CCA's As First Detectors:

An Integral Component of the National Plant Diagnostic Network

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Need for Plant Biosecurity

- Protect agriculture and the environment
  - Biological threats
- Maintain profitability of crop production
  - Invasive species cost > $97-138 billion/year
- Maintain food security
- Protect international trade

Plant Biosecurity Tactics

- Exclusion
  - Inspection and import regulations
- Prevention of Losses
  - Resistance to pathogens
- Containment of Outbreaks
  - Identification, quarantine, eradication




Concerns following September 11

- Possibility of Ag bioterrorism and its impact on the health or economic value of crops in the United States
- Deliberate or unintentional introduction of exotic crop pests
  - Plant pathogens
    - Karnal bunt of wheat, soybean rust, Southern wilt of geranium
  - Arthropods (insects and others)
    - soybean aphid
  - Invasive weeds
    - Purple loosestrife


Photo by Dallas Peterson, Dept. of Agronomy, KSU


Photo by John Obermeyer, Dept. of Entomology, Purdue Univ.


Photo by USDA


Photo by Tom Sims, Kansas Department of Agriculture

Agricultural Bioterrorism Act-2002

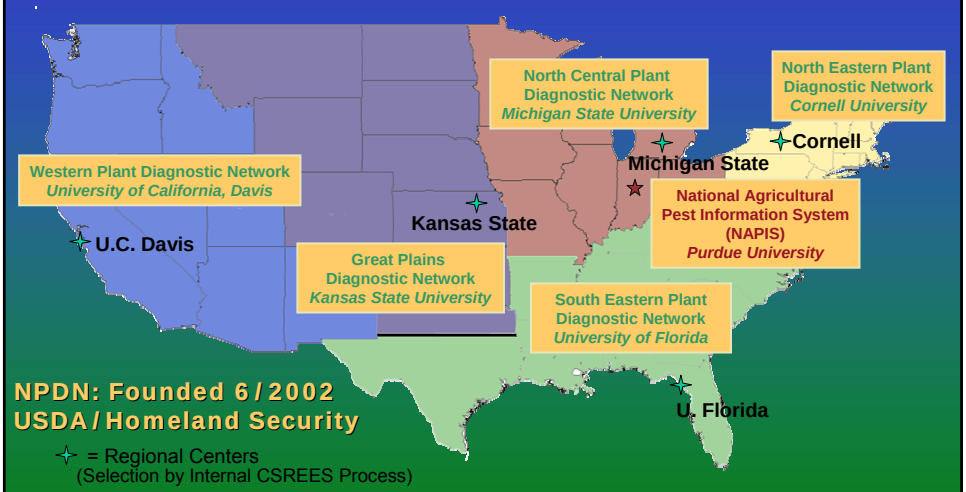
June 2002
Cooperative State Research, Education,and Extension Service (CSREES)
developed a network to link plant disease diagnostic facilities across the country

National Plant Diagnostic Network
NPDN

Land Grant University(LGU) Diagnostic Laboratories Chosen as the Backbone of the Network

NPDN Divided into Five Regions

Apologies to Alaska and Hawaii



NPDN: Founded 6/2002
USDA/Homeland Security

= Regional Centers
(Selection by Internal CSREES Process)

