Report of the Plant Diagnostic Laboratory At North Dakota State University

January 1 through December 31, 2014

Available on-line at http://www.ag.ndsu.edu/pdl

Compiled by Jesse Ostrander and Lauren Bittara
NDSU Plant Diagnostic Lab
Department of Plant Pathology

NDSU **College of Agriculture, Food Systems, and Natural Resources**

NORTH DAKOTA STATE UNIVERSITY
NDSU Extension Service

Table of Contents

About the Lab

For over 40 years, the NDSU Plant Diagnostic Lab has helped individuals and professionals in agriculture and horticulture identify plant pests, diseases, and other various problems. Before submitting a sample to the NDSU Plant Diagnostic Lab, consider referring to local experts (such as county extension agents/educators) within your own state or county, since they may be more familiar with the types of plant problems that are common in your region, and will recommend submitting a sample to the PDL if necessary.

A modest fee applies if you submit a sample for routine diagnosis to the NDSU Plant Diagnostic Lab, to support the costs of lab technicians and lab supplies. The NDSU Plant Diagnostic Lab also performs limited seed health testing and phytosanitary testing. Services and fees are detailed on pages five and six.

Personnel

The lab supports up to three full-time personnel and several hourly students. Lab technicians and hourly help (as well as supplies and equipment) are supported with funds generated by the lab. Kasia Kinzer (MS, Plant Pathology) is the plant diagnostician (since 2004) and Jesse Ostrander (MS, Plant Pathology) is the assistant diagnostician (since July 2013). Kurt Rudolph (MS, Plant Pathology) was the lab technician through March 2014, with Lauren Bittara (MS, Plant Pathology in progress) being hired on in August of 2014 and currently with the PDL.

National Plant Diagnostic Network and NPDN First Detector Training

The NDSU Plant Diagnostic Lab is a member of the Great Plains Diagnostic Network (GPDN), a 9-state region of the National Plant Diagnostic Network (NPDN). The NPDN was established in 2002 and provides critical diagnostic training for plant diagnosticians around the country as well as a means of secure communication among plant diagnosticians and regulatory personnel if high risk plant pest threats occur. Its mission stresses the importance of early detection of pests that can negatively impact our agriculture, forestry, or horticulture, and to this end it offers NPDN First Detector training through face-to-face training events or online training. **County extension agents:** For a programming idea for your county, consider offering NPDN First Detector training. Learn how by contacting the Plant Diagnostic Lab.

A registered **NPDN First Detector** is any individual in agriculture, horticulture, or forestry who has undergone NPDN First Detector training and who has volunteered to become registered with the NPDN. Professionals and master gardeners who are involved in some way with agriculture, forestry, or horticulture are especially encouraged to consider becoming registered NPDN First Detectors. **For self-directed training, on-line training modules are available** at http://firstdetector.org/. After successful completion of at least three of the online modules, individuals may call the NDSU Plant Diagnostic Lab to become registered in the NPDN First Detector national database (this is completely voluntary; not required). Occasionally, face-to-face NPDN First Detector training is offered, and it may be possible to arrange a session near you if enough interest exists. Contact the lab if you would like to become a registered NPDN First Detector (phone: 701-231-7854; email: NDSU.PDL@ndsu.edu).

More information about the Great Plains Diagnostic Network is available at www.gpdn.org. For more information on the National Plant Diagnostic Network please visit www.npdn.org.

Activities of the NDSU Plant Diagnostic Lab

Our goal is to provide economical, unbiased plant and pest diagnostic services to agricultural professionals, the horticulture/turf/forestry industries, homeowners, and individuals in North Dakota. We can accept samples from throughout the United States, but we encourage potential submitters to first contact their local extension agent or land grant university plant/pest diagnostic lab/clinic.

2014 Accomplishments and Highlights

- A personnel change occurred in the lab in 2014:
    - The lab welcomed Lauren Bittara in August, 2014, as the new seed health technician.
- The lab once again processed a higher-than average number of samples in 2014, with a record breaking number of routine diagnostic samples.
- The lab maintained USDA certification to test for bacterial ring rot to fulfill requirements of the Canadian Seed Potato Certification Program, for seed destined to be sold as certified seed in Canada.
- We offered training for various regulatory officials on identification of the potato bacterial ring rot pathogen, *Clavibacter michiganensis* subsp. *sepedonicus.*
- We continued to support the Master Gardener program and other horticultural community programs.
- In addition to offering routine diagnostic services, we continued to provide selected seed health testing for seed growers, phytosanitary testing to support the efforts of the North Dakota Department of Agriculture to facilitate exportation of our crops, and research support services for faculty and private entities.

Services and Fees

Please contact the lab (phone: 701.231.7854; email NDSU.PDL@ndsu.edu) for information on special tests or research support options not listed below – **the lab is flexible and <u>may</u> be able to offer services not listed below to fulfill your needs**. Fees below reflect rates for commonly requested services. Rates were increased for 2014 but will remain at these levels for 2015. For previous rates, please refer to the 2013 and earlier annual reports.

Routine Diagnostic Services – Rates for 2015

Routine Diagnosis (includes visual exam, microscopy, humid chamber incubation)
- ND Resident $25
- Out-of-State $45

Routine Diagnosis + Culture (including Dutch Elm Disease test)
- ND Resident $30
- Out-of-State $45

Routine Diagnosis + Immunostrip (a serological test; may include culture) $45

Tests routinely offered (on-hand):

Immunostrip:

Hosta Virus X, *Clavibacter michiganensis* subsp. *michiganensis* (used to confirm presence of the Goss's wilt pathogen, in conjunction with symptoms and observation of bacterial streaming), Ornamental screen (CMV,INSV,TSWV,TMV), *Phytophthora* sp., *Erwinia* sp. (used to detect the fireblight pathogen), Round-Up-Ready.

Additional immunostrip tests may be available – contact the lab for more info

Routine Diagnosis + ELISA (a serological test) $45

Each additional sample, same pathogen $10

Reduced bulk rates apply – call for details

Tests routinely offered (on-hand):

ELISA:

Potato viruses: PVA, PVM, PVS, PVX, PVY, PLRV

Potato bacterium: *Pectobacterium atrosepticum* (*Erwinia carotovora;* black leg) Bacteria: Cms (ELISA/IFA)

Small grain viruses: WSMV, BYDV-PAV, CYDV-RPV, HPV

Additional ELISA tests may be available

Plant, insect, fungus identification $15

Home mold analysis (based on samples submitted) $15

Soybean Cyst Nematode – soil sieve method $30

Root rot index (*Aphanomyces*) – soil bioassay $135

Potato tuber rot evaluation (35 lbs minimum; MUST <u>contact lab prior to delivery</u>) $45

PCR (DNA-based analysis) – please contact lab for info $50

Conventional: *Phytophthora sojae, Erwinia amylovora, Phialophora gregata*, *Phytoplasma*, PVY Strain Characterization (per sub-sample)

Real Time: *Cms* (Mills/CelA; potato bacterial ring rot), *Ralstonia solanacearum* (brown rot – potato, geranium; including Biovar 2); others may be available on request

Bulk – research culture – isolation from plants ..... $8 per plate

Bulk – research culture – inoculum preparation ..... $5 per plate

Seed Health/Phytosanitary Services – Rates for 2015

General Tests

Nematode seed wash (cyst and foliar nematodes) $30

Pathogen identification from seed – isolation/DNA extraction/PCR/Sequencing ..... $90 per isolate (3 minimum)

Pathogenicity test – pathogen identification from seed plus inoculation on susceptible host plants ..... $135 per isolate (3 minimum)

Specific Tests – by host

Dry Edible Beans

- "Dome Test" for Bacterial Blight pathogens (3-5 lb. minimum sample) $85
- Anthracnose testing (3-5 lb. minimum sample) $85

Potato

- Late Blight tuber screen (min. 400 tubers) $125
- Potato Bacterial Ring Rot (*Clavibacter michiganensis* subsp. *sepedonicus*) for recertification in CANADA (minimum 400 tubers required; method: ELISA/IFA, positives verified with real-time PCR) $185
- Potato Bacterial Ring Rot (*Clavibacter michiganensis* subsp. *sepedonicus*) DNA-based test; 200-tuber subsamples ..... $50 per subsample
- ELISA virus testing on tuber sprouts ..... $2 per test well (600 tubers recommended)
  - Virus tests available: PVY, PLRV, PVX, PVM, PVA, PVS, PMTV (PMTV can be done on dormant tubers).
  - 2 tubers per well, 300 wells at $2/well: $600
  - 5 tubers per well, 120 wells at $2/well: $240
  - With PVY strain characterization (PCR): ..... add $50 per test well
  - Additional viruses: ..... $1.00 per well
  - NOTE: Allow 3-6 weeks for if tubers must be sprouted prior to testing
- Potato tissue culture 6-virus/1-bacteria screen (PVA, PVM, PVS, PVX, PVY, PLRV, and *Clavibacter michiganensis* subsp. *sepedonicus*; *Pectobacterium atrosepticum* by request) ..... $25 per clone
- PSTV (available by special arrangement; contact lab for pricing) ..... varies

Pulse crops - Lentils / Chickpeas (Garbanzos) / Field Peas

- Ascochyta screening, pea/lentil (3-5 lbs; 500 seeds tested) $100
- Ascochyta screening, chickpea (3-5 lbs; 1000 seeds tested) $125

Small Grains

- Bunt/smut teliospore seed wash (per ISTA method; submitted sample: min. 1000 grams; sub-sample: min. 50 grams tested) $75
- Black Point screen (2-3 lb. minimum sample) $85

Other fungi screening $85

Fee Waivers for Extension Personnel

The lab offers a limited number of waivers for Extension Personnel. In 2014, samples referred (or submitted) to the lab by **Extension Personnel** usually qualified for a **fee waiver**. The purpose of these waivers is to help foster relationships between extension personnel and their stakeholders. These waivers were used to waive the following fees: routine diagnosis, culture (including the Dutch elm disease culture test), herbicide injury evaluation (visual only; NDSU Plant Diagnostic Lab does not offer wet chemistry residue analysis), plant/insect/fungus identification, home mold identification, or routine serological test (WSMV, BYDV-PAV, HVX, INSV, TSWV, TMV, CMS, potato viruses). **Note:** The fee waiver cannot be applied to seed health/phytosanitary tests, the potato spindle tuber viroid test, DNA-based tests, and certain other tests. If you have any questions, please contact the lab. Fee waivers and other information are typically distributed in spring.

