

Request for Proposals: Non-destructive, in-field measurement of corn stalk integrity

Background

Corn stalk rots and stalk-boring insects can cause serious damage to the crop and significant yield losses^{1,2,3,4}. Current methods to evaluate resistance of corn varieties to stalk rots and borers require manual splitting of stalks and visual scoring of the discoloration of stalk pith caused by Anthracnose Stalk Rot (*Colletotrichum graminicola*, Fig. 1), disintegration of nodal plates and internodes caused by Gibberella Stalk Rot (*Gibberella zeae*, Fig. 2); or, the tunneling caused by stalk boring insects like European Corn Borer (*Ostrinia nubilalis*, Fig. 3). These methods are not only labor intensive, but also can result in qualitative scoring and destruction of materials, not allowing time course experiments or yield data collection (Fig. 4). Corn stalks have high moisture content throughout most of the planting season, which may interfere with imaging. Many non-destructive imaging methods that are known to transmit through high moisture content materials may not be portable or cost effective for deployment in corn fields.



Fig. 1 Stalk rot internode discoloration



Fig. 2 Stalk rot nodal plate and internode disintegration

¹ Common stalk rot diseases of corn. [EC19898](#). University of Nebraska Lincoln Extension

² [Crop disease loss estimates from the United States and Ontario, Canada — 2016](#). Corn Protection Network, 2017

³ European Corn Borer in Field Corn. [E-17-W](#). Purdue University Extension

⁴ European Corn Borer: A Multiple-Crop Pest in Missouri. [G7113](#). University of Missouri-Columbia Extension

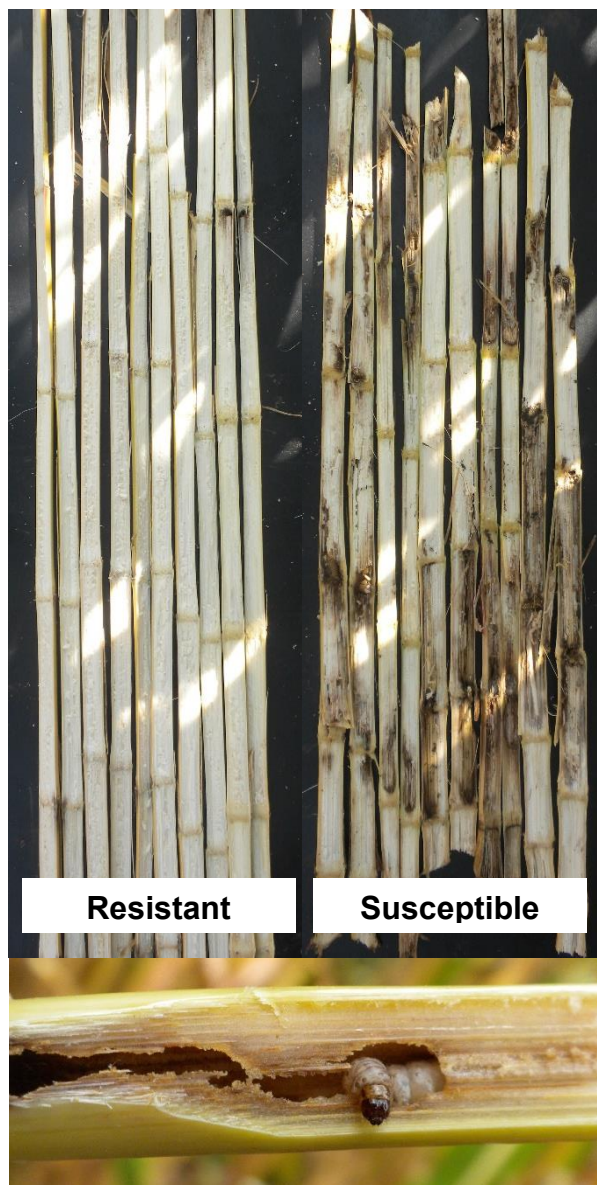


Fig. 3 Stalk borer tunneling



Fig. 4 Corn field after stalk splitting for evaluation of stalk rot resistance

Request for Proposals

We are seeking non-confidential proposals describing a plan to develop and evaluate corn stalk pith damage phenotyping methods that meet the following specifications:

- real-time, reproducible, quantitative measurement of the extent of insect tunneling and/or pathogen-induced stalk infection without stalk splitting or physical damage to the plant
- quantification of internal stalk integrity from as much of the stalk as possible (at a minimum from multiple points along the stalk from the base of the plant to primary ear)
- time-efficient measurement and data recording/storage for high volume phenotyping (ideally under 30 seconds per plant per person or hundreds of stalks per hour)
- portable, durable, and cleanable for use in field conditions (including irregular terrain and debris)
- improve upon safety issues associated with manual stalk splitting (cutting hazard, repetitive motion, fatigue)
- imaging the extent of damage per stalk is desirable, but not required. Image analysis may occur offsite, post measurement

Proposals should include:

- a description of the proposed work to develop and evaluate innovative phenotyping methods for corn stalk integrity, including an explanation and advantages over existing methods
- an explanation of how this type of method will meet the specifications outlined above
- a high-level timeline to proof of concept, ideally within a 12-month period
- expertise, equipment and facilities you have and/or need to execute the proposal
- a breakdown of the estimated project cost (up to \$50,000)