

# 6 QUESTIONS with Nathan Coles

***If you're curious how Corteva Agriscience develops new hybrids and varieties, Nathan Coles is fascinating to talk with. Coles works with a team of researchers in Johnston, Iowa, collecting loads of data that Corteva breeders use to develop high-performance seed products. We asked him to give us a glimpse into how they do it.***



Nathan Coles, Corteva  
Agriscience Senior  
Research Scientist

## 1 "Precision phenotyping" sounds complicated. What is it?

Phenotyping is observing and measuring the characteristics of plants. Precision refers to the way we do it, which involves gathering lots of data. Our role is to make the breeders' jobs easier, more efficient and more accurate. All breeding is driven by data that helps us make a decision about what hybrids, varieties and inbreds produce the best results for farmers. We evaluate all the different characteristics of a hybrid or variety and say: What are the things about this germplasm that make it perform the best? Where does it perform the best? We rely on data collection to do all of that evaluation. The better the data and the more we can collect, the better we can evaluate the end result for the farmer. At Corteva, we do phenotyping on a global scale for every crop we sell except millet. We generate tens of millions of data points every year.

## 2 With that much data to gather and analyze, you must use a lot of cutting-edge technology. What are the tools of the trade in precision phenotyping?

We do get to work with some pretty cool technology. We use satellites, robots, handheld devices and proximal sensors to gather data. But probably the most-used tool in our toolbox is drones. Corteva has an extremely mature drone fleet—at one time, it was the largest drone fleet of any company in the world—not just in agriculture. Corteva drones are at work on every continent in the world except Antarctica.

## 3 What makes drones so useful in this work?

Drones allow us to collect huge amounts of data quickly. In just one drone flight, we can gather tens of thousands of data points, and that just keeps increasing as the technology improves. Compare that to when phenotyping used to be done entirely by hand, in the field. Gathering that kind of data would take weeks even with a big crew.

Drones are also so much more accurate than people. As you can imagine, gathering data in the field is hard work. But a drone never gets tired or thirsty, and it doesn't care what hybrid or crop it's looking at. It doesn't have a favorite pedigree. It's unbiased. The data from drones is so good, we now get about 90% of our observations from drones and about 10% from people in the field.

Of course, the role of this technology is to help a person at the other end of the breeding process. People are still vital to interpret the data. The technology just allows us to eliminate some of the labor-intensive, repetitive tasks and give the breeders more and better information to use.



*Corteva Agriscience uses an extensive drone fleet to gather phenotyping data all over the world. Corteva breeders apply this data to produce ever-improving hybrids and varieties.*

#### 4 What's the next frontier in precision phenotyping?

I'd say it's looking underneath the canopy. Being able to see in three dimensions under that canopy and measuring things like the thickness of a leaf. We also look forward to someday seeing below ground, so we can gather data about what happens with the roots, in the soil. That's an area that's yet to be fully explored.

#### 5 How does precision phenotyping ultimately lead to better products for farmers?

We'll understand hybrids and varieties better than we've ever been able to in the past, and that includes placing them exactly where you can maximize yield potential and minimize exposure to negative environmental impacts. This may develop a few ways. In the future, we may sell farmers a wider variety of materials for their acres that will be more accommodating—there might be 2-3 hybrids in the planter at a time. We may also have single hybrids that accommodate all environments better. You combine that kind of seed with management practices and you can really unlock the potential.

There are also sustainability benefits to gathering all this data. The more data you have, the better you can understand the performance of materials in the field and better make decisions. So, in the past, maybe we wanted to understand a hybrid's nitrogen use efficiency, but it couldn't be quantified in a way that was usable to produce better hybrids. But let's say we could calculate above-ground and below-ground biomass and know how much carbon is being fixed with each plant in the field. Now, you could know how efficiently the roots are taking it up. In the future, these phenotyping technologies will unlock a lot of the secret things we want to understand, like: Is this hybrid better at sequestering carbon? Then we can do a better job selecting for varieties and hybrids that allow us to do that. Now you've got a value-add to the land for the grower.

#### 6 The potential sounds tremendous. Is Corteva on the leading-edge with precision phenotyping?

I believe so. This technology didn't even exist 10 years ago. It's all evolved so rapidly. Corteva leadership saw the value in this and went for it. Phenotyping is one of the costliest activities we do as an organization, but it's fundamental in producing better-quality products. We're unlocking these ideas a little at a time. We're not at an endpoint with this. We're just at the beginning.