NCRPIS Plant Pathology Project

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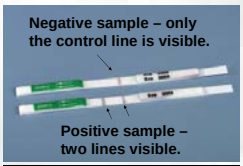
Project Objectives: Research and service activities that support successful regeneration and distribution of healthy plant germplasm.

DISEASE DIAGNOSIS & PHYTOSANITARY TESTING


Stewart's wilt sample prep.


ELISA kit components.

Colored wells are positives.



Immunostrips. Yes/no results. Available for some pathogens.

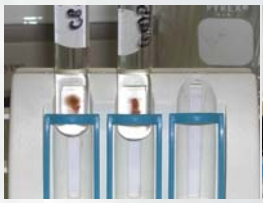

Diplodia testing on corn seed.


Setaria seed soak for nematodes.

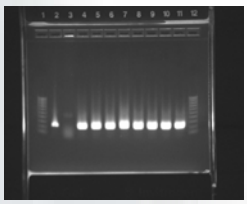
We provide plant disease diagnostic services to the curators and scout seed-increase fields for diseases.

We conduct hundreds of seed health tests each year for in-house use and phytosanitary tests. ELISA is the workhorse, but agar plating, blotter tests and microscopic exams are often used.

SEEDBORNE PATHOGEN RESEARCH


Paramagnetic (iron core) beads coated with DNA.

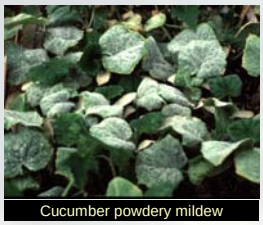

Real-time PCR analysis.


Conventional PCR gel of DNA from bacterial fruit blotch isolates.

Much of our current research focuses on seedborne pathogens – ecology (preventing infection), detection methods, longevity of pathogens in seed.

We are working with scientists at Iowa State and the University of Georgia to develop real-time PCR applications for several pathogens (fungi, bacteria and viruses) using antibody or DNA-coated beads to capture the target organism(s).

CUCURBITS


Cucumber powdery mildew


Squash mosaic virus


Bacterial fruit blotch

Fig. 1. Powdery mildew - caused by the fungus *Podosphaera xanthii* (syn. *Sphaerotheca fuliginea*). Approximately 1000 cucumber accessions have been screened for resistance by NCRPIS staff. Accessions from SE Asia frequently show resistance. See reference: Block, C.C. and Reitsma, K.R. 2005. Powdery mildew resistance in the U. S. National Plant Germplasm System cucumber collection. HortScience. 40(2):416-420.

Fig. 2. Squash mosaic virus – a difficult to manage seedborne and seed-transmitted virus. Important to have disease-free transplants. All greenhouse seedlings are tested by ELISA before transplanting to the field.

Fig. 3. Bacterial fruit blotch - caused by the bacterium, *Acidovorax avenae* ssp. *citrulli*. Seedborne, seed-transmitted and capable of surviving indefinitely on seed. Test for infection by ELISA Immunostrip, PCR, and plant inoculation.

MAIZE


Stewart's bacterial wilt


Gray leaf spot


Northern corn leaf blight

Fig. 1. Stewart's bacterial wilt - caused by the bacterium *Pantoea* (*Erwinia*) *stewartii*. Widespread and common. Seldom damaging except on sweet corn. Of phytosanitary significance for seed exports from the U.S. Extensive disease resistance screening has been conducted and data entered into GRIN.

See reference: **Block, C. C**., Hill, J. H., and McGee, D. C. 1999. Relationship between late-season severity of Stewart's bacterial wilt and seed infection in maize. Plant Dis. 83:527-530.

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Fig. 2. Gray leaf spot – caused by the fungus *Cercospora zea-maydis*. Widespread and common; occasionally damaging. Extensive disease resistance screening has been conducted and data entered into GRIN.

Fig. 3. Northern corn leaf blight – caused by the fungus *Exserohilum turcicum*. Widespread and common. Extensive disease resistance screening has been conducted and data entered into GRIN.

SUNFLOWER


Alternaria leaf blight


Septoria leaf blight


Downy mildew

Fig. 1. Alternaria leaf blight - caused by the fungus *Alternaria helianthi*. Over 1200 sunflower accessions have been screened for resistance. Two wild sunflower populations (SAM-1 and SAM-2) with resistance to three diseases, Alternaria leaf blight, Septoria leaf blight, and powdery mildew were released as breeding populations.

Fig. 2. Septoria leaf blight – caused by the fungus *Septoria helianthi*. Similar to Alternaria leaf blight. See reference: **Block, C.C.** 2005. Evaluation of wild Helianthus annuus for resistance to Septoria leaf blight. Proc. 27th Sunflower Research Workshop, Fargo, ND, Jan 12-13. Online at National Sunflower Association website: http://www.sunflowernsa.com/research/research-workshop/documents/Block_Septoria_05.PDF

Fig. 3. Downy mildew – caused by the fungus *Plasmopara halstedii*. One of the most important phytosanitary diseases of sunflower. Can be seed or soilborne. Typical symptoms of are white spores on underside of leaves.

AMARANTH


Pythium stem canker


Phomopsis leaf blight & stem canker


Phomopsis amaranthicola

Fig. 1. Pythium stem canker – caused by *Pythium aphanidermatum.* An unusual disease because it forms cankers (dead sunken tissue) well above the soil line. Favored by hot, wet weather. We have done screening for resistance in many species and in commercial cultivars.

Fig. 2. Phomopsis leaf blight and stem canker – caused by the fungus *Phomopsis amaranthicola*. Causes rapid defoliation and plant death of susceptible species. Particularly devastating to *Amaranthus tricolor*. We have done screening for resistance in many species. Selections and crosses are being made by the amaranth curator.

Fig. 3. *Phomopsis amaranthicola* in agar culture.