Enhanced Plant Biosecurity

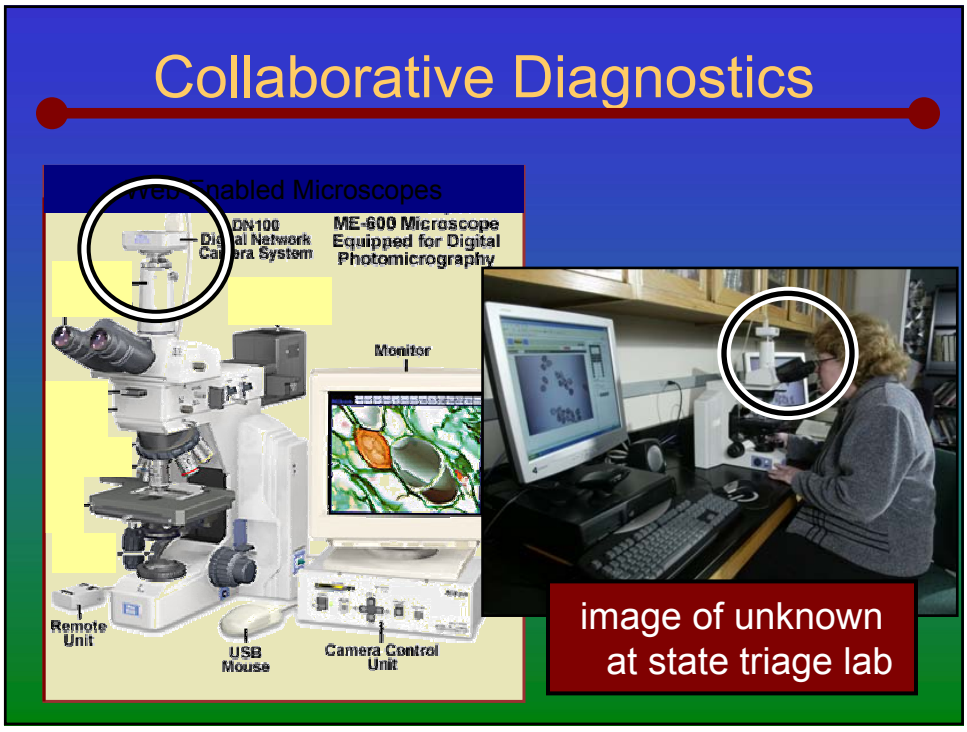
National Plant Diagnostic Network

- Coordinated detection and diagnostic network
- Rapid response

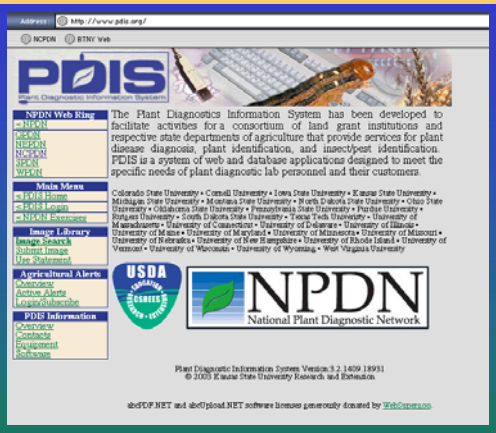
Overall Objectives of the NPDN

1. Improve diagnostic infrastructure
   - Laboratory equipment and supplies
   - Web-based digital cameras for microscopes
   - Web-based clinic database


1 2 3 4 5 6
1 2 3 4 5 6 7 8 9 10 11
Enhance National Infrastructure
Rapid Detection & Diagnosis


Collaborative Diagnostics
Web-Enabled Microscopes
DN100
Digital Network Camera System
ME-600 Microscope Equipped for Digital Photomicrography
Monitor
Remote Unit
USB Mouse
Camera Control Unit
image of unknown at state triage lab