Turn-Around Time

Many of the samples that come into the lab have uncommon or unusual symptoms that are not routinely encountered by experts. As a result, be prepared for longer turn-around times. In some cases a diagnosis cannot be reached despite all efforts of the diagnostician and additional specialists that are consulted. The table below provides a guideline of turnaround times for various sample types. These guidelines are based on one sample (not multiple samples from the same client). Actual turnaround times may vary, depending on complexity of the problem; availability of expert consultants; types of tests needed; number of samples; knowledge of the crop; type of problem suspected; priority (that is, samples that require immediate corrective actions vs. samples with no such immediate need); and so on.
Often, by the time a sample is submitted to the lab, corrective measures for the current season may not be available; thus, the problem may be a management issue for subsequent seasons.

Estimated turnaround times for routine samples:

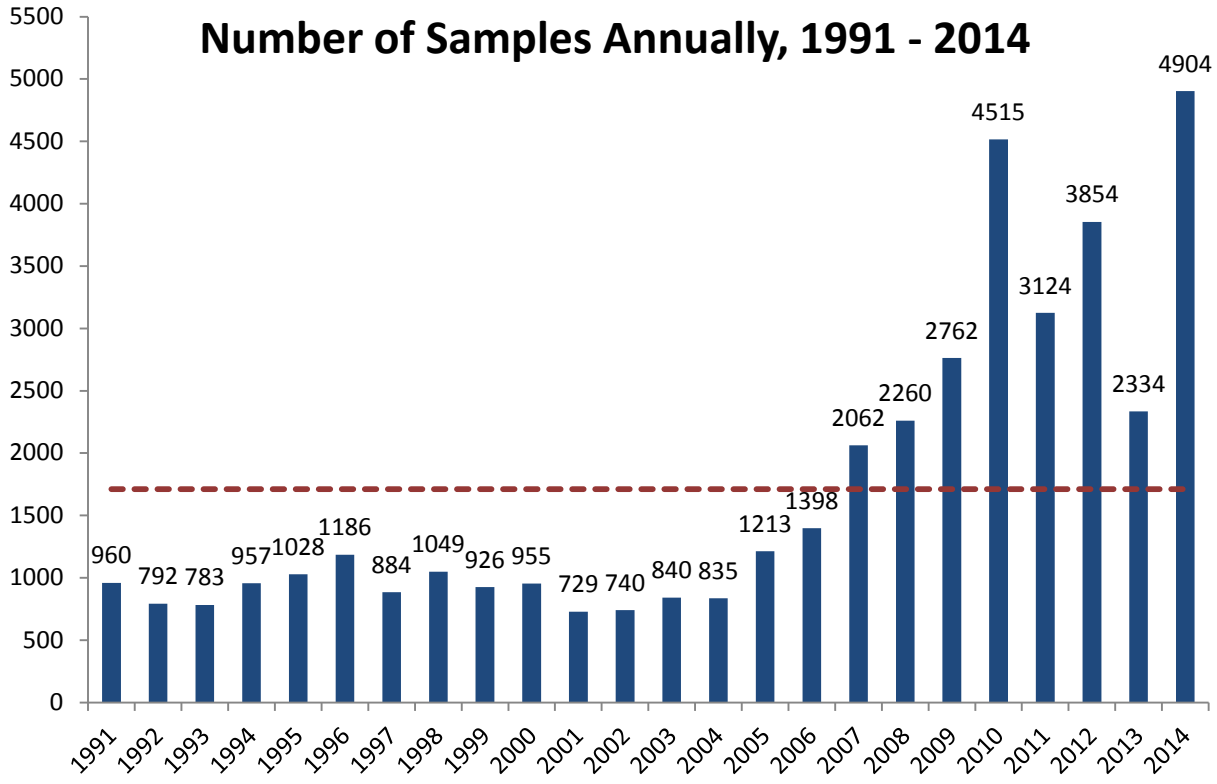
Sample Type	Estimated turnaround time (business days from time of sample receipt)
Field Crops	1-14 days
Tree/Shrub	5-14 days
ELISA testing	1-3 days[1]
PCR testing	1-3 days[1]
Culturing a sample	1-4 weeks (varies)
Nematode	1-7 days
Fruits/Vegetables	1-14 days
Ornamentals	1-14 days
Turf/Lawn	1-14 days
Plant/Insect ID	1-7 days
Fungus/Mold ID	2 weeks
Seed Health	24 hours to 8 weeks
Phytosanitary	24 hours to 8 weeks

NOTE: The lab generally adopts a 'first-come-first-served' policy, but under certain circumstances, some samples, particularly commercial ones or those suspected to be infected by a 'high risk' pest (as defined by USDA-APHIS or the National Plant Diagnostic Network), may be given priority, especially if a very narrow window of time for treatment or response exists.

Lab Statistics

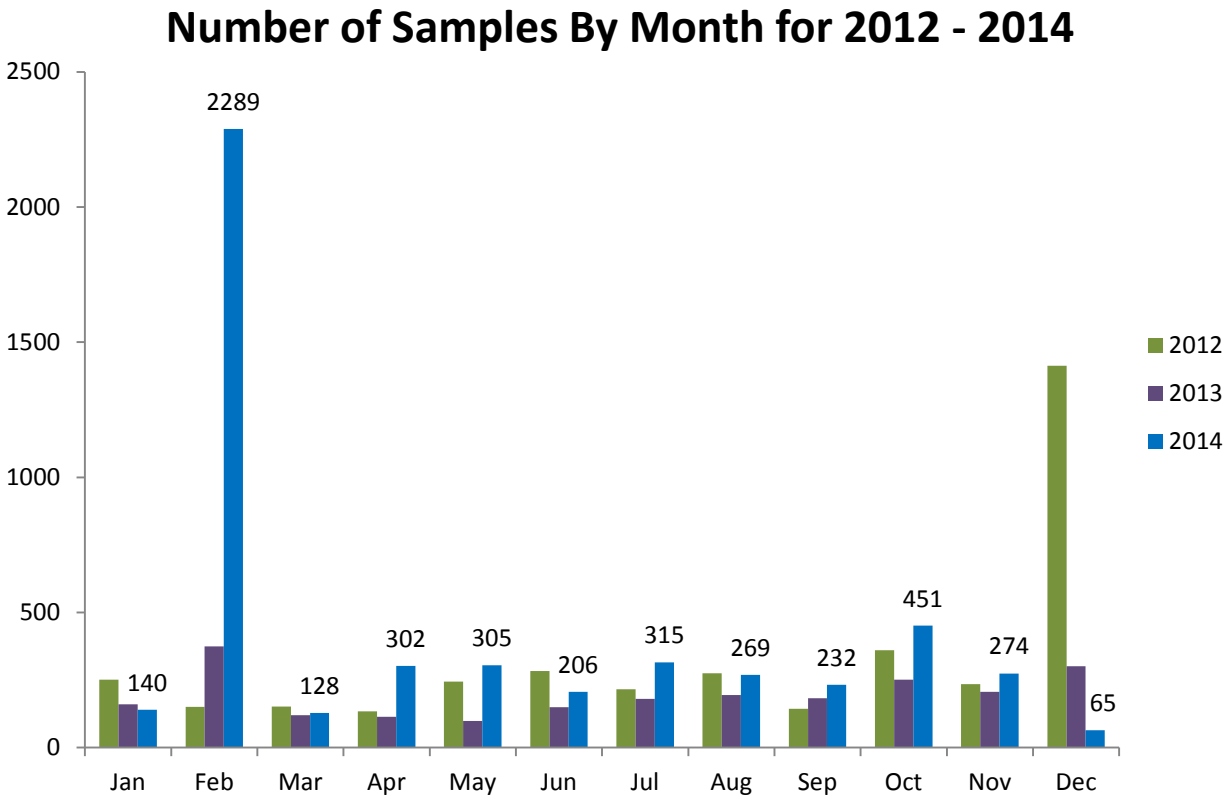
Total samples Received by Year, 1991 through 2014

A historical perspective of total number of samples received by the lab is presented in the graph below. The total number of samples received per year includes routine diagnosis, phytosanitary certification, seed health, research, and survey samples. The average total sample number has been steadily on the rise, albeit inconsistently. The large increase in sample numbers for 2014 is due to over 1,500 research samples being received in spring 2014, rather than December 2013 when such samples are normally received. A historical average of 1,712 samples have been processed per year (dotted red line).



