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High-throughput phenotyping tool for protein biofortification in pulses

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Clemson University Professor Dil Thavarajah (right) at the university's Pulse Quality and Nutrition Phenotyping Lab, with project manager Tristan Lawrence (left) and doctoral student Sonia Salaria (center). Salaria is measuring dry pea seeds for protein quality using Fourier-transform infrared spectroscopy. Photo by Elizabeth Beane, Clemson University.

Protein malnutrition remains a substantial health problem globally. Pulse crops are staple plant-based proteins that provide significant dietary protein but are low in sulfur-containing amino acids (SAA) methionine and cysteine. The development of biofortified, high-protein, quality pulse cultivars has been hindered by a lack of low-cost, high-throughput techniques to screen early generations.

Recently, researchers reported in *The Plant Phenome Journal* that Fourier-transform mid-infrared spectroscopy is a high-throughput, cost-effective method to quantify nutritional traits, total protein, and SAA concentrations in plant matter. The team found the technique can accurately measure the lentil SAA (with the model's accuracy of R^2 of 0.827) using one finely ground seed. The predicted validation data ranged from 0.207 to 0.326%, similar to results validated from high-performance liquid chromatography and literature values.

This research impacts global pulse breeding programs for biofortification. Researchers are now using this technology to develop high-protein, quality pulses at Clemson University's organic dry pea and lentil breeding program; the **USDA-ARS chickpea breeding program** in Washington State; and **the International Center for Agricultural Research in the Dry Areas (ICARDA), Morocco**.

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Madurapperumage, A., Johnson, N., Thavarajah, P., Tang, L., & Thavarajah, D. (2022). Fourier-transform infrared spectroscopy (FTIR) as a high-throughput phenotyping tool for quantifying protein quality in pulse crops. *The Plant Phenome Journal*, *5*,

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