



# WISCONSIN DATCP

PLANT INDUSTRY BUREAU ANNUAL REPORT

2013

## EXOTIC PEST UPDATE

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## HIGHLIGHTS OF 2013

- Emerald ash borer detected in 45 new municipalities...pg 2
- Gypsy moth counts increase to highest level in a decade...pg 3
- Japanese beetle populations decline for second straight year...pg 5
- Tobacco rattle virus found in 40% of ornamentals tested...pg 10

*Spotted Wing Drosophila*

Infestations of this newly introduced, invasive fruit pest were confirmed in 28 Wisconsin counties in 2013. The first flies of the season were collected in Vernon County on June 24 and numerous cases of larvae infesting fruits emerged across the state in July and August. Significant losses to the fall raspberry crop were reported for the second year in a row. The early and rapid appearance of flies and larvae this season indicates the insect overwinters in Wisconsin and is established statewide. Figure 1 summarizes the documented distribution of spotted wing drosophila in Wisconsin.

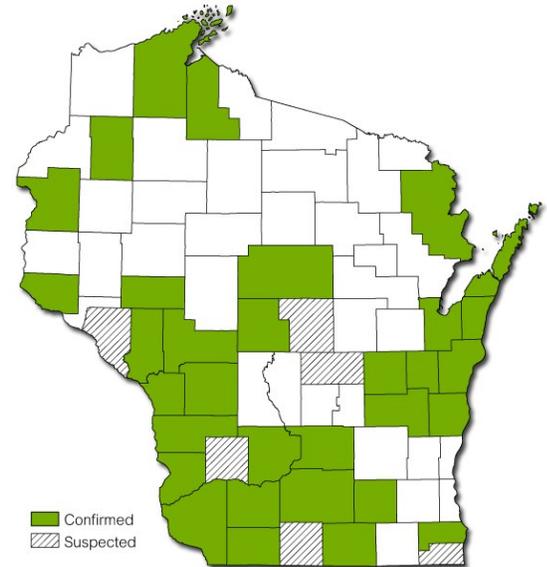


Figure 1. Spotted wing drosophila detections and unconfirmed reports, 2010-2013.

*Gypsy Moth*

Analysis of trapping program data showed a sharp rise in the average number of moths per trap, from 9.5 in 2012 to 19.1 in 2013. The state total count of 353,134 moths in 18,513 traps was a 50% increase over the 173,588 moths caught in 18,293 traps in 2012. As was the case in 2012, the highest numbers were reported from Ashland, Bayfield and Jackson counties while average counts in the southern third of the state declined. Delayed larval development, significant female caterpillar mortality, and an extended flight period are factors that contributed to the large number of male moths captured in the northern part of the state.

*Emerald Ash Borer*

DATCP expanded the emerald ash borer (EAB) quarantine in 2013 to include six new counties after infestations were confirmed for the first time in Dane, Dodge, Douglas, Sauk and Winnebago counties. Jefferson County was also quarantined due to its close proximity to an infestation in adjacent Walworth County. The Wisconsin EAB quarantine now includes 21 counties: Brown, Crawford, Dane, Dodge, Douglas, Fond du Lac, Jefferson, Kenosha, La Crosse, Milwaukee, Ozaukee, Racine, Rock, Sauk, Sheboygan, Trempealeau, Vernon, Walworth, Washington, Waukesha and Winnebago.

*Stem and Bulb Nematode*

The first detection of the stem and bulb nematode, *Ditylenchus dipsaci*, in Wisconsin was confirmed in 2013. *Ditylenchus dipsaci* is considered one of the most destructive plant parasitic nematodes of root crops, ornamental and nursery plants, and some field crops in temperate regions of the world. The nematode was discovered in phlox 'Fireworks' in a Jefferson County greenhouse. There is no evidence to suggest that the nematode has become established in the state as a result of this detection.

*Exotic Grape Moths*

Seventeen vineyards in Brown, Calumet, Dane, Door, Fond du Lac, Kewaunee, Manitowoc, Sheboygan and Waushara counties were systematically trapped for exotic grape moths by DATCP entomologists from May 1-September 30. The target pests were the light brown apple moth, European grape berry moth, European grapevine moth, and silver Y moth, all insects of high concern to the grape industry and USDA APHIS "priority pests" for grapes. No exotic fruit moths were found.

# FOREST PESTS

## Emerald Ash Borer



Emerald ash borer trap

Emerald ash borer (EAB) was first discovered in southeastern Wisconsin in 2008 and is now found in 19 counties: Brown, Crawford, Dane, Dodge, Douglas, Fond du Lac, Kenosha, La Crosse, Milwaukee, Ozaukee, Racine, Rock, Sauk, Trempealeau, Vernon, Walworth, Washington, Waukesha and Winnebago. Its rate of spread greatly accelerated in 2013, with new detections in six counties and 45 municipalities, far exceeding the 32 detections in the previous five years combined. Most of the recent finds were in the southeast where EAB has a longer history of infestation.