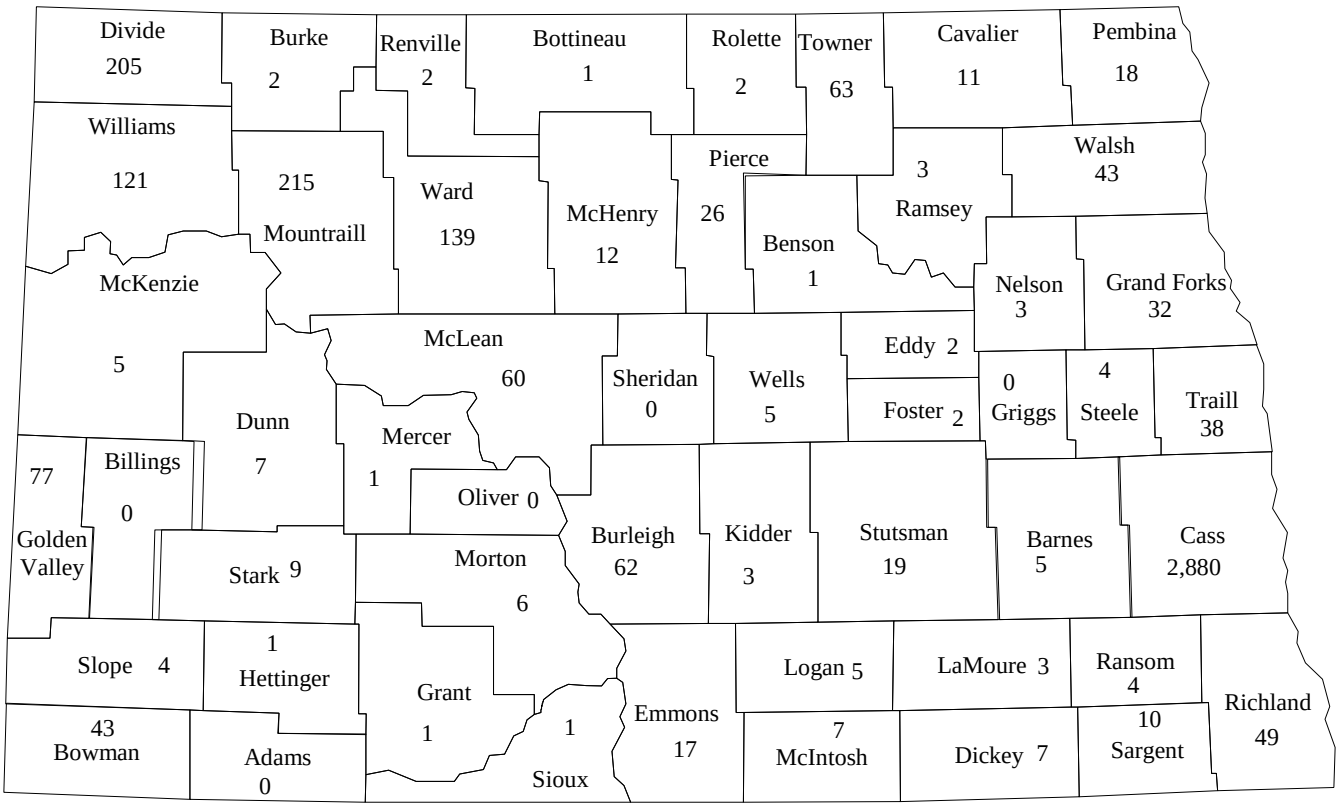
Monthly Sample Submission 2012 through 2014

Samples submitted for routine diagnosis, seed health testing, phytosanitary testing, surveys, and research support are received throughout the year. A large proportion of samples received during June, July, and August are those for routine diagnosis, although survey samples and phytosanitary samples are also received during this time. Samples received in December, January, and February are predominantly research samples. Phytosanitary samples are received throughout the year and seed health testing occurs largely during fall, winter, and spring. The numerical data labels in the chart below correspond to 2014 data only.



North Dakota Samples by County 2014

Includes Routine Diagnosis, Phytosanitary, Research, Seed Health, and Survey samples.



Out-of-State samples 2014

(Includes routine diagnosis, seed health, and phytosanitary samples)

Location	# Samples
Canada	3
Arizona	6
Colorado	3
Florida	1
Idaho	65
Kentucky	1
Massachusetts	1
Maryland	2
Michigan	49

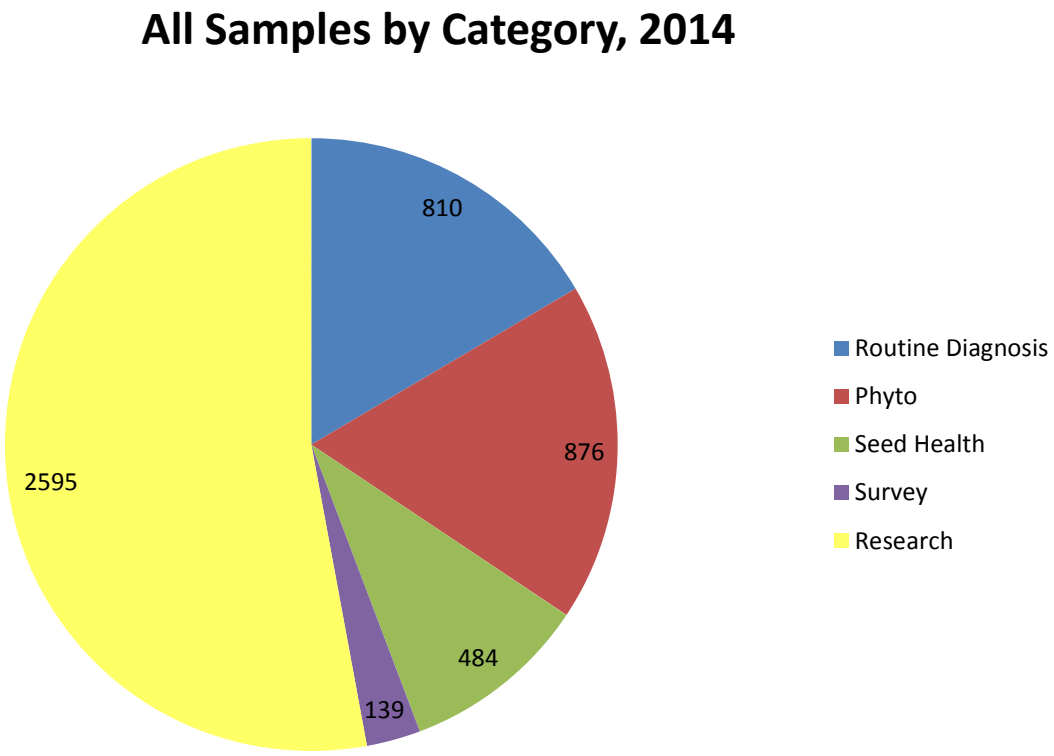
Location	# Samples
Minnesota	278
Montana	46
Oregon	1
South Dakota	17
Utah	19
Virginia	2
Washington	1
Wisconsin	30
Total Out of State	525

Total Number of Samples Received By Sample Category, 2014

Samples processed by the lab are separated into five main categories:

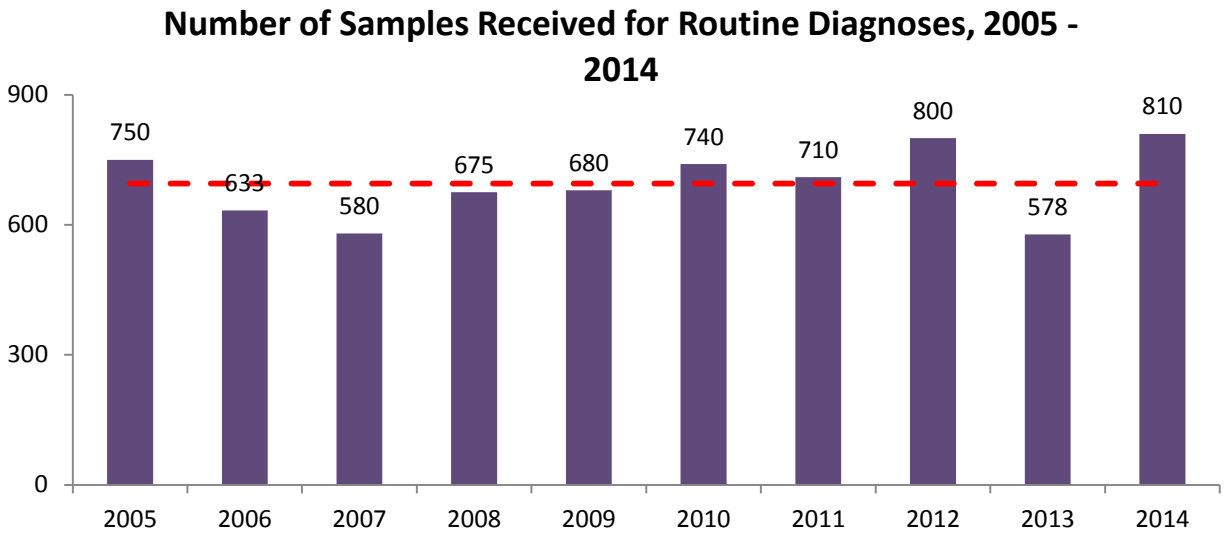
1. Survey
2. Research
3. Routine Diagnosis
4. Seed Health
5. Phytosanitary

A total of **4,904** samples were submitted in 2014. The pie chart below summarizes the total number of samples submitted by main category.



