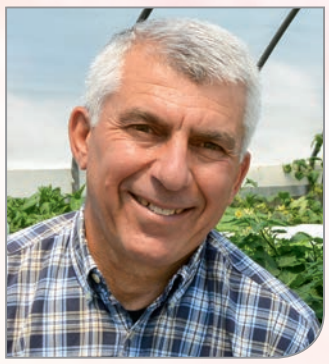
BY PETER KONJOIAN AND BRIAN KRUG

Growers Can Conduct Meaningful Trials



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Today's guest is Brian Krug, greenhouse technology leader/head grower at DowDuPont Pioneer in Johnston, Iowa. Brian received his undergraduate degree at Iowa State University in 2000, interning at DeJong Greenhouses in Iowa and at Yoder Brothers in Florida. After graduating, he returned to DeJong's until deciding to pursue graduate school at N.C. State with Brian Whipker. He graduated in 2007 with his Master's and PhD degrees and took a position at the University of New Hampshire. He is also a member of the inaugural class of GPN's 40 Under 40 (2012). Brian left academic life in 2015 to move closer to home.

Peter: Welcome, Brian, thanks for joining me. A tip of the cap as you developed this topic a year ago for a session at Cultivate and invited me to join you. We had a fun hour with fellow growers discussing the principles of good experimental design regarding their in-house product trials. Let's begin by discussing differences between conducting research in the academic environment where both of us started our careers and the private sector where we currently reside.

Brian: Peter, it is always my pleasure to take time and chat about things with you. There are a lot of similarities but also a lot of differences between conducting research in the two environments. I think in the academic arena we have more opportunity to do the research that we want to do. Of course, you always want to be working toward something that will have an impact on the industry, but you really have the opportunity to look at the entire greenhouse industry and choose what interests you. Although, this can be a blessing and a curse, with so many options it can be hard to narrow down the topics. On the flip side, conducting research in the private sector, the decision on what research to conduct most often comes down to what is good for the business, regardless if you are passionate about the experiment or not.

Peter: I agree. If we drill down further on the private side of the industry — the sector comprised of commercial greenhouse operations — there is a freedom of choice that is quite flexible.

For me, the Florel project was amazing in that I was free to follow experimental results wherever they led. I believe that the daily chores in my commercial greenhouse, like pinching potted crops and trimming hanging baskets, provided a setting that allowed me the freedom to imagine how ethylene could be harnessed to manage plant growth. Had I stayed on the academic side my belief is that I would not have had the instinctive sense to pursue the project as aggressively as I did.

Another dimension to research is funding. How does it differ between the academic and private sectors?

Brian: In academia, you can usually limit your options of research based on what you can get funding for. With budget constraints at most universities, academic researchers need to look outside the university for funding. In my experience, here at Pioneer, funding is usually not the limiting factor — labor and space are. Additionally, I usually have to "sell" my research ideas to only one or two people to get approval rather than a grant review board. If it has promise to have an impact on the business the answer is usually yes. When the answer isn't yes, the response is usually "not right now;" when budget and resources become available I get the green light.

I mentioned that there are a lot of similarities too. Regardless of which arena you are doing research in, you still have to have design, execute and report on the work in the same fashion. Not taking time to do these things with care results in wasted time and conclusions that may not reflect reality.

Peter: Great point. We've both seen poorly designed and executed experiments in commercial greenhouses that failed to generate meaningful information. Let's talk about how growers can conduct good product trials.

Brian: When research has to compete for time and space in your greenhouse it needs to generate helpful information. To increase the odds of generating data that is useful, we as growers need to keep a few research basics in mind.

Peter: Allow me to interrupt to emphasize this point. A critical difference between conducting research in academic versus commercial settings is the intense pressure to generate profit from every square foot of space in a commercial greenhouse. In university greenhouses we have the freedom to include treatments that may result in unsalable plants but generate valuable insight. In a commercial setting most experiments are designed to minimize such outcomes because a grower cannot afford to lose many plants. Continue with your research basics.

Brian: First off, identify the question that you want to answer, and be focused. Instead of asking, "How can I make my geranium crop better?" break that down and ask, "What is the optimal rate of 15-5-15 for 4.5-inch geraniums?" Or instead of "Will a paclobutrazol spray of 5 ppm give me shorter plants?" ask "What rate of paclobutrazol will give me plants that are 30 percent shorter?" Doing this will focus the effort and set you up to succeed.

Second, and maybe most importantly, be sure to include a control of some type. What I mean by a control is a treatment that either you grow with your current fertilizer rate or one that does not have paclobutrazol applied to it, in our examples above. This gives you something to compare against.

Peter: In my opinion, Brian, this is the most important point of our discussion. The importance of a control treatment is impossible to overstate, and I'm certain any of our colleagues reading this are nodding their heads in agreement.

Calling on the Florel project again, I took many calls from fellow growers asking my opinion on what they were seeing. The first comment they heard from me was a question: How do the treated plants compare to the controls? Too many of them did not include untreated control plants and could not answer the question. Too often they replied that they just decided to spray the entire crop. There were many teachable moments during those calls and there's still work to be done to educate growers about the value of control treatments. What else is on your experimental design list?

Brian: Next, decide how big the experiment is going to be, how many different treatments and how many plants in each treatment. Making it too big will be unmanageable, and making it too small will make it meaningless. I like to have three to five treatments and six to 10 plants in each treatment.

The last two steps are common steps that growers miss. Complete the experiment, don't let the rush of spring deprioritize the effort. You will be tempted to just sell the plants in the experiment because they look good and might feel that you don't have time to evaluate the results.

Finally, document what you did and what you learned. There is the old academic saying, "If it isn't published, it didn't happen." This is true in our greenhouses too. Simply type up a one-page document that outlines your experiment and results (include pictures).

Peter: The class of experiment you describe as having a handful of treatments, including a control, each having a workable number of replicate plants, lends itself well to certain product and production practice categories. Figure 1 shows such an experiment using zonal geraniums as the subject crop that involved growing media and nutrition treatments.

Executing a good trial requires labeling plants well. In this bench-size experiment every plant has a label because a level of randomization was used to cancel out environmental variances

Figure 1. Bench-size experiment using zonal geraniums as subject crop.

due to plant location on the bench. For instance, if all of the plants for one treatment were in a neat line on the edge of the bench that row of plants might receive more light compared to the rows of plants in the center of the bench, introducing experimental bias. Designing trials to minimize experimental bias doesn't require an advanced degree, just common sense and understanding your greenhouse environment.

One more detail to consider: Is it right or wrong to have hanging baskets over a bench where a trial is being run? From a pure control of experiment perspective, we would avoid having baskets hanging over the experiment; if they drip onto some plants below but not others and this is a nutrition trial, well, that introduces variability which is not good.

On the other hand, a grower may decide that any treatment selection will eventually need to perform under baskets because there's no other way to make a profit on that bench. A solution could be to run the first trial without baskets and their associated complications, select the best treatment or two, and then run these best treatments again next to the control treatment with baskets over them.

Can you offer short lists of product categories that fit your general experiment design and those that do not? There are some products and practices that are best addressed in an academic setting.

Brian: Sure, Peter. Experiments that are exploring plant growth regulators, fertilizers or substrates all fit into this design nicely because they are easy to manage and data collection is straight forward. Cultivar trials are a little more difficult because the data collection is often a little more subjective. Trialing with pesticides, light or temperature can be more difficult because the treatments can be difficult if not impossible to control in a production setting. These are best left to academic institutions.

Peter: Thanks Brian. By following these basic scientific steps any grower should be able to conduct productive on site trials that answer questions, solve problems and boost profitability. gpn