The 2013 emerald ash borer detection survey was an interagency effort comprised of members from the Department of Agriculture, Trade and Consumer Protection (DATCP), the Department of Natural Resources (DNR), the USDA Animal and Plant Health Inspection Service (APHIS) and nine tribal partners. Nearly 800 traps were set in 66 counties. DATCP and APHIS panel traps were set at high-risk sites outside of the EAB quarantine area, DNR double-decker traps were placed in state park and forest campgrounds, and tribal cooperators set panel traps on tribal lands (Figure 2). The survey resulted in the capture of beetles on traps in Crawford, Dodge, Fond du Lac, Ozaukee and Sauk counties. Of these five, Dodge, Fond du Lac and Sauk were new county records.

In addition to the EAB adults captured on survey traps, infested trees were also found in many new municipalities and three new counties: Dane, Douglas and Winnebago. The Douglas County detection was more than 200 miles north of any previous known population, while the others were nearby or adjacent to areas where EAB was already established.

Emerald ash borer has begun to dramatically alter Wisconsin's forests, woodlands, and urban landscapes, especially in the southeastern portion of the state where ash mortality is becoming increasingly evident. Current estimates suggest EAB now infests 20% of the state's ash trees and the number of new detections in 2014 is expected to surpass the 2013 total.

## Banded Elm Bark Beetle

New county records for the banded elm bark beetle (BEBB) were established in five counties, for a total of 12 counties since 2009. Survey work conducted at sawmills and municipal

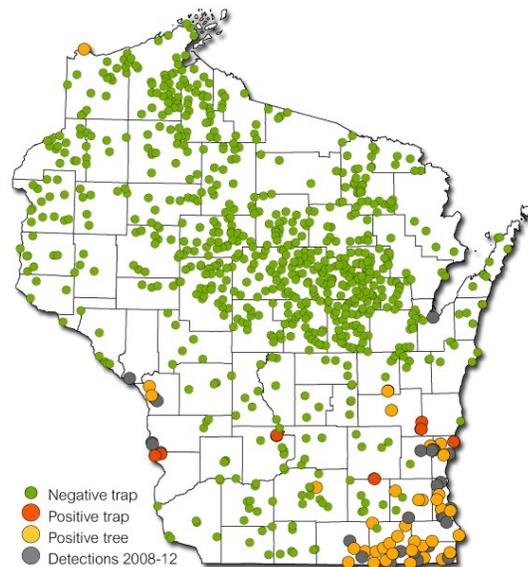


Figure 2. Emerald ash borer survey results 2013 and previous detections, 2008-2012.

EAB spread to six new counties and 45 municipalities this year, and now infests an estimated 20% of the state's ash trees.



Emerald ash borer adult

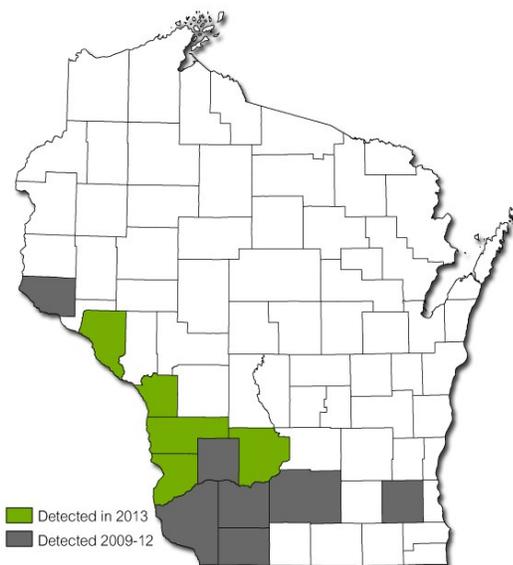


Figure 3. Banded elm bark beetle finds, 2009-2013.

# FOREST PESTS *continued...*

wood waste disposal sites yielded 99 specimens from Buffalo (one beetle), Crawford (66), La Crosse (21), Sauk (eight) and Vernon (three) counties. The list of Wisconsin counties in which BEBB has been confirmed in the last five years also includes Dane, Grant, Iowa, Lafayette, Pierce, Richland and Waukesha (Figure 3).

This nonnative Asian beetle is common in the western U.S. and is now spreading into states east of the Mississippi River. Its North American host range includes American elm, English elm, Siberian elm, and rock elm. The BEBB is known to carry the Dutch elm disease fungal pathogen, but has not yet been confirmed as a vector of the disease.

### *Thousand Cankers Disease of Walnut*

A trapping survey for the walnut twig beetle, the vector of thousand cankers disease (TCD) of eastern black walnut, was conducted for the second consecutive year. The survey included 36 pheromone traps deployed at five municipal wood waste disposal sites and 13 sawmills in Buffalo, Chippewa, Crawford, Grant, La Crosse, Langlade, Manitowoc, Richland, Sauk, Shawano, Trempealeau, Vernon and Waupaca counties (Figure 4). Survey sites were selected based on proximity to black walnut timber or walnut log transport pathways. The walnut twig beetle was not detected.

