Fast, accurate way to check peanut plants for healthy traits

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Lee Sanchez, coauthor and biochemistry graduate student, takes peanut samples for the study. Credit: Dmitry Kurouski

The lengthy process of breeding better peanut plants can be sped up by using a biophysics technique, Raman spectroscopy.

Texas A&M AgriLife biophysicists and plant breeders have demonstrated the use of Raman spectroscopy to quickly scan the levels of oleic acid in peanuts. Oleic acid, a monounsaturated oil, lends peanuts a longer shelf life. The oil is also healthy for the heart.

They also used the method to determine how resistant plants are to nematode pests.

Using Raman spectroscopy is quicker, cheaper and more portable than standard approaches of screening peanut varieties for these beneficial traits. The study was recently published in *Scientific Reports*.

"We've shown that the method can save a huge amount of time in our screening process," said John Cason, Ph.D., coauthor and Texas A&M AgriLife Research peanut breeder, Stephenville. "You can get a 'fingerprint' of a particular peanut and tease out large amounts of information. The possibilities are endless."

"Raman spectroscopy is commonplace in biochemistry but mostly unknown in the world of farmers and plant breeders," said Dmitry Kurouski, Ph.D., principal investigator of the study and assistant professor in the Department of Biochemistry and Biophysics, Texas A&M College of Agriculture and Life Sciences. "Yet it is portable, inexpensive, accurate and fast, and can transform digital farming."

Funding for the study came from AgriLife Research and the Governor's University Research Initiative. In addition, the Texas Peanut Producers Board and Southwestern Peanut Shellers Association provided funding for Cason's group to buy a hand-held Raman spectrometer.

Benefits of Raman versus established methods

In the past, if Cason wanted to analyze the pest-resistance of plants or the fatty acid content of peanuts, he would extract DNA from plants or send samples to an off-site lab for infrared analysis. Both methods are considerably more time-, cost- and labor-intensive than Raman, Cason said.

For this project, the collaborators used a commercially available, hand-held Raman spectrometer, a device about the size of a shoebox. Raman spectroscopy measures how materials scatter harmless laser light. Each material has a specific scattering "fingerprint" that offers clues about many types of molecular information in a one-second scan. Running a scan is relatively straightforward, Cason said, but the collaborators are still developing and fine-tuning ways to analyze the data.

Cason's team received training and guidance from Kurouski and three young scientists from his lab: Charles Farber, a graduate student; Lee Sanchez, a research assistant; and Stanislav Rizevsky, Ph.D., a visiting scholar.

Scans of peanut leaves could distinguish nematode-resistant and susceptible plants with roughly 75% accuracy. What's more, scans of peanut seeds could distinguish with 82% accuracy the varieties with high levels of oleic acid.

Other peanut projects in the works

The team is currently expanding its studies of peanut plants. The first goal is to use Raman to quickly isolate peanut varieties with high tolerance for drought conditions. The team is also looking into expanding its studies of nutritional content to help breed more nutritious

peanut varieties.

One limitation of the technology is that the scanner needs to be in contact with the material being scanned. Kurouski's team is working on a Raman "telescope" to enable scans of plants that are 100 feet away.

"Biophysicists and peanut breeders don't usually associate in the same circles, but this has been a good project," Cason said. "I don't think it will be the last from this team."

More information: Charles Farber et al. Raman Spectroscopy Enables Non-Invasive Identification of Peanut Genotypes and Value-Added Traits, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-64730-w

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