

# NIR Detects, Destroys Insect Pests

Researchers are evaluating NIR for triple duty: detecting, identifying, and destroying insect pests hidden inside grain storage bins.

**W**hat's good for Georgia peanuts may also be good for Kansas wheat. An electric eye that scans all food-grade peanuts for visual defects could one day do the same for wheat kernels.

For peanuts, it's a proven method for monitoring quality. In wheat, scanning with near-infrared (NIR) energy can reveal hidden insect infestations that lower wheat quality.

ARS entomologists James E. Throne and James E. Baker and ARS agricultural engineer Floyd E. Dowell are the first to combine NIR with an automated grain-handling system to rapidly detect insects hidden in single wheat kernels.

The instrument combines a diode array spectrometer and a wheat singulator developed under a cooperative research and development agreement by Perten Instruments of Springfield, Illinois, and engineers at the agency's Grain Marketing and Production Research Center in Manhattan, Kansas. The singulator separates individual kernels and delivers them to the tester for NIR scanning. The spectrometer is an optical sensor that can distinguish insect pests from grain kernels by the different amounts of light energy reflected or absorbed.

"Detecting hidden insect infestations has been a serious problem in the grain industry," says Baker.

These infestations are important because larvae of the lesser grain borer, rice weevil, and maize weevil can cause severe damage to wheat. Feeding by these insects' larvae costs the U.S. wheat industry about \$500 million annually. The NIR system can spot and identify hidden larvae that cannot be visually detected.

"And with visual examination, a rice weevil looks just like a granary weevil," says Baker. Studies show that NIR can distinguish between them.

"Each species has its unique spectral signature," adds Dowell, "based on how much carbon, hydrogen, and nitrogen it contains." Insects' body chemistry determines how much light is absorbed, and the instrument produces a graph much like a cardiogram with peaks and valleys.

Primary insects like the granary weevil, maize weevil, or lesser grain borer destroy the whole kernel. Secondary ones, such as the sawtoothed grain beetle or the rusty grain beetle, come in after other pests have opened things up for them. They eat small fragments of broken kernels and are not considered damaging enough to warrant fumigation unless they occur in very large numbers. So grain storage managers can often save the cost of fumigation if they know which species has infested the grain.

The researchers have shown that NIR can also kill insects feeding inside wheat kernels. "NIR is effective, and it's safer than microwave radiation," says Throne. Studies done in June 1997 showed 100 percent of rice weevil larvae killed in wheat kernels exposed to NIR.

The researchers envision this technology being used with grain samples or while grain moves on a conveyor belt at storage and food-processing facilities.—By **Linda Cooke McGraw**, ARS.

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Maize weevil feeding on corn kernels.