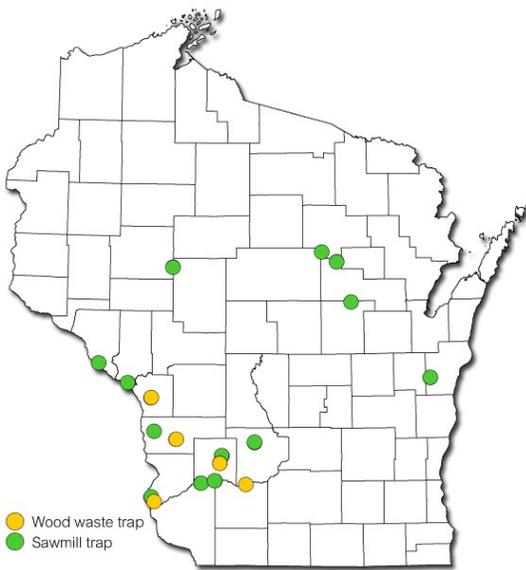


Figure 4. Walnut twig beetle survey, 2013.

Thousand cankers disease is a newly-described, fatal fungal disorder that has caused widespread tree mortality in five eastern states (North Carolina, Ohio, Pennsylvania, Tennessee, and Virginia) and nine western states (Arizona, California, Colorado, Idaho, New Mexico, Nevada, Oregon, Utah, and Washington) in the last decade. The disease has not been found in Wisconsin, though its serious threat to the state's black walnuts prompted DATCP in 2011 to enact an exterior quarantine prohibiting the import of any walnut material (excluding bark-free processed lumber or finished wood products and nuts) from known infested areas without an accompanying compliance agreement or certificate.

# GYPSY MOTH

The Cooperative Gypsy Moth Program consists of field surveys to trap male moths and locate egg masses, and aerial treatments to kill young larvae or disrupt mating. Annual trapping survey data indicate population densities close to the leading edge of the gypsy moth's advancing front and are used to prioritize future treatment sites in western Wisconsin. Survey results showed a 50% increase in the state moth count and an 8.16 km advance in the rate of gypsy moth spread this year (Table 1).



*Banded elm bark beetle galleries*

The invasive banded elm bark beetle, *Scolytus scolytoides*, was found in five more counties in 2013, for a total of 12 counties since 2009.



*Male gypsy moth*

# GYPSY MOTH continued...

## Slow the Spread Treatments



*Gypsy moth defoliation*

The Slow the Spread (STS) Program’s regional strategy is to eradicate isolated or low-level populations west of the “STS Action Zone” and delay spread of the gypsy moth within the zone to 10 km per year. The Program’s current 50-million-acre project area spans 1,200 miles long and 65 miles wide across 11 states from Minnesota east to North Carolina.

In 2013, STS treated 146,477 acres (66 sites) in 25 Wisconsin counties. Aerial treatments of Btk totaled 36,711 acres, Gypchek applications totaled 1,440 acres, and mating disruption, which included a single 11,000-acre block treated with Specialized Pheromone and Lure Application Technology (SPLAT), totaled 108,326 acres. The DNR Suppression Program also treated a 220-acre site in Iowa County with Btk. Applications began May 21 and were completed July 23.

Table 1. Rate of gypsy moth spread in Wisconsin (km), 2009-2013.

Year	Northern WI	Central WI	Southern WI	State Average
2009	-15.71	-26.69	-15.27	-19.01
2010	21.34	18.55	-2.87	12.36
2011	20.63	-1.23	12.51	10.64
2012	23.79	-1.55	-2.93	6.44
2013	38.37	-0.81	12.20	14.60

## Trapping Results

Moth counts increased in 2013 to the highest level in a decade. The annual trapping survey found an average of 19.1 moths per trap, the highest count since 2003 when the average was 26.4. A total of 353,134 moths were captured in 18,513 traps. The pronounced increase in male moths was attributed to fungal and viral outbreaks that killed proportionally more female larvae due to their extra instar and longer feeding period. Larval development was also significantly delayed by cold weather last spring, which prolonged the adult flight period and may have contributed to the higher counts observed. The scarcity of egg masses found during fall surveys suggests female larvae were disproportionately impacted by the *Entomophaga maimaiga* fungus and NPV virus in 2013.

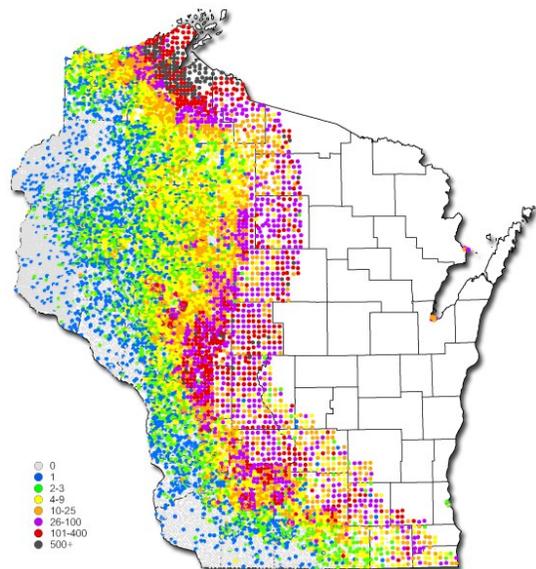


Figure 3. Male gypsy moth trap counts, 2013.

