Survey of postharvest disease in Michigan potato storages, 2019

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Tuber shrinkage and loss in storage can result in substantial economic consequences in Michigan, making postharvest disease management a priority. Persistent rainfall throughout the growing season and warm temperatures during late harvest favor fungal and bacterial development in the field and storage. Preliminary surveys performed by MSU researchers in 2012-2014 found that growers were concerned with dry rot (Gachango et al. 2012a,b), bacterial soft rot and blackleg (caused by *Dickeya* and *Pectobacterium* spp.), and Pythium leak (Long and Hammerschmidt 2014) contributing to tuber breakdown in storage.

Through this survey we will: 1) characterize postharvest diseases impacting Michigan growers, 2) identify disease progression of prevalent pathogens in storage, and 3) devise integrated pest management strategies to minimize loss.

Materials and Methods:

In 2019, tubers were received from 12 fields across six counties after harvest from September - October. Tubers were collected from five areas of a field and separated into two samples of 50 tubers for monitoring in storage and 50 tubers for pre-storage destructive sampling. Destructive preharvest sampling was performed in the laboratory from September – October. Storage samples were placed in the Montcalm Research Center Storage Facility in standard storage conditions (48 F) after harvest and will be monitored at four timepoints for disease progression and shrinkage. In April – May 2020, these samples will be destructively sampled.

At the time of destructive sampling, external and internal tissues were examined for abiotic and biotic symptoms and signs of disease. A scrape was defined as an injury that removed layers of the periderm but did not extend into the cortex. A wound was an injury which extended into the cortex and may have included complete removal of portions of the tuber. Symptomatic and asymptomatic tissues were chosen for further isolations.

Tissues exhibiting abiotic or biotic symptoms, signs of disease, damage or injury, or asymptomatic tissue were excised as 1 cm^2 samples. Samples of epidermal and vascular tissue were taken for all tubers and surface disinfested and plated on 1.5% water agar. Fungal growth was isolated by hyphal tipping after three to five days. Tubers with visible soft rot symptoms were streaked using an inoculation hoop onto crystal violet agar media (CVA) and observed for pitting (common characteristic of pectolytic bacteria, e.g. *Dickeya* and *Pectobacterium* spp.). Morphological characteristics of fungi were observed through microscopic observation and assigned putative genera. Molecular characterization will be performed on randomly selected representatives of each sample isolated in order to confirm identities. Further characterization of pathogenicity will be conducted through inoculated tuber experiments.

Results and Conclusions:

A total of 679 tubers underwent preharvest destructive sampling. Eight tubers were asymptomatic and undamaged. The following internal and external abiotic symptoms were observed: 48% scrape, 31% wounding, 12% bruising, 3% pink eye, 2% vascular discoloration, 2% asymptomatic, 1% internal brown spot, 1% hollow heart (Figure 1). Symptoms and signs of the following diseases were also observed: 60% scab, 17% black dot, 6% black scurf, 6% soft rot, 4% silver scurf, 4% dry rot, 2% leak, 1% asymptomatic (Figure 2).