Plant Diagnostic Information System

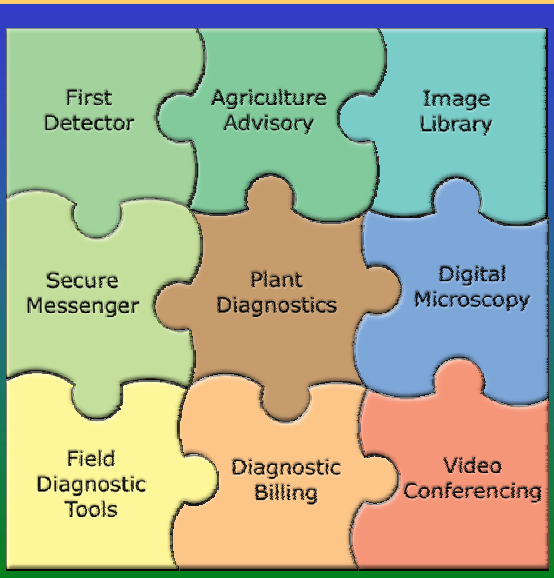


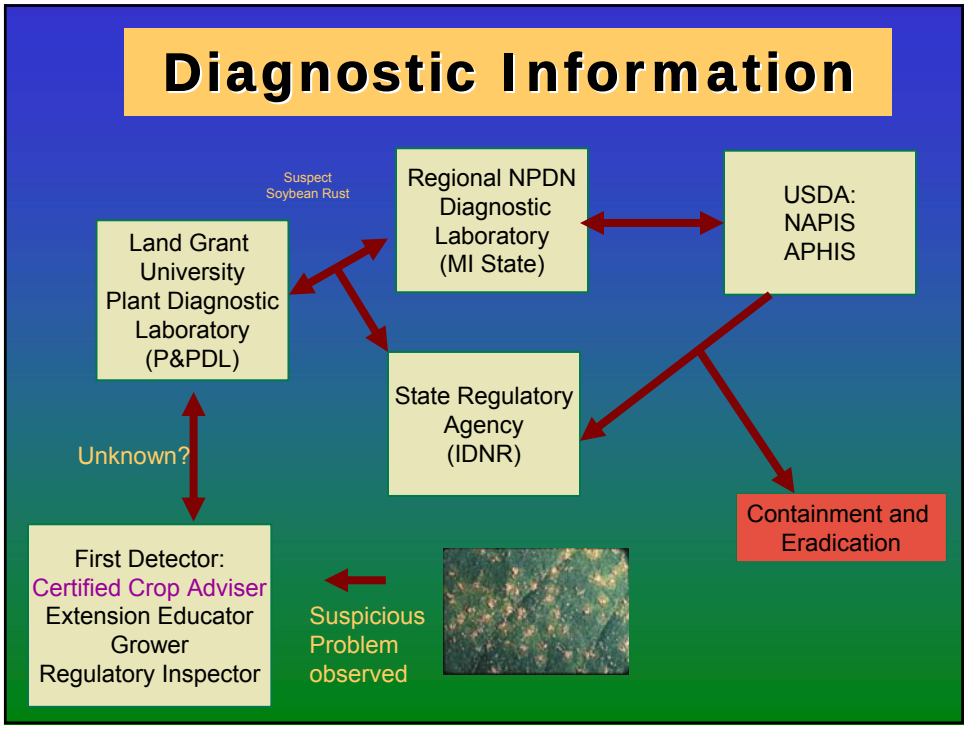
Web based clinic data base and much more!