The state average gypsy moth count doubled in the last year, from 9.5 per trap in 2012 to 19.1 per trap in 2013.



*Female gypsy moths*

## Defoliation

DNR aerial surveys documented 12,248 gypsy moth-defoliated acres this season: 7,320 acres in Bayfield County, 4,324 acres on the Bad River Reservation in Ashland County, and 604 acres on several small parcels throughout the state. Approximately 12,200 acres were considered lightly defoliated and 48 acres were heavily defoliated.

# NURSERY INSPECTION

The Nursery Stock Dealer and Grower Inspection Program provides regulatory inspection of licensed retail and wholesale nurseries to ensure the production and sale of healthy, insect and disease-free plants. Inspectors enforce licensing requirements and issue certificates needed to facilitate movement of nursery stock in trade. Program personnel inspected 435 fields of the 652 licensed nursery growers in the state this season, an increase from 421 in 2012. A total of 415 of the 1,936 licensed nursery dealers were inspected compared to 399 in the previous year.

## Japanese Beetle

Counts in Wisconsin nurseries declined for the second straight year. The annual trapping survey yielded an average of 81 beetles per trap, a 49% decrease from 165 per trap in 2012 and a 66% decline from 238 in 2011. High average counts of 200 or more beetles per trap were registered in Jefferson and Manitowoc counties, moderate counts of 50-199 per trap were found in Dodge, Eau Claire, Jackson, Ozaukee and Washington counties, and 30 other counties averaged fewer than 50 per trap. Dry soils during the summer drought of 2012 were unfavorable for the eggs and larvae and likely contributed to this year's reduced beetle counts.

## Impatiens Downy Mildew

The first report of impatiens downy mildew (IDM) in the state in 2013 was confirmed very early in the season, on April 5 in a Monroe County greenhouse. The disease was subsequently found by DATCP and the UW-Madison in Dane, Clark, Jackson, Kewaunee and Oneida counties, as well as in Waukesha County where it devastated a garden planting in September. Impatiens downy mildew has been widespread in U.S. greenhouses and landscape settings in the last two years, with Wisconsin and more than 30 other states reporting cases.

## Rejected Nursery Stock

By state regulation, ornamental plants and trees infested with regulated pests, or that fail to meet pest cleanliness, labeling, or grade and quality standards, cannot be offered for sale in Wisconsin. Among the nursery stock found to be in violation of these regulations in 2013 were numerous herbaceous perennials with viruses, pear trees with fireblight, phlox 'Fireworks' with stem and bulb nematode, redbud and catalpa trees with verticillium wilt, assorted non-viable stock, and various trees and shrubs with scale insect infestation and wood-boring insect damage. Many plants also lacked proper labels, which must include the botanical name and USDA hardiness zone. Nursery inspectors require proper labeling before sale is allowed.

Also rejected again this year were plants listed in the NR 40 Invasive Species Rule, such as blue lyme grass, curly-leaf pondweed, red stemmed parrot feather, Tartarian honeysuckle, yellow floating heart and variegated porcelain berry vine. Violations of the NR 40 rule were documented by inspectors at 19 locations in 2013.

## Boxwood Blight

DATCP nursery inspectors submitted two suspect boxwoods to the Plant Industry Bureau Laboratory for testing this year, one from Milwaukee County and the other from Ozaukee County. Results were negative for both samples.

## Sudden Oak Death

Eleven ornamental samples—eight rhododendron, two mountain laurel and one beech—were tested and found to be negative for sudden oak death (SOD). Four of the samples were “trace forwards” from a confirmed *Phytophthora ramorum*-infected nursery. Six of the rhododendrons were diagnosed



*Impatiens downy mildew*

Downy mildew devastated impatiens plantings in Wisconsin and across the U.S. for the second year in a row.



*Boxwood blight*

# NURSERY INSPECTION continued...

with other Phytophthora species, *P. cactorum*, *P. plurivora*, and *P. nicotiana*, and were forwarded to the USDA identifier at Penn State for further analysis. All six were negative for SOD.

## Thousand Cankers Disease of Black Walnut

Laboratory testing of five black walnut samples from Dane and Richland counties found no evidence of the TCD fungal pathogen, *Geosmithia morbida*. Three of the samples were infected with cankers caused by *Botryosphaeria obtusa* and *Diplodia seriata* anamorph. Neither the TCD fungus nor its walnut twig beetle vector has to date been found in Wisconsin.