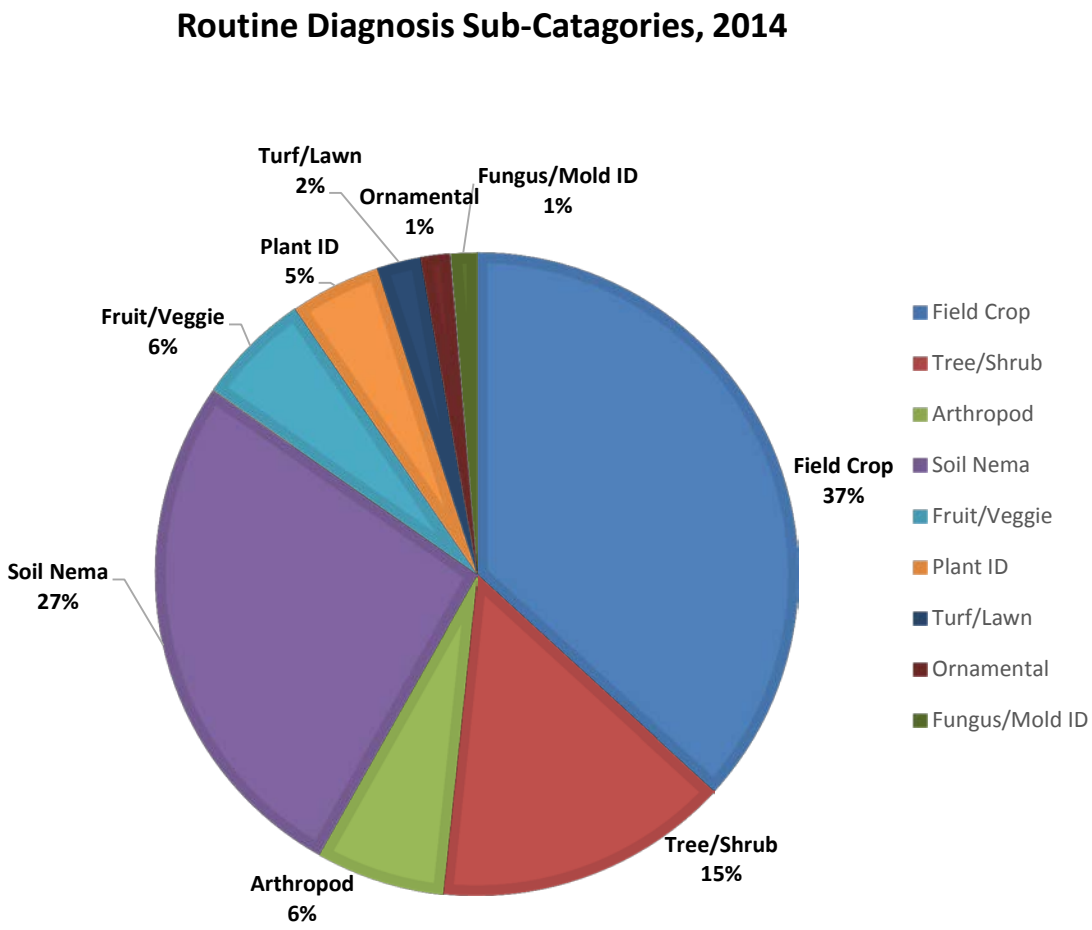
Routine Diagnoses Received in 2014

The following figure details sample numbers for **Routine Diagnosis** only (Phytosanitary, Seed Health, and Research samples are NOT included). The ten-year average is 694 (dotted red line). While numbers were down in 2013, they were higher than average in 2014.



Routine Diagnoses samples in 2014

Samples submitted for Routine Diagnosis are further divided into nine subcategories. Field crops, as usual, comprise the largest portion of samples submitted for routine diagnoses, followed by tree/shrub samples, arthropod (insect) identification requests, and soybean cyst nematode (soil) samples, as shown below:



Number of Diagnoses and Causal Agent Type by Routine Diagnosis Subcategory 2014

The table below summarizes the type of diagnosis applied to samples submitted for routine diagnosis. Since samples often have more than one diagnosis applied to them, the number of diagnoses exceeds the number of samples submitted. The table excludes data for phytosanitary, seed health, research, and survey samples.

Subcategory	Total Diagnoses	Confirmed or Suspected Causal Agent Type										
		Fungus	Bacterium	Virus	Arthropod (Insect)	Nematode	Chemical Injury	Abiotic	Other	No Pest or Pathogen Detected	Unknown	Insufficient sample
Arthropod ID Request	48	0	0	0	48	0	0	0	0	0	0	0
Field Crop	300	61	30	6	2	1	27	49	10	95	6	13
Fungus/Mold ID Request	11	11	0	0	0	0	0	0	0	0	0	0
Ornamental	12	3	0	0	1	1	0	1	1	5	0	0
Plant ID Request	37	0	0	0	0	0	0	0	37	0	0	0
Small Fruit/Vegetable	47	12	0	3	2	0	6	14	2	4	0	4
Soil (SCN or bioassay)	216	0	0	0	0	205	0	0	0	11	0	0
Tree/Shrub	121	27	2	0	29	0	4	30	7	12	0	10
Turf/Lawn	18	2	0	0	2	0	0	12	1	0	0	1
Total Diagnoses	810	116	32	9	84	207	37	106	58	127	6	28

Number of Routine Sample Submissions by Sample Source 2014

The table below summarizes the proportion of samples submitted by extension personnel and non-extension, and whether the samples were for a commercial and noncommercial entity. Extension samples comprise 22% of samples received for routine diagnosis (this excludes Phytosanitary, Research, Routine Diagnosis, Seed Health, and Survey samples). Use of the lab by extension personnel is encouraged, and the large proportion of Routine Diagnosis samples submitted by extension personnel demonstrates their continued support of the lab.

Submitter Type	Number of Samples for Routine Diagnosis Only
Extension - Total	**181**
Commercial	70
Non-commercial	111
Non-Extension - Total	**626**
Commercial	492
Non-commercial	134
Not Indicated - Total	**3**
Total:	**810**

Dutch Elm Disease in ND and MN

Dutch elm disease continues to infect American elm trees throughout the Red River Valley and the state of ND. The data presented here is limited to samples submitted to the Diagnostic Lab and as such cannot fully indicate whether incidence has risen or lowered from one year to the next. While symptoms of Dutch elm disease are fairly diagnostic by experienced tree health professionals, only a laboratory test can confirm the presence of the Dutch elm disease pathogen.

Keeping American elm trees healthy is the best defense against infection. An NDSU Extension bulletin is available with more information on managing Dutch elm disease. An electronic version of this publication is available online at:

http://www.ag.ndsu.edu/publications/landing-pages/gardens-lawns-trees/dutch-elm-disease-in-nd-pp-1635

A PDF version is available at: http://www.ag.ndsu.edu/pubs/plantsci/trees/pp1635.pdf

Dutch Elm Disease Samples by ND County, 2011 - 2014

County, Number submitted	2011		2012		2013		2014	
	Positive	Not Detected	Positive	Not Detected	Positive	Not Detected	Positive	Not Detected
Burleigh	--	--	--	--	1	0	--	--
Cass	4	0	4	1	8	0	2	0
Clay, MN	--	--	--	--	--	--	2	0
Eddy	--	--	--	--	--	--	1	0
Grand Forks	--	--	--	--	--	--	1	1
Kidder	--	--	--	--	1	0	--	--
Morton	0	1	--	--	--	--	--	--
Mountrail	--	--	--	--	--	--	1	0
Richland	--	--	--	--	1	0	--	--
Sheridan	--	--	1	0	--	--	--	--
Stark	1	0	1	0	0	1	--	--
Stutsman	--	--			0	1	--	--
Wells	--	--	1	0	--	--	--	--
Total:	**5**	**1**	**7**	**1**	**11**	**2**	**7**	**1**

Seed Health and Phytosanitary Samples of 2014

Samples for seed health testing are usually submitted during the winter months, typically beginning in September. Phytosanitary tests fulfill export requirements and occur year-round. The numbers below do not necessarily reflect unique samples – some samples are submitted for more than one seed health or phytosanitary test.

Seed Health and Phytosanitary Samples

Test Type	Number of Samples
Nematode test – export (pulses)	599
Nematode test – export (soil)	114
Dome (dry bean, bacterial)	2
Dry bean anthracnose	0
Bunt teliospore seed wash	16
Potato bacterial ring rot	852
Potato viruses	35
Potato Late Blight	1

2014 Sample Details

The table below summarizes selected diagnoses by the NDSU Plant Diagnostic Lab, sorted by host or habitat. Note that the level of confidence of the diagnosis is included, where **Confirmed or Suspected** indicates that the pest or pathogen was keyed out (morphology) or verified with serological or genetic testing, or based on general morphology, microscopy, or other evidence; **Not Detected or Inconclusive** means that the pathogen was not detected using one or more tests such as microscopy, culture, serology, or PCR; or test results were contradictory or unresolved.

