

Title Comparison of soft x-rays and NIR spectroscopy to detect insect infestations in grain
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Abstract

One of the challenges that need to be addressed to automate grain inspection is the machine detection of insect infestations in grains. In this study, the soft X-ray and NIR spectroscopy methods to detect insect infestations were evaluated for their potential for real-time application. Infested wheat kernels were prepared by artificially infesting Canada Western Red Spring wheat by *Sitophilus oryzae* adults. Single kernels of wheat uninfested and infested by larvae, pupae, and adults of *S. oryzae* were first scanned by X-rays. The same infested kernels were then mixed with uninfested bulk grain and scanned using a spectrophotometer. The infestation level in the soft X-ray method was quantified by counting the number of infested and uninfested kernels whereas in the NIR spectroscopy method it was quantified by the mass of infested and uninfested grain. The identification of infestations by both methods increased with the increase in the developmental stage of the insect from larvae to adult stage. The soft X-ray method has the advantage of potential application in grain inspection over NIR spectroscopy where the number of infested or insect-damaged kernels is an essential information. The NIR spectroscopy analyzing bulk samples has applications in grain management such as fumigation where the identification of insect species is critical and precise quantification of infestations is not vital.