The Rise of Lab Robots: Faster, Smarter, Greener Disease Testing

By Annu Albert, Plant Pathology and Molecular Biology Technician, SGS Canada Crop Science

When someone steps into our disease lab at SGS Canada, they know they are seeing technology that is at the forefront of something special. Yes, this is where we test for diseases, primarily fungal pathogens, but also some bacteria and protists, using basic agar plating methods as well as DNA extraction techniques.

But significant changes are underway in how we do it.

For years, we relied on manual labour to extract DNA — a tiring process that took a long time for us and, as a result, for customers. But then robotics changed everything.

Let me give you a glimpse of how we work and how robots are reshaping our approach.

The Old Way: Manual Labour with DNA Extraction

DNA extraction is a meticulous process where we break down cells to isolate DNA. Most of our work currently focuses on soil samples, although we occasionally process tissues and seeds. The idea is to extract all the DNA present in the sample, including plant DNA and DNA from all the microorganisms present in the sample — both the good and the bad — after which we use specific reagents to identify the specific pathogens we are testing for, like *Plasmodiophora brassicae*, the pathogen responsible for clubroot.

In the past, this was done entirely by hand. We worked with small tubes, transferring chemicals step by step, using pipettes to add precise amounts of reagents. It was painstaking work. A single batch of samples took over two hours, and during busy seasons, we would do three or four batches a day. By the third batch, fatigue set in. Was I at step three or step four? Did I add the reagent already? These were common questions. Mistakes were easy to make, and maintaining consistency in pipetting volumes became increasingly difficult as exhaustion took its toll.

The New Way: Enter Robotics and the QIAcube HT

Two years ago, we acquired the QIAcube HT, a robotic DNA extraction system, and it revolutionized everything. This machine mimics the manual process but eliminates the physical strain and human error.

Here is how it works and how it transforms soil and tissue testing:

- Efficiency and Precision: Instead of transferring one sample at a time with a pipette, the QIAcube HT handles eight at once. It follows a programmed sequence, adding reagents with pinpoint accuracy and reducing variability.
- Higher Capacity: The machine processes numerous samples simultaneously, nearly doubling our previous capacity. It still takes about two and a half hours to run a full batch, but the robot can handle double the number of samples in a single batch, when compared to the manual extraction method. Plus, I don't have to babysit it. After initial setup, I'm free to focus on other tasks.
- User-Friendly Design: The software calculates everything for us — where reagents go, how much to add, and in what order. It is as simple as following on-screen instructions and letting the robot do the rest.
- Reduced Waste: By consolidating steps, the QIAcube HT cuts our plastic usage by 60%. It is a win for efficiency and sustainability.

Once the DNA is extracted, the next step is amplification using PCR (polymerase chain reaction). This process multiplies the DNA to detectable levels, but it requires precision in adding reagents. The same robotic principles that transformed DNA extraction are applied here, ensuring accuracy and minimizing human involvement in repetitive tasks.

A Glimpse of the Future

Robotics has not only improved our accuracy and throughput but also enhanced the way we work. The time saved allows us to focus on data analysis and quality assurance rather than repetitive manual tasks. It is exciting to think about where this technology could lead us next.

In a field where precision is paramount, robotics has become our most valuable lab partner, redefining what is possible in disease testing. At SGS Canada, we are proving every day that innovation and automation are the future of agriculture.