Black walnut infected with Thousand Cankers Disease

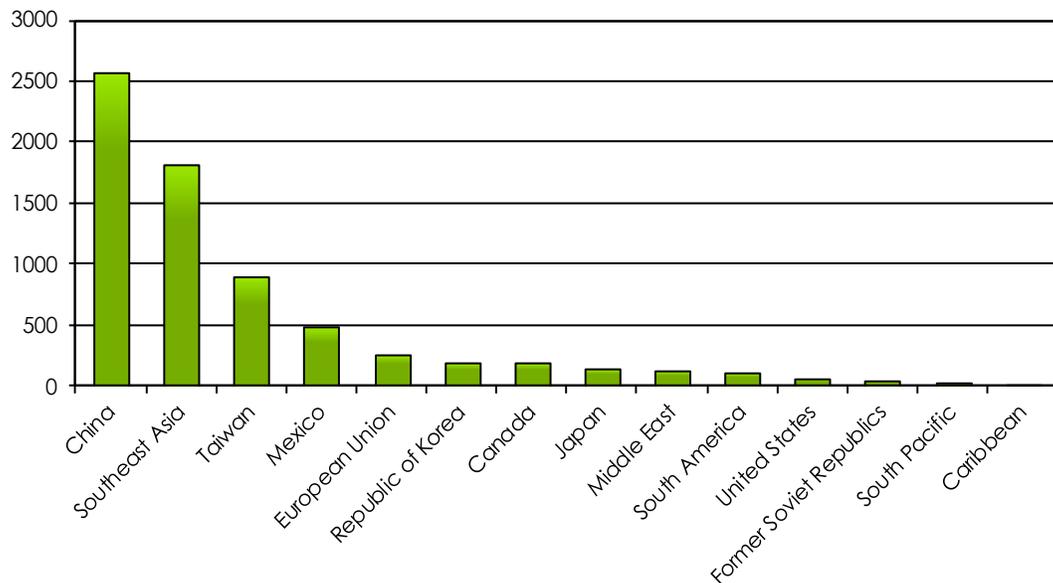
# PHYTOSANITARY CERTIFICATION

The Phytosanitary Certification Program serves Wisconsin exporters of plants and plant commodities by certifying their shipments as free from regulated pests. In 2013, the program was responsible for the export of over \$869,887,039 in plants and plant products. Demand for phytosanitary certification increased in 2013 to the highest level in three years. The number of certificates (phytos) issued was 8,245, a 20% increase from 6,779 in 2012. China, Southeast Asia (Indonesia, Malaysia, Philippines, Thailand, Vietnam), and Taiwan remained the destination countries for more than 66% of the phytos issued (Figure 5). Wood products accounted for the largest percentage of phytos (32%), followed by soybean and corn grain (both 27%), and nursery plants (4%). No Wisconsin commodities were rejected or destroyed at destination ports in 2013.

Annual total of 8,245 certificates were issued in 2013:

- |   |  |
|---|--|
| 6,854 Federal Certificates (1,057 were replacements)  | 334 State Certificates   |
| <ul style="list-style-type: none"> <li>• 350 Processed Plant Product Certificates</li> <li>• 6,467 Phytosanitary Certificates</li> <li>• 37 Re-Export Certificates</li> </ul> | <ul style="list-style-type: none"> <li>• 54 Phytosanitary Certificates</li> <li>• 280 Plant Inspection Certificates</li> </ul> |

Figure 5. Total number of phytosanitary certificates issued by DATCP and country destinations.



China, Southeast Asia and Taiwan were the destination countries for more than 66% of the phytos issued in 2013.



Inspection of kiln-dried lumber

# PHYTOSANITARY CERTIFICATION

Table 2. Estimated total value of exports, top six countries/regions.

Country	Value	Country	Value
Southeast Asia	\$349,102,253	Republic of Korea	\$19,568,349
China	\$293,016,438	European Union	\$15,663,166
Taiwan	\$171,731,360	Japan	\$6,985,745



Scouting an alfalfa field

# FIELD CROP INSECT SURVEY

The Pest Survey Program was established to provide timely information on the abundance and distribution of important pests of Wisconsin field crops. During the growing season, surveys are conducted in alfalfa, corn, potatoes, small grains, snap beans and soybeans. Information acquired through these systematic surveys is used to alert growers, county agents and other agriculture professionals to pest occurrence and outbreaks, determine pest trends affecting agricultural management practices, and certify Wisconsin plants and plant products entering trade are free from regulated pests. The program also participates in plant disease and insect survey projects in cooperation with the United States Department of Agriculture and the University of Wisconsin.

## European Corn Borer

Larval surveys in the fall of 2013 found the second lowest population in 72 years, 0.04 borer per plant. The lowest state average recorded in the history of the Wisconsin European corn borer survey was 0.03 per plant in 2012. Minor population increases from 2012 were charted in the southwest,

south-central, southeast, northwest and north-central agricultural districts, and decreases occurred in the west-central and northeast areas. District averages in the central and east-central regions remained unchanged at 0.01 borer per plant. Only 18% of the 229 fields sampled in fall showed evidence of infestation, while the other 82% had no signs of larval injury.

The near-historic low number of corn borers observed again this year reflects the increased prevalence of Bt corn, which comprised 66% of corn acreage in the state in 2013. Another exceptionally low overwintering population indicates the spring moth flight and subsequent first generation of larvae are unlikely to pose an early-season threat to the 2014 corn crop.