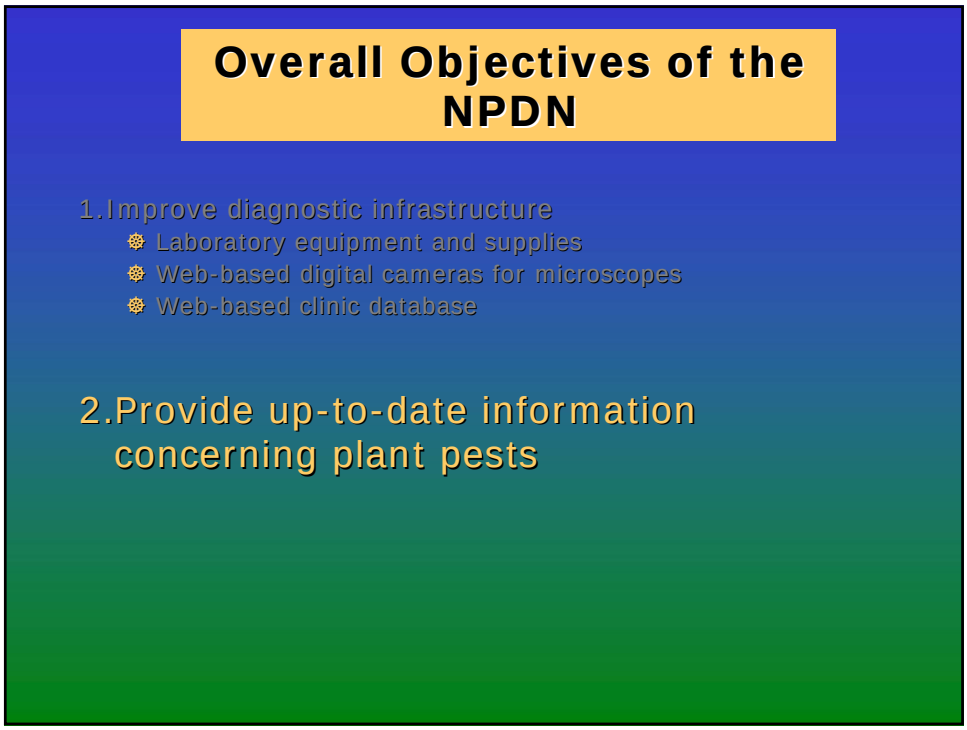
- Software package
- Developed by the information and educational technology division of KSU's Department of Communications
- For use by the NCPDN,GPDN and NEPDN

Plant Diagnostics Information System

Software Modules







Overall Objectives of the NPDN

1. Improve diagnostic infrastructure
   - Laboratory equipment and supplies
   - Web-based digital cameras for microscopes
   - Web-based clinic database

2. Provide up-to-date information concerning plant pests

3. Enlist the help of and provide training for First Detectors

First Detector Training

Monitoring and diagnosing of 'high risk' pest problems

FIRST DETECTORS NEED TO KNOW:

- What is normal
- How to respond
- What to collect; how to package; how and where to send
- How to incorporate digitally assisted distance diagnosis (DADD)

First Detector Training

FIRST DETECTORS NEED TO KNOW:

- What is normal
  - Recognition of common or economically important pests of major crops in Indiana

In order to recognize something NEW

Exotic Pests – USDA Select Agent List

Pathogen	Disease	Primary host
Phakopsora pachyrhizi	soybean rust	soybean
Sclerophthora rayssiae var. zeae	brown stripe downy mildew	corn
Peronosclerospora philippinensis	philippine downy mildew	corn
Ralstonia solanacearum race 3 biovar 2	bacterial wilt, brown rot	potato, tomato
Synchytrium endobioticum	potato wart or potato canker	potato
Plum pox potyvirus	plum pox	stone fruits
Xanthomonas oryzae pv. oryzicola	bacterial leaf streak	rice
Liberobacter africanus & L. asiaticus	citrus greening disease	citrus
Xylella fastidiosa	citrus variegated chlorosis	citrus
Exotic to Indiana		
Tilletia (Neovossia) indica	karnal bunt	wheat
Phytophthora ramorum	sudden oak death	trees, shrubs

Karnal Bunt (KB) – A Wheat Disease with Potentially Serious Consequences

*KB introduced to U.S. from India via Mexico – first found in U.S. in 1996.

*KB is a minor quality disease in the U.S., but has major implications because many trading (export) partners have a “zero” tolerance on wheat infested with KB.

Bunted Wheat Grain

- Wheat bunts & smuts affect the grain – they replace grain endosperm with fungal spores.

Karnal bunt (also called 'partial bunt')
Often just germ-end is bunted.