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
Apple (*Malus* sp./spp.)					
	Botrytis Blight (*Botrytis* sp./spp.)	0	0	1	0
	Fire Blight (*Erwinia amylovora*)	0	0	1	0
	Scorch (Abiotic disorder)	0	0	0	0
Ash (*Fraxinus* sp./spp.)					
	Ash Anthracnose (*Gnomoniella fraxini*)	0	1	0	0
	Ash Mites (*Eriophyes* sp./spp.)	1	2	0	0
	Ash Plant Bug (*Tropidosteptes* sp./spp.)	1	0	0	0
	Ash Rust (*Puccinia sparganioides*)	1	0	0	0
	Curculionid Bark Beetles (Family *Curculionidae*)	0	1	0	0
	Herbicide Injury/Exposure (Abiotic disorder)	0	1	0	1
	Leaf Scorch (Abiotic disorder)	1	0	0	0
	Insufficient Rootball (Abiotic disorder)	0	1	0	0
	Unknown Abiotic Disorder	0	3	0	0
Aspen (*Populus* sp./spp.)					
	Buprestid Beetle (*Dicerca tenebrica*)	1	0	0	0
	Insufficient Rootball (Abiotic disorder)	0	1	0	0
	Sunscald (Abiotic disorder)	0	1	0	0
	Trunk Girdling (Abiotic disorder)	1	0	0	0
Azalea (*Rhododendron* sp./spp.)					
	Transplant Stress/Shock (Abiotic disorder)	0	1	0	0
Barberry (*Berberis* sp./spp)					
	Scale (*Coccus* sp./spp.)	0	1	0	0
Barley (*Hordeum* sp./spp.)					
	Barley Net Blotch (*Pyrenophora teres*)	2	0	0	0
	Barley Strip Mosaic Virus	0	0	0	2
	Barley Yellow Dwarf Virus	0	0	0	1
	Stem Nematodes (*Ditylenchus* sp./spp.)	0	0	0	1
	Bunt (*Tilletia* sp./spp.)	0	0	0	3
	Dwarf Bunt (*Tilletia* sp./spp.)	0	0	0	2
	Karnal Bunt (*Tilletia indica*)	0	0	0	2
	Leaf Spot (Abiotic disorder)	0	1	0	0
	Nutrient Imbalance (Abiotic disorder)	0	1	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Smut (*Urocystis* sp./spp.)	0	0	0	3
	Unknown Abiotic Disorder	0	1	0	0
	Wheat Streak Mosaic Virus	0	0	0	1
Bassword/Linden (*Tilia* sp./spp.)					
	Growth Regulator Effect (Abiotic disorder)	0	1	0	0
	Leaf Scorch (Abiotic disorder)	1	0	0	0
	Mycosphaerella Leaf Spot (*Mycosphaerella* sp./spp.)	0	1	0	0
Bean (*Dolichos* sp./spp.)					
	Stem and Bulb Nematodes (*Ditylenchus* sp./spp.)	0	0	0	8
	Cyst Nematode (*Heterodera* sp./spp.)	0	0	0	8
	Chemical Injury (Abiotic disorder)	0	0	1	0
	Common Bacterial Blight (*Zanthomonas campestris* pv *phaseoli*)	1	0	0	0
	No Pathogen Found	1	0	0	0
	Nutrient Imbalance	0	1	0	0
Snap Beans (*Phaseolus vulgaris*)					
	Common Bacterial Blight (*Xanthomonas campestris* pv. *phaseoli*)	0	1	0	0
Beet (*Beta vulgaris*)					
Garden Beet					
	Insufficient Sample	1	0	0	0
Sugar Beet (*Beta vulgaris* var. *altissima*)					
	Chemical Injury (Abiotic disorder)	0	1	0	0
	Cold Wet Soils (Abiotic disorder)	0	1	0	0
	Damping Off (*Fusarium* sp./spp.)	1	0	1	0
	Fusarium Yellows (*Fusarium oxysporum*)	0	0	0	1
	Herbicide Injury (Abiotic disorder)	0	1	0	0
	Pythium Root Rot (*Pythium aphanidermatum*)	1	0	0	0
	Rhizoctonia Blight; Damping off (*Rhizoctonia* sp./spp.)	0	2	0	0
	Root Rot (*Aphanomyces chchlioides*)	1	0	0	0
Birch (*Betula* sp./spp.)					
	Iron Deficiency	0	1	0	0
	Magnesium Deficiency	0	0	1	0
Broccoli (*Brassica oleracea*)					
	Growth Regulator Effect (Abiotic disorder)	0	1	0	0
Building Materials					
	Aspergillus (*Aspergillus* sp./spp.)	0	1	0	0
	Black Mold (*Alternaria* sp./spp.)	0	1	0	0
	Black Mold (*Stachybotrys chartarum*)	1	0	0	0
	Cladosporium Mold (*Cladosporium* sp./spp.)	1	0	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Mold (*Ulocladium* fungus)	1	1	0	0
	Wood Rot Fungus (*Chaetomium* sp./spp.)	0	1	0	0
	Sooty Mold (*Epicoccum* sp./spp.)	0	1	0	0
Canola (*Brassica napus*)					
	Black Leg (*Phoma* sp./spp.)	4	1	2	0
	Black Spot (*Alternaria brassicae*)	0	1	0	0
	Insufficient Sample	1	0	0	0
	Phoma Root Rot	0	1	0	0
	Black Spot	0	1	0	0
	Chemical Injury (Abiotic disorder)	0	6	0	0
	No Pathogen Found	2	0	0	0
	Pythium Damping Off (*Pythium* sp./spp.)	0	2	0	0
	Rhizopus Rot (*Rhizopus* sp./spp.)	1	0	0	0
	Wind Damage (Abiotic disorder)	0	1	0	0
Celery (*Apium graveoleons*)					
	Cold Temperature Exposure Damage	0	1	0	0
Chickpea (garbanzo) *(Cicer arietinum)*					
	Insufficient Sample	1	0	0	0
	Foliar Nematodes (*Ditylenchus* sp./spp.)	0	0	0	10
	Cyst Nematode (*Heterodera* sp./spp.)	0	0	0	10
Cherry *(Prunus* sp./spp.*)*					
	Eriophyid Mites (Family *Eriophyid*)	0	1	0	0
	Sap Beetles (Family *Nitidulidae*)	1	0	0	0
	Spotted Wing Drosophila (*Dropophila suzukii)*	0	1	0	0
Choke Cherry (*Prunus virginiana*)					
	Gall Midge (*Contarinia virginianae*)	1	1	0	0
	Lauzaniid Fly	1			
	Leaf Spot; Shothole (Various biotic agents)	0	2	0	0
	Unknown Abiotic Disorder	0	1	0	0
Corn (*Zea mays*)					
	Common Corn Rust (*Puccinia sorgh*)	2	0	0	0
	Environmental Stress (Abiotic disorder)	0	2	0	0
	European Corn Borer (*Ostrinia nubilalis*)	0	1	0	0
	Fusarium Stalk Rot (*Fusarium* sp./spp.)	1	0	0	0
	Gibberella Root Rot *(Gibberella*(*Fusarium*) *zeae* (*graminearum*))	1	0	0	0
	Goss's Blight (*Clavibacter michiganensis* subsp *nebraskensis*)	17	0	0	13
	Herbicide Carryover (Abiotic disorder)	0	1	0	0
	Holcus Spot (*Pseudomonas syringae*)	1	0	0	0
	Insect Damage (Unidentified insect)	0	1	0	0
	Insufficient Sample	2	0	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	No Pathogen Found	3	0	0	0
	Northern Corn Leaf Spot (*Cochliobolus carbonum*)	0	1	0	0
	Pale Western Cutworm (*Agrotis orthogonia)*	1	0	0	0
	Physiological Response (Abiotic disorder)	0	1	0	0
	Unknown Abiotic Disorder	0	3	0	0
	Yellow Leaf Blight (*Mycosphaerella zeae-maydis*)	0	1	0	0
Crabapple (*Malus* sp./spp.)					
	Botryosphaeria Canker (*Botryosphaeria melanops*)	0	0	0	1
	Environmental Stress (Abiotic disorder)	0	1	0	0
	Fire Blight (*Erwinia amylovora*)	0	0	0	1
	Flowering Crabapple (Plant Identification)	1	0	0	0
	Insufficient Sample	1	0	0	0
	Marginal Leaf Burn (Abiotic disorder)	0	1	0	0
	Transplant Stress (Abiotic disorder)	0	1	0	0
Cucumber (*Cucumis sativus*)					
	No Pathogen Found	1	0	0	0
	Nutrient Imbalance (Abiotic disorder)	0	1	0	0
	Soil Compaction (Abiotic disorder)	0	1	0	0
	Unknown	1	0	0	0
	Viruses (Viral screen)	0	0	0	1
Dogwood (*Cornus* sp./spp.)					
	Environmental Stress (Abiotic disorder)	0	1	0	0
Dracaena (*Dracaena* sp./spp.)					
	Environmental Stress (Abiotic disorder)	0	1	0	0
Dry Bean (*Phaseolus vulgaris*)					
	Bean Anthracnose (*Colletotrichum lindemuth*	0	0	0	4
	Bean Bacterial Wilt (*Clavibacter flaccumfaciens*)	0	0	0	1
	Bean Halo Blight (*Pseudomonas syringae* pv *phaseolicola*)	0	0	0	2
	Botrytis Blight (*Botrytis* sp./spp.)	1	0	0	0
	Chemical Injury (Abiotic disorder)	0	3	0	0
	Common Blight (*Xanthomonas campestris* pv *phaseoli*)	0	1	0	2
	Thrips (Family *Thripidae*)	1	0	0	0
	Hail Damage (Abiotic disorder)	0	1	0	0
	Insufficient Sample (Abiotic disorder)	1	0	0	0
	Nutrient Deficiency (Abiotic disorder)	0	2	0	0
	Rhizoctonia Root Rot (*Rhizoctonia* sp./spp.)	1	1	0	0
	Tomato Spotted Wilt Virus (TSWV)	0	0	0	2
	White Mold (*Sclerotinia* sp./spp.)	1	0	0	0
Field Peas (*Pisum sativum*)					