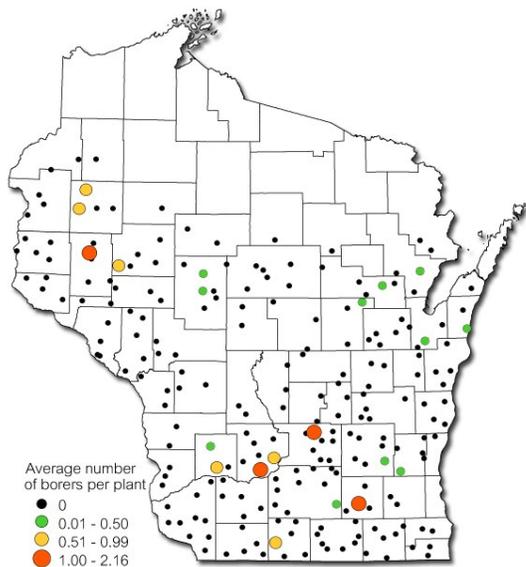


Figure 6. European corn borer survey, 2013.

The first significant flight was registered in Dodge and Grant counties from May 6-7, and the prima-

The annual European corn borer survey found the second lowest fall population in 72 years.

## Black Cutworm

Moths began arriving in the state on April 15.



European corn borer moth

## FIELD CROP INSECT SURVEY *continued...*

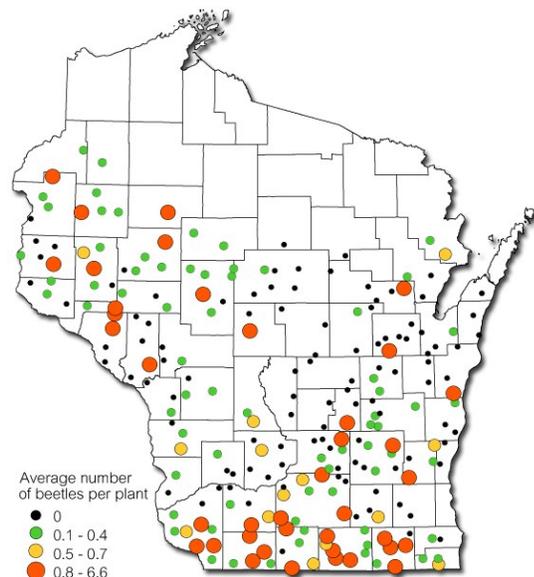


*Western corn rootworm beetles*

ry cutting period was predicted to start by May 28. Spring planting delays and rampant weed infestations created very favorable outbreak conditions this year, but widespread cutworm problems failed to develop. The spring migration of 577 moths collected from April 16-June 5 was much smaller than last year's flight of 2,601 moths. Damage to emerging corn was not as prevalent or severe as expected.

### *Corn Rootworm Beetle*

Development was delayed this season by historically cold, wet spring weather. The first beetles appeared later than normal, around July 11, and populations peaked during the third and fourth weeks of August. The state average population of 0.5 beetle per plant was a decrease from the 2012 average of 0.6 per plant, indicating that beetle pressure was slightly lower in 2013. A few reports of heavy populations were received from the northwestern counties where the survey found an average of 0.7 per plant and about one-quarter of sampled fields had economic beetle counts above the 0.75 beetle per plant threshold. Averages across the northern and central counties were otherwise low.



*Figure 7. Corn rootworm beetle survey, 2013.*

Results of the annual beetle survey suggest a lower potential for root damage to non-Bt continuous corn in central, north-central and northeastern Wisconsin next spring. A higher risk of damage is forecast for the areas represented by red symbols in the accompanying map (Figure 7).

### *Western Bean Cutworm*

Moth counts were the lowest in the nine-year history of western bean cutworm monitoring in Wisconsin. The 2013 trapping survey registered just 663 moths in 114 traps, or six per trap. This is considerably lower than in 2012 when a total of 3,290 moths were collected in 132 traps (25 per trap). The highest individual count for the eleven-week monitoring period was 60 moths near Montello in Marquette County.

Possible explanations for the unprecedented decline are that larval populations were reduced by the 2012 drought, or that high mortality occurred during the 2012-13 winter months. Moth numbers have consistently declined since 2010 when the annual survey found the state record of 10,807 moths in 136 traps, or 79 per trap.

### *Corn Earworm*

Migrants first arrived during an early flight that started by May 29 and continued throughout July. Moth numbers fluctuated during this period, with a weekly high count of 154 registered from June 7-13 near Janesville. Larvae resulting from the early flight appeared in vegetative corn by June 27.

A subsequent and more destructive primary flight from early August to mid-September led to larger larval populations which required spray programs to prevent ear damage. Counts during the primary flight peaked from August 23-September 5 when the Fond du Lac County sites registered 309-613

*Western bean cutworm counts fell to a nine-year low, with only 663 moths registered in 114 traps (or 6 per trap).*



*Western bean cutworm*

# FIELD CROP INSECT SURVEY *continued...*

moths per trap. Although the cumulative seasonal capture of 6,568 moths in 2013 was 38% lower than 10,656 moths in 2012, late-season infestations were more widespread this year compared to last year, when most of the moths arrived after sweet corn was well past the susceptible silking stage.