Common bunt
Entire grain filled with spores

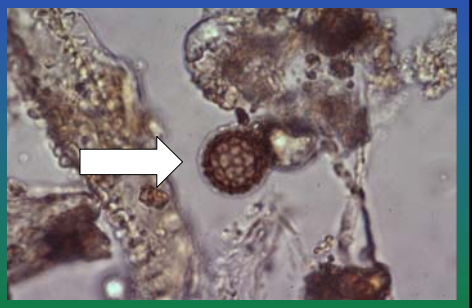
Spores of Karnal & Common Bunted Wheat Grain Bunt

Karnal bunt

1000X magnification

~22-49 microns

Common bunt



1000X magnification

~15-23 microns

Current Status of Karnal Bunt in the United States

*Currently only found (and quarantined) in small areas of Texas, California, and Arizona.

*A national survey looking for KB in U.S. wheat is conducted annually.

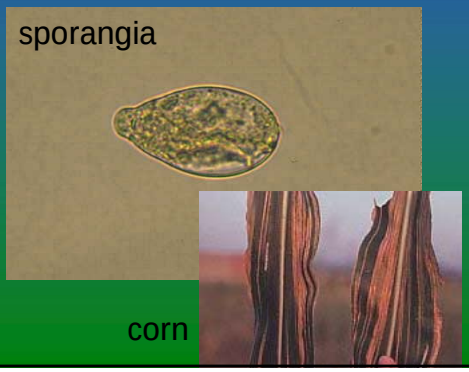
*If found, areas are quarantined – further tests used to pinpoint fields with KB infestations.

*If not found, phytosanitary certificates are issued by USDA-APHIS stating that wheat was produced in an area not known to be infested with KB.

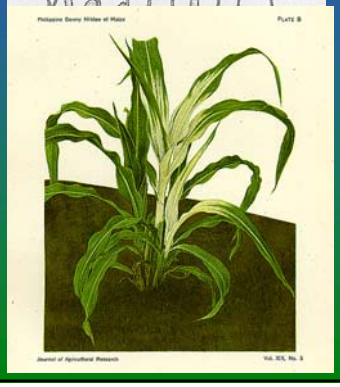
*The certificate allows movement of wheat into international markets.

Brown stripe downy mildew

- Occurs in India, Pakistan, Nepal, and Thailand
- Very damaging (60% yield loss)
- Obligate parasite
- Sporangia short lived
- Oospores - could be introduced
- Seedborne only in non-dried seed