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Ascochyta Blight (*Ascochyta* sp./spp.)	0	0	0	8
	Bulb/Stem Nematodes (*Ditylenchus* sp./spp.)	0	0	0	450
	Chemical Injury (Abiotic disorder)	0	1	0	0
	Cyst Nematode (*Heterodera* sp./spp.)	0	0	0	450
	No Pathogen Found	2	0	0	0
	Pea Seed-Borne Mosaic Virus (PsbMV)	13	0	2	67
Elaeagnus (*Elaeagnus* sp./spp.)					
	Insufficient Sample	1	0	0	0
	Unknown Abiotic Disorder	0	1	0	0
Elderberry (*Sambucus* sp./spp.)					
	Environmental Stress (Abiotic disorder)	0	1	0	0
	Unidentified Virus	0	0	1	0
Elm (*Ulmus* sp./spp.)					
	Cladoptosis	0	1	0	0
	Dutch Elm Disease (*Ophiostoma* sp./spp.)	4	0	0	0
	Insufficient sample	1	0	0	0
American Elm (*Ulmus americana)*					
	Dutch Elm Disease (*Ophiostoma* sp./spp.)	2	0	0	0
Chinese Elm (*Ulmus parvifolia*)					
	Anthracnose (*Stegophora ulmea*)	1	0	0	0
	Elm Lace Bug (*Corythucha ulmi*)	0	1	0	0
Flax (*Linum usitatissimum*)					
	Excessive Water (Abiotic disorder)	0	0	1	0
	Chemical Injury (Abiotic disorder)	0	0	1	0
	Nutrient Imbalance (Abiotic disorder)	0	2	1	0
Fungus/Mushroom Idenficiation					
	Unidentified Mushroom	0	0	1	0
Building Materials					
	Aspergillus (*Aspergillus* sp./spp.)	0	1	0	0
	Black Mold (*Alternaria* sp./spp.)	0	1	0	0
	Black Mold (*Stachybotrys chartarum*)	1	0	0	0
	Cladosporium Mold (*Cladosporium* sp./spp.)	1	0	0	0
	Mold (*Ulocladium* fungus)	1	1	0	0
	Wood Rot Fungus (*Chaetomium* sp./spp.)	0	1	0	0
	Sooty Mold (*Epicoccum* sp./spp.)	0	1	0	0
General Identification					
	Pollen (Plant material)	1	0	0	0
Grape (*Vitis* sp./spp.)					
	Black Rot (*Phyllosticta ampelicida*)	2	0	0	0
	Grape Flea Beetle (*Altica chalybea*)	1	0	0	0
	Insect Damage (Unidentified Insect)	0	1	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Nitidulid Sap Beetle (*Glischrochilus* sp./spp.)	1	0	0	0
	Cultural Problem (Abiotic disorder)	0	1	0	0
Ground Cherry (*Physalis* sp./spp.)					
	Corn Earworm (*Helicoverpa zea*)	1	0	0	0
Hollyhock (*Alcea rosea*)					
	Cucumber Mosaic Virus	0	0	0	1
	Impatiens Necrotic Spot Virus	0	0	0	1
	Tobacco Mosaic Virus	0	0	0	1
	Tomato Spotted Wilt Virus	0	0	0	1
Honeysuckle (*Lonicera* sp./spp.)					
	Environmental Stress (Abiotic disorder)	0	0	1	0
Impatiens (*Impatiens* sp./spp.)					
	Downy Mildew (*Plasmopara obducens*)	1	0	0	0
Insect Identification					
	Aphids	1	0	1	0
	Ash Plant Bug (*Tropidosteptes* sp./spp.)	0	1	0	0
	Bat Bug (*Cimex pilosellus*)	2	0	0	0
	Booklice (Family *Psocidae*)	0	0	1	0
	Camel Cricket (*Ceuthophilus* sp./spp.)	1	0	0	0
	Carrion Beetles (Family *Silphidae*)	3	0	0	0
	European Earwig (*Forficula auricularia*)	1	0	0	0
	European Honeybee (*Apis mellifera european*)	2	0	0	0
	Foreign Grain Beetles (*Ahasverus advena*)	1	0	0	0
	Fungus Gnats (Family *Mycetophilidae*)	1	0	0	0
	German Cockroach (*Blattella germanica*)	1	0	0	0
	Hairy Fungus Beetle (*Typhaea stercorea*)	1	0	0	0
	Head Louse (*Pediculus humanus*)	1	0	0	0
	Insect Damage (Unidentified insect)	0	1	0	0
	Larder Beetles (*Dermestes lardarius*)	2	2	0	0
	Lesser Grain Borer (*Rhyzopertha dominica*)	1	0	0	0
	Merchant Grain Beetle (*Oryzaephilus mercator*)	1	0	0	0
	Plant Bugs (Family *Miridae*)	1	0	0	0
	Scarab Beetle (*Ataenius* sp./spp.)	1	0	0	0
	Scuttle Fly (*Dohrniphora cornuta*)	1	0	0	0
	Spiders (Order *Araneae*)	1	0	0	0
	Spider (Black and yellow *Argiope* spider)	1	0	0	0
	Three Spotted Flea Beetle	1	0	0	0
	Webbing Clothes Moth	3	0	0	0
	Winter Tick (*Dermacentor albipictus*)	1	0	0	0
Iris (*Iris* sp./spp.)					
	Cold Wet Soils (Abiotic disorder)	0	1	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Sap Beetles (Family *Nitidulidae*)	1	0	0	0
	Winter Injury (Abiotic disorder)	0	1	0	0
Juniper (*Juniperus* sp./spp.)					
	Cedar-Apple Rust (*Gymnosporangium juniper-virginianae*)	0	0	0	1
	Tip Blight (*Kabatina* sp./spp.)	1	0	0	0
	No Pathogen Found	4	0	0	0
	Unknown Abiotic Disorder	0	1	0	0
Rocky Mountain Juniper (*Juniperus scopulorum*)					
	Growth Regulator Effect (Abiotic disorder)	0	1	0	0
	Cedar-Apple Rust (*Gymnosporangiums* sp./spp.)	1	0	0	0
Kale (*Brassica oleracea*)					
	Cabbage Aphid (*Brevicoryne brassicae*)	0	1	0	0
Larch (*Larix* sp./spp.)					
	Environmental Stress (Abiotic disorder)	0	1	0	0
Lentil (*Lens culinaris*)					
	Ascochyta Blight (*Ascochyta* sp./spp.)	0	0	0	5
	Bulb and Stem Nematodes (*Ditylenchus* sp./spp.)	0	0	0	387
	Cyst Nematode (*Heterodera* sp./spp.)	0	0	0	387
	Pea Seed-Borne Mosaic Virus (PsbMV)	0	0	0	1
Lilac (*Syringa* sp./spp.)					
	Chemical Injury (Abiotic disorder)	0	1	1	0
	Insufficient Rootball (Abiotic disorder)	0	1	0	0
	Lilac Borer/Ash Clearwing (*Podosesia syringae*)	0	0	1	0
	No Pathogen Found	1	0	0	0
Lily (*Lilium* sp./spp.)					
	Cucumber Mosaic Virus (CMV)	0	0	0	1
	Impatiens Necrotic Spot Virus (INSV)	1	0	0	0
	Tobacco Mosaic Virus (TMV)	0	0	0	1
	Tomato Spotted Wilt Virus (TSWV)	0	0	0	1
Maple (*Acer* sp./spp.)					
	Environmental Stress (Abiotic disorder)	0	1	0	0
	Eriophyid Mites (*Aculops* sp./spp.)	1	0	0	0
	Maple Bladdergall Mite (*Vasates* sp./spp.)	1	0	0	0
	Maple Canker (*Stegonsporium* sp./spp.)	0	0	1	0
	Verticillium Wilt (*Verticillium* sp./spp.)	1	0	0	1
Mulch (habitat)					
	Scrambled-Egg Slime Mold (*Fuligo septica*)	1	0	0	0
Navy Bean (Phaseolus vulgaris)					
	Chemical Injury (Abiotic disorder)	0	1	0	0
Oak (*Quercus* sp./spp.)					