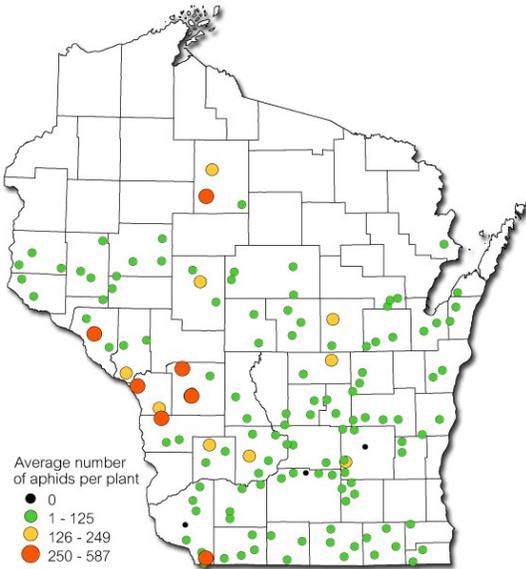


Figure 8. Soybean aphid survey, 2013.

This insect was the most economically important insect pest affecting soybeans in 2013, with populations reaching the highest levels since 2008.

## Soybean Aphid

Densities during the second half of the annual survey were the highest in five years. Examination of 139 soybean fields, once in July and again in August, found a state average of 18 aphids per plant during the July survey and a substantially higher count of 55 per plant in August. For comparison, state average densities from 2010-2012 were extremely low at 7-16 aphids per plant and the state average in 2008 was 72 per plant. Approximately 6% of sites sampled from August 6-28 contained economic populations of 250-587 per plant, 22% of fields had moderate averages of 50-249 per plant, and 72% had counts of less than 49 per plant (Figure 8). Populations in 30% of fields decreased from July to August, suggesting that about one-third of the survey sites may have been treated for aphid control this season. This



Soybean aphids

Soybean aphids were the leading soybean pest insect this season, with densities reaching the highest levels since 2008.

# PLANT DISEASE SURVEY & DIAGNOSIS

The Plant Industry Bureau (PIB) Laboratory provides plant disease diagnostic services to the Pest Survey Program, the Nursery and Christmas Tree Inspection Programs, and the Environmental Enforcement Section. Plant samples with diseases caused by fungi, bacteria, viruses and nematodes are submitted to the lab by DATCP field specialists. The lab also offers testing for phytosanitary certification necessary for domestic and international export of certain plants.

In 2013, laboratory pathologists diagnosed disorders on 402 nursery stock and Christmas tree samples and screened 308 samples for pests of field crops. A total of 710 plant and soil samples were processed this year, including 93 samples for export certification.

## Phytophthora Root Rots of Christmas Trees

A third annual survey for Phytophthora root rots of Christmas trees was conducted in 2013. The collaborative project of the PIB Laboratory and the Christmas Tree Program was started in 2011 and will continue through 2014. A total of 44 diseased conifer samples (balsam, Canaan and Fraser firs) from Christmas tree fields in nine counties were collected during September and October inspections and tested for root rot. Twenty percent (nine) of the samples from Christmas tree fields in Eau Claire, Lincoln and Marathon counties tested positive for Phytophthora, a slight decrease from 26% in 2012 and 27% in 2011.



Christmas trees with root rot symptoms

## PLANT DISEASE SURVEY *continued...*



*Fraser firs dying from Phytophthora root rot*

Four distinct *Phytophthora* species were identified again this year: *Phytophthora cactorum*, *P. europaea*, *P. plurivora* (synonym *citricola*) and *P. sansomeana*. The most frequently detected was *P. europaea*, found in 11% of the samples, followed by *P. cactorum* (5%), *P. plurivora* (2%), and *P. sansomeana* (2%) (Table 3). *Phytophthora europaea* was also the most widely distributed, with detections in Ashland, Clark, Jackson, Lincoln, Marathon, Shawano and Taylor counties in the last three years. *Phytophthora sansomeana* was found in Clark, Jackson, Lincoln, Marathon and Price counties, *P. cactorum* was detected in Dodge and Eau Claire counties, and *P. plurivora* was found in Marathon and Shawano counties.

Table 3. *Phytophthora* species found in Wisconsin Christmas trees, 2011-2013.

<i>Phytophthora</i> Species Detected in Fir	2011	2012	2013
<i>P. europaea</i>	6 (12%)	12 (21%)	5 (11%)
<i>P. sansomeana</i>	8 (16%)	1 (2%)	1 (2%)
<i>P. plurivora</i> (syn. <i>citricola</i> )	0	1 (2%)	1 (2%)
<i>P. cactorum</i>	0	1 (2%)	2 (5%)
Total no. of samples collected	51	58	44
Total no./percent of samples with <i>Phytophthora</i>	14 (27%)	15 (26%)	9 (20%)

Sixty percent of the ornamentals submitted to the PIB Lab for testing in 2013 were infected with one or more viruses.

