to lobby our research needs to a public that's becoming increasingly skeptical towards chemical pest control. I think we could make a compelling case. **GT**

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