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Kermes Scale (*Kermes* sp./spp.)	0	1	0	0
Oats (*Avena sativa*)					
	Barley Yellow Dwarf Virus (BYDV)	0	0	0	1
Ohio Buckeye (*Aesculus glabra*)					
	Unknown Abiotic Disorder	0	1	0	0
Oleander (*Nerium oleander*)					
	Spotted Oleander Caterpillar Moth (*Empyreuma pugione*)	0	1	0	0
Pasture Grass/Ground Cover (habitat)					
	Algae	1	0	0	0
	Ergot (*Clavicepts* sp./spp.)	1	0	0	0
Pea Tree (*Caragana* sp./spp.)					
	Powdery Mildew (*Microsphaera* sp./spp.)	1	0	0	0
Pear Tree (Ornamental; *Pyrus* sp./spp.)					
	Unknown Abiotic Disorder	0	1	0	0
Peony (*Paeonia* sp./spp.)					
	Powdery Mildew (*Erysiphe* sp./spp.)	1	0	0	0
Pepper (*Capsicum* sp./spp.)					
	Environmental Stress (Abiotic disorder)	0	1	0	0
	Fertilizer Injury (Abiotic disorder)	1	0	0	0
	Freeze; Frost Damage (Abiotic disorder)	0	1	0	0
	No Pathogen Found	0	1	0	0
Phlox (*Phlox* sp./spp.)					
	Cucumber Mosaic Virus (CMV)	0	0	0	1
	Impatiens Necrotic Spot Virus (INSV)	0	0	0	1
	Tobacco Mosaic Virus (TMV)	0	0	0	1
	Tomato Spotted Wilt Virus (TSWV)	0	0	0	1
	Powdery Mildew (*Erysiphe* sp./spp.)	1	0	0	0
Pine (*Pinus* sp./spp.)					
	Conifer Aphids (*Cinara* sp./spp.)	0	0	1	0
	Canker; Dieback (*Diplodia* sp./spp.)	1	0	0	0
	Herbicide Injury (Abiotic disorder)	0	0	1	0
Plant Identification					
	Ash; Green/Red (*Fraxinus pennsylvanica*)	1	0	0	0
	Aster (*Aster* sp./spp.)	0	1	0	0
	Bouncingbet (Common Soapwort; *Saponaria officinalis)*	1	0	0	0
	Roving Bellflower (*Campanula rapunculoides*)	0	1	0	0
	Yellow Toadflax (*Linaria vulgaris*)	1	0	0	0
	Ash (*Fraxinus species*)	1	0	0	0
	Black Current (*Ribes nigrum*)	0	1	0	0
	Buckthorn (*Sideroxylon* sp./spp.)	1	0	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Buffalograss (*Buchloe dactyloides*)	0	1	0	0
	Common Lambsquarters (*Chenopodium album)*	1	0	0	0
	Common Waterhemp (*Amaranthus rudis*)	1	0	0	0
	Fine Fescue (*Festuca glauca*)	0	1	0	0
	Flixweed (*Descurainia sophia*)	0	1	0	0
	Grape (*vitis species*)	0	1	0	0
	Ground Plum (*Astragalus crassicarpus*)	1	0	0	0
	Insufficient sample	1	0	0	0
	Large Crabgrass (*Digitaria ssanguinalis*)	0	1	0	0
	Low Japanese Fleeceflower (*Fallopia japonica*)	0	1	0	0
	Motherword (*Leonurus cardiac*)	0	2	0	0
	Mustards (Family *Cruciferae*)	0	1	0	0
	Nutall Alkaligrass (*Puccinellia nuttaliana*)	1	0	0	0
	Pigweed (*Amaranthus* sp./spp.)	1	0	0	0
	Prairie Junegrass (*Koeleria macrantha*)	0	1	0	0
	Purple Lovegrass (*Eragrostis spectabilis*)	0	1	0	0
	Russian Almond (*Prunus tenella*)	0	1	0	0
	Saltbush (*Atriplex heterosperma*)	1	0	0	0
	Tall Fescue (*Festuca arundinacea*)	3	0	0	0
	Tall Tumble-mustard (*Sisynbrium altissimum*)	0	1	0	0
	Virginia Creeper (*Parthenocissus quinquefolia*)	0	1	0	0
	Western Wheatgrass (*Pascopyrum smithii*)	0	1	0	0
	Yellow Woodsorrel (*Oxalis stricta*)	1	0	0	0
Pine (Ponderosa Pine) (*Pinus ponderosa*)					
	Cold Wet Soils (Abiotic disorder)	0	1	0	0
	Hail Damage (Abiotic disorder)	0	1	0	0
	Insufficient Sample	1	0	0	0
	Low pH; High Soluble Salt Damage	0	1	0	0
	Tip Blight (*Diplodia* sp./spp.)	0	0	0	1
	Transplant Shock (Abiotic disorder)	0	1	0	0
Plum (*Prunus* sp./spp.)					
	Nutrient Imbalance (Abiotic disorder)	0	1	0	0
	Plum Curculio (*Conotrachelus nenuphar)*	2	0	0	0
	Unknown Abiotic disorder	0	1	0	0
Poplar (*Populus* sp./spp.)					
	Leaf Spot (Abiotic disorder)	0	1	0	0
Potato (*Solanum tuberosum*)					
	Bacterial Soft Rot (*Erwinia* sp./spp.)	1	0	0	0
	Chemical Injury (Abiotic disorder)	0	1	1	1
	Cultural/Environmental Damage (Abiotic disorder)	0	1	0	0
	Cold Damage (Abiotic disorder)	0	1	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Fusarium Dry Rot (*Fusarium* sp./spp.)	0	1	0	0
	Fusarium Wilt Complex (*Fusarium* sp./spp.)	8	2	0	1
	Late Blight (*Phytophthorab infestans*)	1	0	0	17
	Lightning Damage	0	0	1	0
	Low Soil Moisture (Abiotic disorder)	0	0	1	0
	Natural Senescence	0	2	0	0
	No Pathogen Found	2	0	0	0
	Nutrient Imbalance (Abiotic disorder)	0	1	0	0
	Potato Leaf Roll Virus (PLRV)	1	0	0	163
	Potato Virus M (PVM)	5	0	0	163
	Potato Black Dot (*Colletotrichum coccodes*)	2	0	0	0
	Potato Black Scurf (*Rhizoctonia* sp./spp.)	4	0	0	0
	Common Scab (*Streptomyces scabies*)	1	0	0	1
	Potato Mop-Top Virus (PMTV)	2	0	0	58
	Potato Virus A (PVA)	0	0	0	113
	Potato Powdery Scab (*Spongospora subterranean*)	0	0	1	2
	Potato Virus S (PVS)	9	0	0	89
	Potato Virus X (PVX)	1	2	0	114
	Potato Virus Y (PVY)	4	0	0	116
	Root Knot Nematodes (*Meloidogyne* sp./spp.)	0	0	0	1
	Severe Pink Eye (Abiotic disorder)	0	1	0	0
	Silver Scurf (*Helminthosporium solani*)	2	0	0	0
Potting Media					
	Nitrogen Deficiency	1	0	0	0
	Phosphorus Deficiency	1	0	0	0
Pumpkin (*Cucurbita* sp./spp.)					
	Unknown Abiotic Disorder	0	1	0	0
Raspberry (*Rubus* sp./spp.)					
	Bacterial Blight (*Erwinia* sp./spp.)	0	0	0	1
	Cane Blight (*Leptosphaeria coniothyrium*)	0	1	0	0
	Leaf Spot (*Sphaerulina rubi*)	1	0	0	0
Rhubarb (*Rheum rhabarbarum*)					
	Insufficient sample	1	0	0	0
	Phyllostica Leaf Spot (*Phyllosticta* sp./spp.)	0	1	0	0
Rose (*Rosa* sp./spp.)					
	Rose Slug (*Endelomyia aethiops*)	0	1	0	0
Safflower (*Carthamus tinctorius*)					
	Rust (*Puccinia carthami*)	0	1	0	0
Serviceberry (*Amelanchier* sp./spp.)					
	Brown Rot (*Monilinia* sp./spp.)	1	0	0	0
	Gallmaking Midges (Family *Cecidomyiidae*)	1	0	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Powdery Mildew (*Erysiphe* sp./spp.)	2	0	0	0
Soil (Habitat)					
	Cyst Nematodes (*Heterodera* sp./spp.)	292	0	0	23
	Slate/Metamorphic rock	1	0	0	0
Soybean (*Glycine max*)					
	Charcoal Rot (*Macrophomina* sp./spp.)	2	0	0	0
	Chemical Injury (Abiotic disorder)	0	12	0	0
	Crown and Root Rot (*Phytophthora* sp./spp.)	0	0	0	3
	Environmental Damage (Abiotic disorder)	0	7	0	0
	Diaporthe Stem Rot; Stem Canker (*Diaporthe* sp./spp.)	5	4	0	0
	Fungicide Sensitivity *In Vitro* Assay	1	0	0	0
	Fusarium Root Rot (*Fusarium* sp./spp.)	0	1	0	0
	Fusarium Wilt (*Fusarium oxysporum*)	0	0	1	0
	High Soluble Salts (Abiotic disorder)	0	2	0	0
	Insect Damage (Unidentified insect)	0	1	0	0
	Insufficient Sample	6	0	0	0
	Iron Deficiency (Abiotic disorder)	0	1	0	0
	Marginal Leaf Burn (Abiotic disorder)	0	1	0	0
	Nitrogen Deficiency (Abiotic disorder)	0	1	0	0
	No Pathogen Found	3	0	0	0
	Nutrient Imbalance (Abiotic disorder)	0	4	0	0
	Phytophthora Root and Stem Rot (*Phytophthora* sp./spp.)	2	0	1	8
	Pod and Stem Blight (*Diaporthe* sp./spp.)	0	1	0	0
	Purple Seed-Stain; Leaf Blight (*Cercospora kikuchi*)	0	0	0	1
	Pythium Rot (*Pythium* sp./spp.)	0	1	0	0
	Rhizoctonia Crown and Stem Rot (*Rhizoctonia* sp./spp.)	6	0	0	4
	Soybean Bacterial Blight (*Pseudomonas syringae* pv. *glycinea*)	0	1	0	0
	Soybean Brown Stem Rot (*Cadophora gregata*)	1	0	0	1
	Soybean Cyst Nematode (*Heterodera glycines*)	2	0	1	1
	Soybean Frogeye Leaf Spot (*Cercospora sojina*)	0	0	0	2
	Sudden Death Syndrome (*Fusarium virguliforme*)	0	0	0	1
	Stem Rot (*Sclerotinia sclerotiorum*)	1	0	0	0
Spelt (*Triticum spelta*)					
	Dwarf Bunt (*Tilletia controversa*)	0	0	0	1
Spruce (*Picea* sp./spp.)					
	Abnormal Root Development (Unidentified agent)	0	1	0	0
	Chemical Injury (Abiotic disorder)	0	2	0	0
	Spider Mites (*Oligonychus* sp./spp.)	0	11	1	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Environmental Damage (Abiotic disorder)	0	7	0	0
	Cytospora Canker (*Cytospora* sp./spp.)	0	0	1	0
	High Soil Moisture (Abiotic disorder)	0	1	0	0
	Insufficient Sample	1	0	0	0
	Stigmina Needle Cast (*Stigmina* sp./spp.)	1	0	0	0
	Needle Cast (*Lirula* sp./spp.)	1	0	0	0
	No Pathogen Found	5	0	0	0
	Phytotoxicity (Abiotic disorder)	0	1	0	0
	Pine Needle Scale (*Chionaspis pinifoliae*)	1	1	0	0
	Rhizosphaera Needle Cast (*Rhizosphaera* sp./spp.)	2	1	0	0
	Spruce Bud Scale (*Physokermes* sp./spp.)	0	1	0	0
	Stigmina Needle Blight (*Stigmina lautii*)	4	1	0	0
	Transplant Shock (Abiotic disorder)	0	1	0	0
	Winter Injury (Abiotic disorder)	0	1	0	0
Black Hills Spruce (*Picea gluaca* 'Densata')					
	Rhizophaera Needle Cast (*Rhizophaera* sp./spp.)	1	0	0	0
	Spruce Gall Midge (*Mayetiola piceae*)	0	1	0	0
Blue Spruce (*Picea pungens*)					
	Insufficient Light	1	0	0	0
	Pine Needle Scale (*Chionaspis pinifoliae*)	1	0	0	0
	Rhizosphaera Needle Cast (*Rhizosphaera* sp./spp.)	0	1	0	0
	Spider mite Injury (Unidentified spider mite)	1	0	0	0
	Winter Injury	1	2	0	0
Stachys (*Stachys* sp./spp.)					
	Cucumber Mosaic Virus (CMV)	0	0	0	1
	Foliar Nematode (*Aphelenchoides* sp./spp.)	1	0	0	0
	Impatiens Necrotic Spot Virus (INSV)	0	0	0	1
	Tobacco Mosaic Virus (TMV)	0	0	0	1
	Tomato Spotted Wilt Virus (TSWV)	0	0	0	1
Sunflower (*Helianthus* sp./spp.)					
	Downy Mildew (*Plasmopara halstedii*)	4	0	0	0
	Head Rot (*Sclerotinia sclerotiorum*)	1	0	0	0
	Herbicide Carryover; Exposure	0	2	0	0
	No Pathogen Found	1	0	0	0
	Phomopsis brown stem canker (*Phomopsis* spp.)	1	0	0	0
	Rhizopus Head Rot	0	1	0	0
	Sclerotinia Stem Rot (*Sclerotinia* sp./spp.)	1	0	0	0
	Sunflower Black Stem (*Phoma macdonaldii*)	2	0	0	0
	Sunflower Maggot (*Strauzia longipennis*)	1	0	0	0
	Sunscald (Abiotic disorder)	0	1	0	0

