AGILENT CASE STUDY: EMPOWERING RESEARCHERS

FEED THE WORLD
AGILENT AIDS QUEST FOR MORE EFFICIENT CROPS

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Here's the challenge for plant biologists like Harvey Millar and his team: The world isn't getting any bigger, but we have a lot more people—7 billion now, 9.5 billion expected by 2050—so how do we grow enough crops to feed them all when environments are changing?

"At a very high level, the question is one of efficiency," says Millar, who directs the Australian Research Council's Centre of Excellence in Plant Energy Biology. "How do we make plants more efficient?"

Millar and his colleagues in Perth are using Agilent technologies—mass spectrometers coupled with gas and liquid chromatographs, plus advanced informatics software—in their quest for answers.

One might think that, after millions of years of evolution, plants should be just about as efficient as they can possibly be. But that line of thinking doesn't take into account the way agriculture works.

"We grow only a few crops, and we grow them all over the world," Millar points out. "They didn't come from the environments we grow them in; they've only been growing there for a couple of hundred years. So we can wait millions of years for them to adapt to their new environments, or we can try to speed the process."

To Millar, the advantage of working with a partner like Agilent is that the company is always striving to increase its capacity for measurement. "We have a biological aim and Agilent has an engineering/analytical aim, and together we're pushing in the same direction," he says.

"Plants pretty much have to take what comes their way—they can't run away and hide—so they tend to be very flexible in the ways they are able to survive in different conditions," Millar says. "My team is looking at the energy metabolism of plants, what fuels the plants are using to perform different activities, and how they regulate themselves when the environment changes."

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Scientists have long been able to look at the proteins plants produce, but only recently, using Agilent technology, has the team been able to determine the age of the proteins—that is, how often are they replaced?

"One of the most exciting things we're doing at the moment," he says, "is trying to understand the energy costs as plants turn over their protein machinery."

The team's primary goal, Millar says, is to find metabolic pathways that can be modified to make the plants stronger and increase their yields. "The problem with metabolism is it's very complicated, with a lot of feedback loops," Millar says, "but we've already found some interesting pathways, and we're working with a number of companies to put those into crop plants and test them in the field."

He acknowledges that modifications that work in a lab, where conditions are all controlled, may break down in field testing. "The big challenge is just the variability of the field setting," Millar says. "The mechanism you understood in the lab may turn out to be less important in the real life of the plant than you imagined."

That said, his national team's understanding of plant metabolism—specifically, how plant's transport salt—provided a key insight to an Australia-wide study involving improvement in durum wheat (also known as macaroni wheat because it is often used to make pasta).

"We recognized that a gene found in a wild relative of wheat contained the instructions for a transporter. It was found in a very specific cell type, and that was the key. If you can get the transporter into that type of cell, you get this effect of keeping salt out. So it was really a matter of learning from nature and then being able to take that as a tool and engineer it into other plants," Millar explains.

The modification has been shown to increase yields of durum wheat by as much as 25 percent in saline environments like Australia's. Now they are working to find new leads through their science to improve drought tolerance and temperature tolerance in wheat.

For the world's growing population, particularly pasta and bread lovers, that's good news indeed.

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