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DETECTING WHEAT FUSARIUM HEAD BLIGHT USING HYPERSPECTRAL IMAGING

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Track

4. Hyperspectral Imaging

Keywords

Fusarium Head Blight (FHB), caused by Gibberella zeae, is particularly devastating for wheat. This disease poses a significant threat to both humans and animals, as Gibberella zeae produces a mycotoxin called deoxynivalenol (DON), which can disrupt normal cell function by inhibiting protein synthesis. In order to avoid health risks, diseased grains must be identified before they are processed and incorporated to humans' and animals' food and feed. Currently, grain experts usually perform this grain disease assessment visually. Therefore, this evaluation is subjective and may not be consistent or entirely reliable. Thus, special attention has been dedicated to the use of Near-Infrared (NIR) Hiperspectral Imaging (HSI) as the basis for more reliable disease detection. The objective of this study was to detect FHB in wheat kernels using HSI. An algorithm, based on mathematical morphological operations and linear thresholding, was developed and implemented in order to be both simple and accurate. The outcome was a Fusarium index (FI), ranging from 0 to 1, that can be interpreted as the likelihood of the kernel to be damaged by FHB. The algorithm focused on the detection of FHB-damaged kernels, using hyperspectral images captured in the 528–1785 nm wavelength range. A threshold value was set to 0.5, i.e., a kernel was considered damaged if it has an FI higher than or equal to 0.5, and healthy otherwise. The accuracy of the algorithm was approximately 91%. An algorithm implementation

with a graphical user interface is available for download at https://www.digipathos-rep.cnptia.embrapa.br (https://www.digipathos.cnptia.embrapa.br). A set of six hyperspectral images containing kernels with different DON concentrations was prepared in order to assess whether the algorithm was capable of estimating such concentrations in wheat kernels. A relationship between DON concentration and FI was found suitable only in higher contaminated samples. This mismatch between DON concentration and FI assessments likely occurs because, when the DON concentration is low, visible symptoms are either absent or too mild to be visually distinguished. However, with higher DON concentrations, kernels are more likely to be damaged, thus DON and FI tend to have better correlation.