Philippine downy mildew

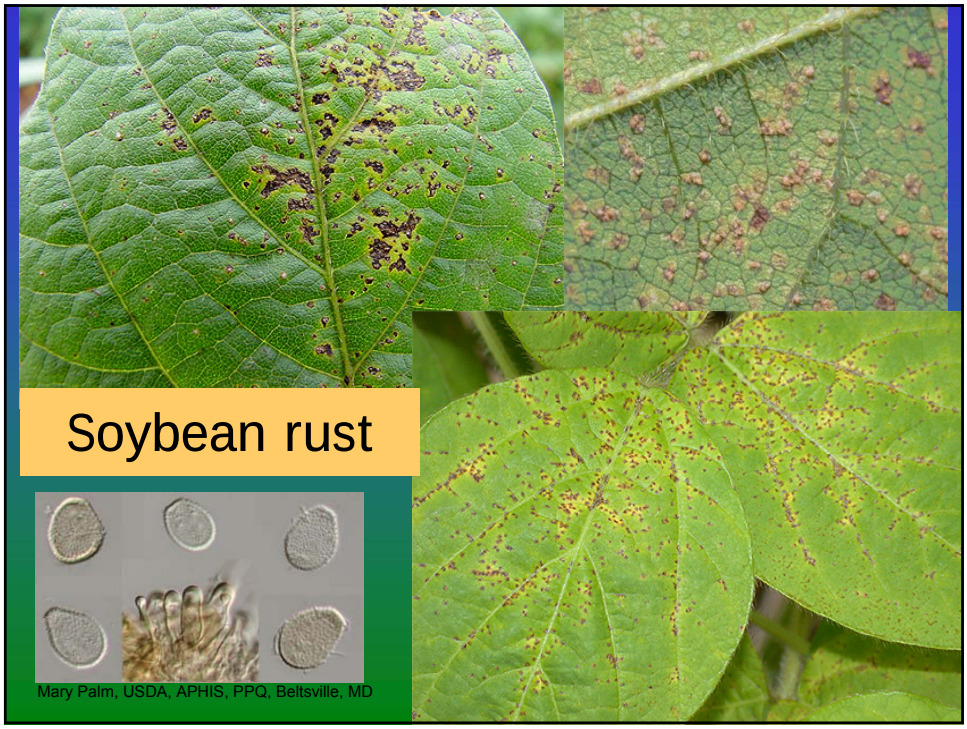


- Occurs in Philippines and elsewhere in Asia
- Very damaging (50% yield loss)
- Obligate parasite
- Sporangia short lived
- No oospores – unlikely to be introduced
- Seedborne only in non-dried seed

Soybean Rust (Asian, virulent type)

- Behaves like wheat rusts (airborne)
- Long history in Asia and Australia
- Spread to Africa in 1996 and South America in 2001
- Expected to naturally spread into North America
- Destructive - 50% yield losses possible
- No resistant varieties
- Fungicides required for control (Sec. 18)

http://www.ppdl.purdue.edu/ppdl/soybean_rust.html


Soybean rust
Mary Palm, USDA, APHIS, PPQ, Beltsville, MD


Soybean
Rust

Soybean Rust – host range

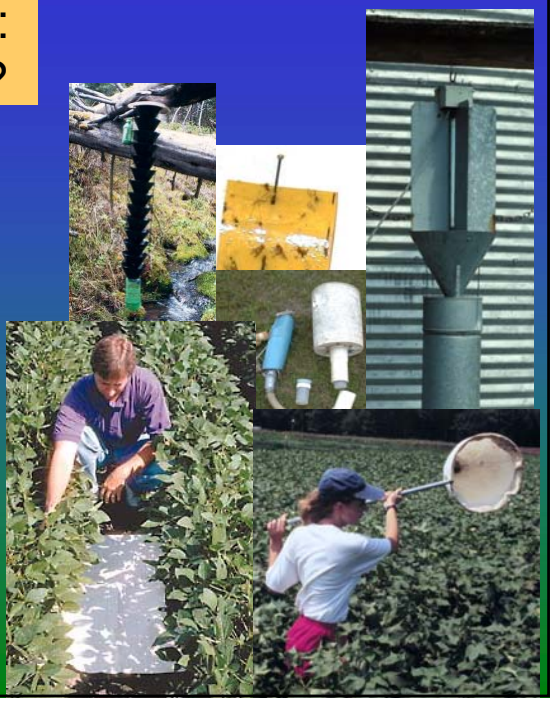
31 legume species, including:

- •Cultivated Crops
  - •Soybeans
  - •Lima beans
  - •Butter beans
  - •Green beans
  - •Kidney beans
  - •Cowpeas
  - •Pigeon peas
  - •Yam bean or jicama
- •Ornamental plants
  - •Hyacinth bean
  - •Lupine
  - •Royal poinciana
- •Wild hosts
  - •Kudzu
  - •Sweet Clover

Soybean rust on Kudzu

Monitoring Tools: New arthropods?

- Visual traps
  - Sticky traps
  - Pyramid traps
  - Black light traps
- Vacuum devices
- Odor traps
  - Pheromones
  - Plant volatiles
- Sweep nets
- Pitfall traps
- Hand lens



First Detector Training

FIRST DETECTORS NEED TO KNOW:

What is normal

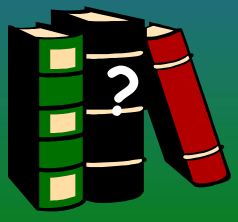
How to respond to something UNUSUAL

Local experts

Reference guides

Field handbooks

Web sites



If In Doubt, Ship It Out!