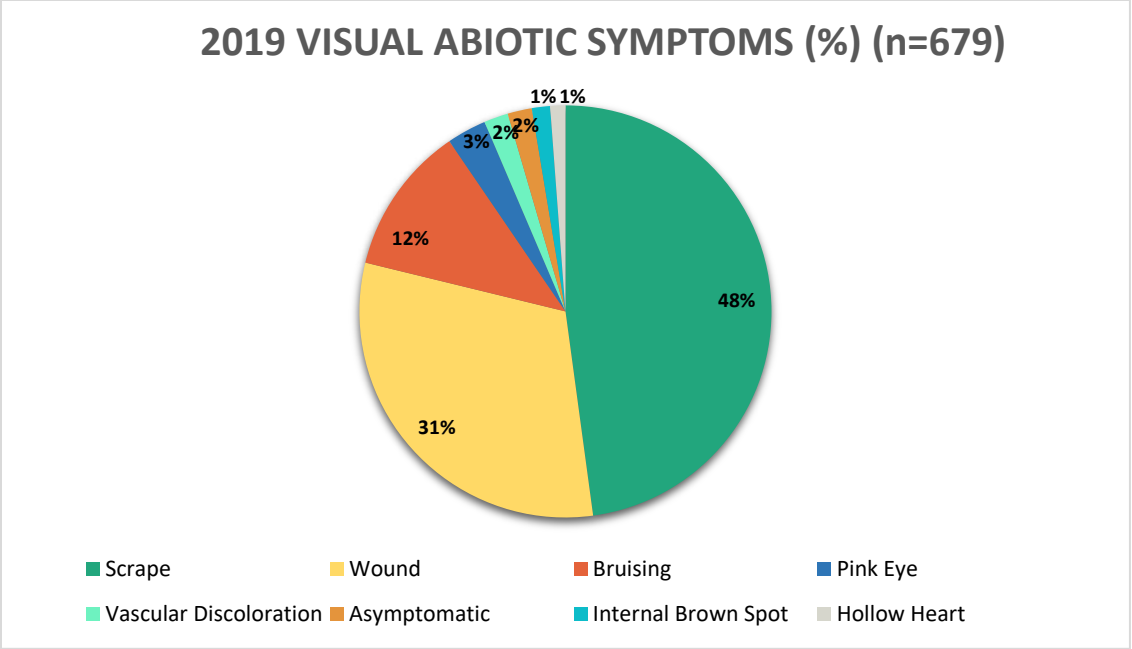

Figure 1. Abiotic damage and physiological disorders observed on tubers selected for at-harvest destructive sampling.

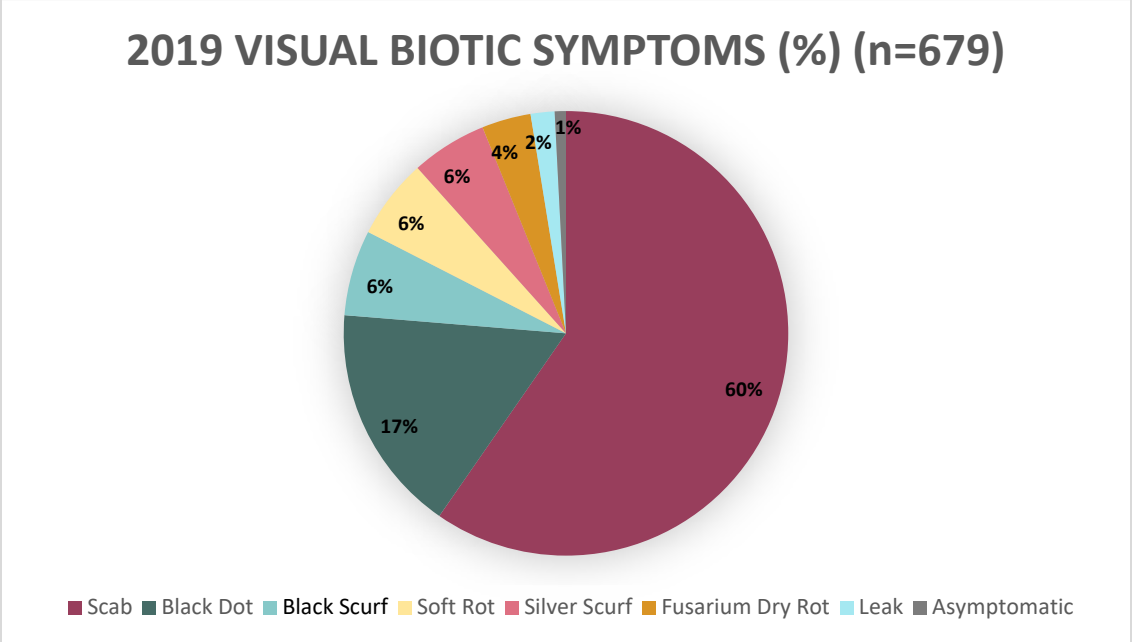

Figure 2. Biotic signs and symptoms of disease observed on tubers selected for at-harvest destructive sampling.

The following relative frequencies of known pathogenic genera have been observed from 570 tubers: *Fusarium* (25%), *Rhizoctonia* (24%), *Pythium* (17%), *Alternaria* (15%), *Colletotrichum* (7%), *Streptomyces* (3%), *Phytophthora erythroseptica* (0.3%), and *Geotrichum* (0.3%). Putative bacterial

pathogens (9%) are currently being characterized with the help of the MSU Plant and Pest Diagnostic Clinic and Dr. Noah Rosenzweig (Figure 3).

