

Title Entomological applications of near-infrared spectroscopy.
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Citation Advances in stored product protection. Proceedings of the 8th International Working Conference on Stored Product Protection, York, UK, 22-26 July 2002 (2003); 131-134

Abstract

Our recent work on applications of near infrared spectroscopy (NIRS) to entomological problems is reviewed. Using an automated NIRS system to scan individual wheat kernels at the rate of 15 per minute, we were able to differentiate between uninfested kernels and kernels infested with late instar larvae of *Rhyzopertha dominica*, *Sitophilus oryzae*, or *Sitotroga cerealella*. The ability to rapidly scan individual kernels indicates potential for automated segregation of infested kernels from bulk grain. The automated NIRS system was used to differentiate uninfested wheat kernels, kernels infested with rice weevils, and kernels that contained rice weevils that were parasitized by *Anisopteromalus calandrae*. Being able to distinguish kernels containing parasitoids would be useful for quality control in commercial insectaries that rear biological control agents, and would be useful for research on natural enemies. The NIRS system was used to segregate samples of transgenic maize that contain low and high levels of the protein avidin. Avidin is toxic to a number of insect pests, and transgenic maize that contains a level of avidin that is toxic to insect pests of stored grain has been developed. A manual NIRS system was used to quantify insect fragments in flour. Although the sensitivity is not sufficient to detect insect fragments at the US Food and Drug Administration defect action level (75 fragments per 50 grams of flour), the technique is accurate at an action level of 130 fragments per 50 grams of flour and could be useful for prescreening large numbers of flour samples to select samples for more expensive and labour intensive chemical analyses. A manual NIRS system was used to identify stored product insect pests to species level. We were able to identify insects to genus with greater than 95% accuracy and to identify insects as being primary or secondary pests with greater than 99% accuracy. Ability to identify insects to species depended on the genus. This technology could be useful to pest managers who may not be familiar with insect taxonomy. The manual NIRS system was used to determine chronological age of two primary pests and one secondary pest of stored products.