- Local experts
- Reference guides
  - Field handbooks
  - Web sites

- If you are unsure of ID, rely on diagnostic experts

►Purdue Plant and Pest Diagnostic Laboratory
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Purdue University
West Lafayette, IN 47907-2054

http://www.ppdl.purdue.edu/ppdl/SampleSubmission.html

First Detector Training

FIRST DETECTORS NEED TO KNOW:

What is normal

How to respond to the unusual

How to submit a quality and secure sample

Sample Security

- Communication: Early contact with diagnostic labs and regulatory officials
- Confidentiality
- Accuracy of source data
- Chain of custody
- Delivery details: Where, How, When

Sample Quality

- The accuracy of a disease diagnosis or insect ID can only be as good as the sample and information provided.
- Sample must be representative of symptoms and severity in the field and must contain the right material.
- Samples must be fresh and in good condition.
- Rapid delivery may be critical.

http://www.ppdl.purdue.edu/ppdl/SampleSubmission.html#Collecting&Shipping

Dead Plants "Tell no Tales"

- Avoid dead plants
- Choose plants which show a range of symptoms: moderate to severe

Accompanied by Appropriate Info

www.ppdl.purdue.edu

Sample form

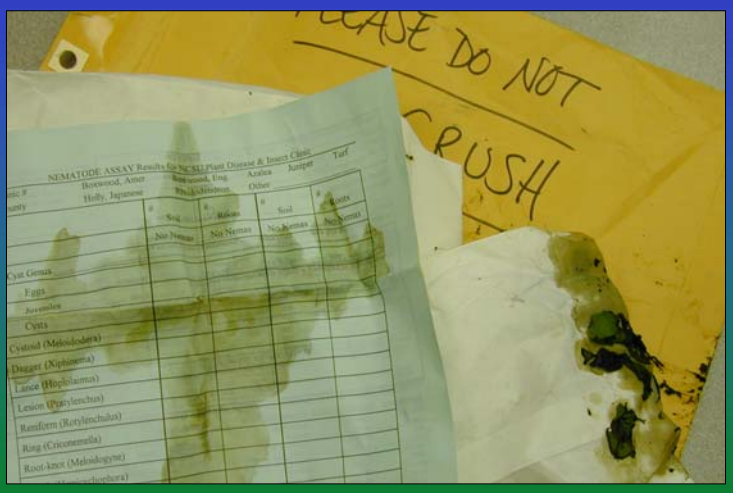
A Good Picture is Worth a 1000 Words.

Sample Quality: Packaging & Shipping

- Strong crush-proof box; All seams taped
- Keep soil on roots; place bag around roots & secure to stem with twist tie
- No extra water
- Wrap in dry paper & then double bag in plastic
- Flatten leaves between newspaper, place between cardboard, double bag and mail in envelope
- Disinfect exterior of bags if contaminated

Good Intentions?

Bad Results!



Good Packaging

- Plastic bag to keep soil on roots
- Dry paper to protect leaves from contact with plastic bag

Quality and Secure Sample Submission: Insects

Poor Packaging = Body Parts!

Properly Packaged Mailing Tubes Protect Samples!

Plant ID

- If unknown, collect botanical samples for host plant identification
  - Include: Flowers, Fruits, Leaves, Roots
- The same method can be used for Weed ID specimens.

Info, Info, Info!

- Be specific on collection information!

Including…
- Where and when the sample was found
- Symptoms of Concern
- Severity of problem
- Who collected the sample
  - Need contact info

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Certified Crop Advisors
CRITICAL
TO SUCCESS OF NPDN

Scout fields

Submit digitals and samples of something new or unusual

Report on current crop pests, crop conditions or unusual finds

NPDN
National Plant Diagnostic Network

North Central Plant Diagnostic Network

P&PDL

CCA's

Protecting Agriculture in America's Heartland