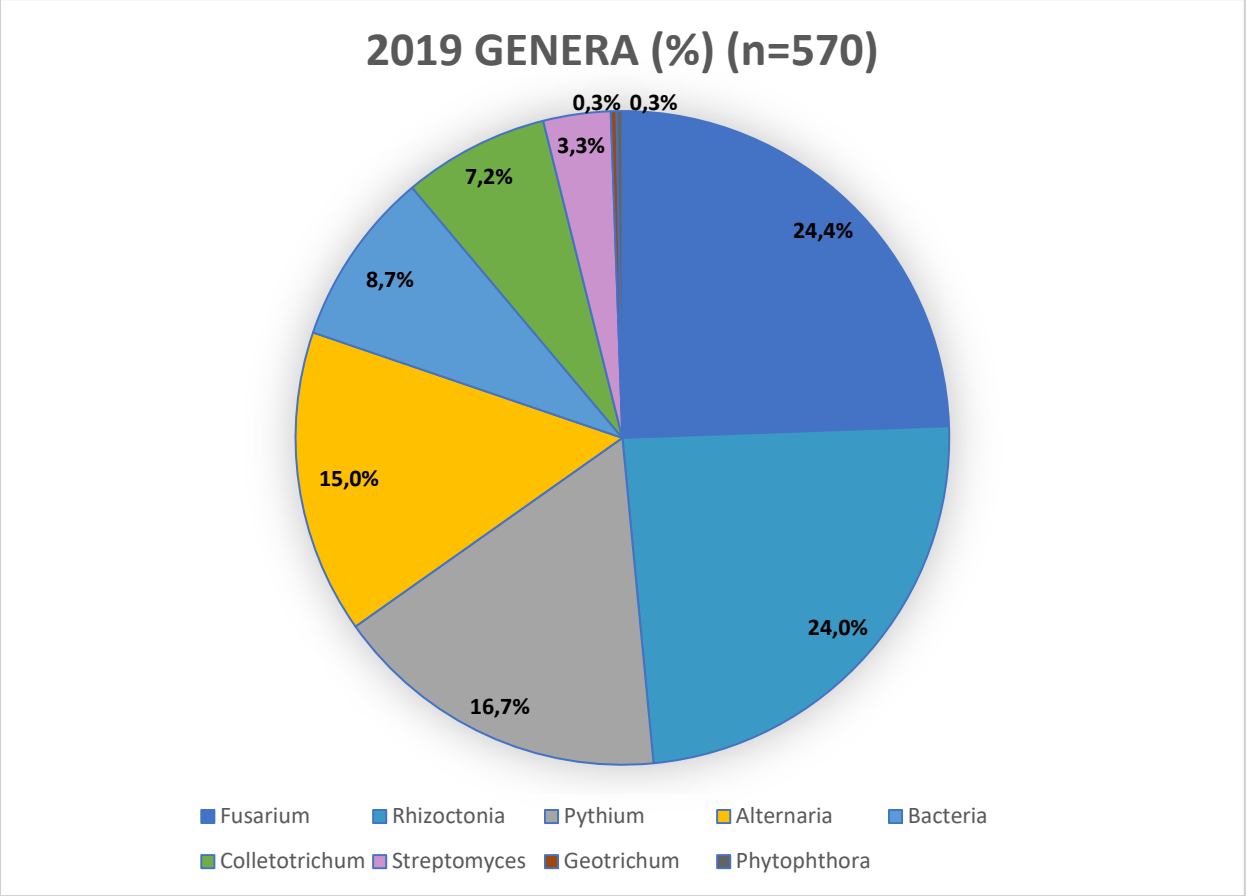

Figure 3. Relative frequencies of known pathogenic genera isolated from tubers, excluding samples without identified pathogens.

Correlations between abiotic and biotic symptoms were calculated using Kendall's tau B coefficient (SAS v. 9.4) and evaluated at the α=0.05 significance level. Highly significant correlations were found between dry rot and wound ($r = 0.2082$, $P < 0.0001$) and dry rot and internal bruising ($r = 0.3726$. $P < 0.0001$). These results support that damage inflicted upon tubers increases susceptibility to disease. Signs and symptoms of disease were low in initial samples, however, pathogen genera were detected on 83% of the tubers sampled at-harvest. We hypothesize that correlations between symptoms and genera observed will be higher at postharvest sampling due to advanced disease progression.

Acknowledgements:

We would like to thank the grower cooperators and key industry representatives and researchers who participated in this survey. We specifically thank other MSU Extension programs, Agri-business Consultants, Inc., Walther Farms, and MSU AgBioResearch for their contributions and support.