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
Tomato (*Lycopersicon* sp./spp.)					
	Blossom End Rot (Abiotic disorder)	0	1	0	0
	Chemical Injury (Abiotic disorder)	0	3	0	0
	Cucumber Mosaic Virus (CMV)	1	0	0	1
	Ethylene Exposure (Abiotic disorder)	0	2	0	0
	Growth Regulator Effect (Abiotic disorder)	0	2	0	0
	Impatiens Necrotic Spot Virus (INSV)	0	0	0	1
	Insufficient Sample	1	0	0	0
	Septoria Leaf Spot (*Septoria* sp./spp.)	2	1	0	0
	Sunscald (Abiotic disorder)	0	0	1	0
	Tobacco Mosaic Virus (TMV)	0	0	0	1
	Tomato Spotted Wilt Virus (TSWV)	1	0	0	2
	Yellow Shoulder; Water Imbalance (Abiotic disorder)	0	1	0	0
Turf Grass (Mixed species)					
	Black Layer of Soil (Abiotic disorder)	1	0	0	0
	Cold Wet Soils (Abiotic disorder)	0	1	0	0
	Dense Thatch Layer (Abiotic disorder)	2	0	0	0
	Ectotrophic Root Infecting Fungi (Complex of Fungi)	0	0	0	1
	Heat Stress (Abiotic disorder)	0	1	0	0
	Insufficient Sample	1	0	0	0
	No Pathogen Found	2	0	0	0
	Phytotoxicity (Abiotic disorder)	0	1	0	0
	Poor Root Development (Abiotic disorder)	1	0	0	0
	Unknown Abiotic Disorder	0	1	0	0
Kentucky Bluegrass (*Poa pratensis*)					
	Drought Stress (Abiotic disorder)	0	1	0	0
	Sod; Transplant Stress (Abiotic disorder)	0	1	0	0
	Winter Injury (Abiotic disorder)	0	2	0	0
Viburnum (*Viburnum* sp./spp.)					
	Viburnum Erineum Mite (*Eriophyes viburni*)	1	0	0	0
Watermelon (*Citrullus lanatus*)					
	No Pathogen Found	1	0	0	0
Wheat (*Triticum* sp./spp.)					
	Bacterial Stripe; Black Chaff (*Xanthomonas campestris* pv. *translucens*)	0	2	0	0
	Barley Stripe Mosaic Virus (BSMV)	0	0	0	1
	Barley Yellow Dwarf Virus (BYDV)	1	1	1	5
	Bird Cherry Oat Aphid (*Rhopalosiphum padi*)	1	0	0	0
	Cereal Leaf Beetle (*Oulema melanopus*)	1	0	0	0
	Cereal Yellow Dwarf Virus (CYDV)	0	0	0	3
	Chemical Injury (Abiotic disorder)	0	2	1	1

Host	Diagnosis (Pathogen)	Confirmed	Suspected	Inconclusive	Not Detected
	Copper Deficiency (Abiotic disorder)	0	1	0	0
	Dwarf Bunt (*Tilletia controversa*)	0	0	0	5
	Flag Smut (*Urocystis agropyri*)	0	0	0	4
	High Plains Virus (HPV)	0	0	0	4
	Insufficient Sample	1	0	0	0
	Karnal Bunt (*Tilletia indica*)	0	0	0	5
	Nitrogen Deficiency (Abiotic disorder)	0	1	0	0
	Nutrient Imbalance (Abiotic disorder)	0	1	0	0
	Russian Wheat Aphid (*Diuraphis noxia*)	0	0	0	1
	Scorch; Leaf Scorch (Abiotic disorder)	0	2	0	0
	Stagonospora Nodorum Blotch (*Stagonospore nodorum*)	0	1	0	0
	Sulfur Deficiency (Abiotic disorder)	0	1	0	0
	Take-All Root Rot (*Gaeumannomyces* sp./spp.)	0	0	1	0
	Unknown Abiotic Disorder	0	1	0	0
	Wheat Gall Nematode (*Anguina tritici*)	0	0	0	1
	Wheat Streak Mosaic Virus (WSMV)	3	0	0	7
Spring; Winter Wheat (*Triticum aestivum*)					
	Barley Stripe Mosaic Virus (BSMV)	0	0	0	4
	Barley Yellow Dwarf Virus (BYDV)	0	0	0	4
	Cereal Yellow Dwarf Virus (CYDV)	0	0	0	3
	Chemical Injury (Abiotic disorder)	0	2	4	0
	Common Root Rot (*Cochliobolus sativus*)	1	0	0	0
	Dwarf Bunt (*Tilletia controversa*)	0	0	0	1
	Flag Smut (*Urocystis agropyri*)	0	0	0	1
	Fungal Pathogen (Unidentified fungus)	0	2	0	0
	Fusarium Root Rot (*Fusarium* sp./spp.)	1	0	0	0
	High Plains Virus (HPV)	1	0	0	3
	Karnal Bunt (*Tilletia indica*)	0	0	0	1
	No Pathogen Found	1	0	0	0
	Sooty Mold (Unidentified fungus)	1	0	0	0
	Take-All Root Rot (*Gaeumannomyces* sp./spp.)	1	0	0	0
	Wheat Streak Mosaic Virus (WSMV)	3	0	0	3
	Windburn (Abiotic disorder)	0	1	0	0
Willow (*Salix* sp./spp.)					
	Insufficient Sample	1	0	0	0
	No Pathogen Found	1	0	0	0
	Sawflies (Superfamily *tenthredinoidea*)	1	0	0	0
	Transplant Shock (Abiotic disorder)	0	1	0	0

Specialists consulted

Given the broad nature of the samples that we accept at the NDSU Plant Diagnostic Lab, accurate diagnoses often rely on collaboration with members of the Department of Plant Pathology, other departments at NDSU, and industry experts.

We would like to take this opportunity to acknowledge all faculty and specialists associated with NDSU as well as experts in private industry for their continued support of the lab. Without the expertise of a wide range of individuals, the quality of diagnoses from the lab would suffer tremendously.

The table below is an attempt to acknowledge the diagnostic assistance and other contributions of various faculty, specialists, and other professionals to the NDSU Plant Diagnostic Lab, and represent every individual who assisted with at least one sample (although most of you helped with multiple samples and we are extremely grateful!). Due to the nature of entering these 'consultants' into the database, a few people may have been inadvertently overlooked. For those who were mistakenly omitted from the list, please accept our sincere apologies. If you feel a name should be added to this list, PLEASE inform us so we can add it immediately.

Name	Department
Aaron Bergdahl	ND Forest Service
Alan Zuk	NDSU Plant Sciences
Andrew Robinson	NDSU Extension Agronomist
Angela Kazmierczak	NDSU Plant Sciences
Berlin Nelson	NDSU Plant Pathology
Charles Elhard	North Dakota Department of Ag
David Franzen	NDSU Soil Science
Dave Hopkins	NDSU Soil Science
Ester McGinnis	NDSU Extension Plant Sciences
Fabina Mathew	NDSU Plant Pathology
Francisco Bittara	NDSU Plant Pathology
Gary Secor	NDSU Plant Pathology
Greg Morgenson	NDSU Plant Sciences
Greta Gramig	NDSU Plant Sciences
Guiping Yan	NDSU Plant Pathology
Hans Kandel	NDSU Plant Sciences
Jan Knodel	NDSU Extension Entomology
Jared LeBoldus	NDSU Plant Pathology
Jim Walla	NDSU Plant Pathology
Joe Zeleznik	NDSU Plant Sciences
Joel Ransom	NDSU Plant Sciences
Julie Pasche	NDSU Plant Patholgy
Kimberly Zitnick	NDSU Plant Pathology
Kirk Howatt	NDSU Plant Sciences
Lee Diying	NDSU Plant Sciences
Luis del Rio	NDSU Plant Pathology
Michelle Gilly	NDSU Plant Pathology
Neil Gudmestad	NDSU Plant Pathology
Pat Beauzay	NDSU Extension Entomology
Richard Zollinger	NDSU Plant Sciences

- Continued on Next Page -

Name	Department
Rodney Lym	NDSU Plant Sciences
Sam Markell	NDSU Plant Pathology
Scott Liudahl	City Forester, Fargo
Susan Ruud	NDSU Plant Pathology
Thomas Kalb	NDSU Extension Plant Sciences
Tom Peters	NDSU Plant Science
Viviana Rivieras	NDSU Plant Pathology