Cumulative results since 2011 include the detection of *Phytophthora* root rot in 38 of 153 samples from 10 of the state's major Christmas tree-producing counties: Ashland, Clark, Dodge, Eau Claire, Jackson, Lincoln, Marathon, Price, Shawano and Taylor. *Phytophthora* sp. '*kelmania*', a new species first identified in two Wisconsin counties in 2010, has not been found in any field sampled from 2011-2013.

Other diseases associated with Christmas tree mortality this year were armillaria root rot, cytospora canker, and sirocooccus blight. Compacted roots were also a common problem, as was carryover of the effects of a severe summer drought in 2012.

### Survey for Viruses in Ornamentals

The PIB Laboratory in 2013 surveyed for viruses of ornamentals at 59 Wisconsin greenhouse, nursery and retailer locations. Two hundred and eleven plants exhibiting virus symptoms were collected and diagnosed. Several samples were tested for as many as nine viruses, depending upon the host. Of the 211 plants tested, 127 (60%) were infected with at least one virus.

Tobacco rattle virus (TRV) was the most common virus, found in 68 of 170 plant samples (40%) from 17 different host genera. *Epimedium* (100% of samples positive for TRV), *dicentra* (95% positive), *paeonia* (47% positive), *delphinium* (44% positive), and *phlox* (40% positive) were the genera most often infected with TRV.



*Epimedium 'Rubrum' with TRV symptoms*

Several other viruses were also detected. Hosta virus X was diagnosed in 11 of 32 samples (34%), and a variety of potyviruses were found in 15 of 82 samples (18%), including *canna* (*canna* yellow streak virus), *lily* (*lily* mottle virus), *lobelia* (*turnip* mosaic virus), and a few as-yet-unidentified potyviruses detected in *clematis*, *iris*, *phlox*, *pachysandra* and *sedum*.

# PLANT DISEASE SURVEY *continued...*

Another 10 of 152 samples (7%) tested positive for cucumber mosaic virus, five of 34 samples (15%) were positive for alfalfa mosaic virus, and impatiens necrotic virus was found in six of 159 host plants (34%). A total of 53 host plant genera were tested in 2013.

Color images of virus disease symptoms detected during the survey were submitted to the Bugwood.org image database where a special archive collection, *Viruses in Imported and Domestically Produced Ornamentals*, has been compiled: <http://www.ipmimages.org/browse/Archivethumb.cfm?Arc=8>.

## Soybean Viruses

One hundred and fifty-one soybean fields were sampled and tested for soybean dwarf virus (SbDV), soybean vein necrosis-associated virus (SVNaV) and alfalfa mosaic virus (AMV) this season. Nine percent of fields tested were infected with SbDV in 2013, comparable to a 10% infection rate in 2012. Alfalfa mosaic virus was found in 5% of tested fields, an increase from 2% the year before. Soybean vein necrosis-associated virus, a tospovirus first detected in Wisconsin last season, was found in 12% of samples. The PIB Laboratory has surveyed for AMV, SbDV and other soybean viruses since 2003.

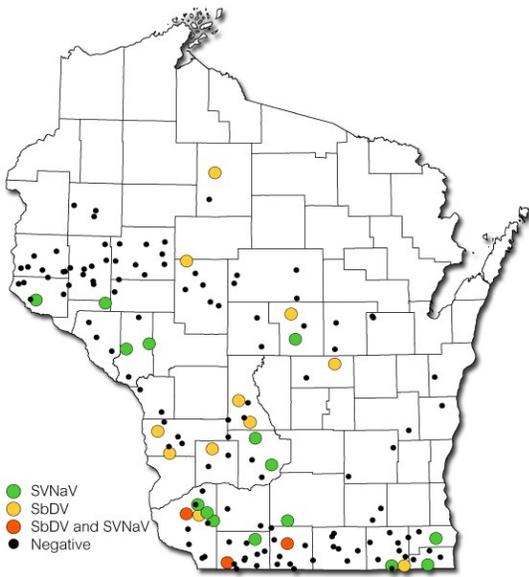


Figure 9. Soybean virus survey, 2013.

upward trend in the percentage of samples testing positive for SbDV, from 2% in 2003 to 9% in 2013. As mentioned, the virus was found in 9% (14 of 151) of soybean fields sampled this season (Figure 9). SbDV is likely transmitted by the soybean aphid, although DATCP data on SbDV incidence and aphid pressure are not well correlated.

## Soybean Vein Necrosis-associated Virus

Soybean vein necrosis-associated virus was first detected in Wisconsin in 2012, when it was identified by UW-Madison researchers and was found in 35% of soybean virus survey samples collected by DATCP. In 2013, SVNaV was identified in 12% (18 of 151) of soybean leaf samples tested. The thrips-vectored virus has been widely reported across the Midwest in the last two years.

## Alfalfa Mosaic Virus

Five percent (8 of 151) of soybean fields surveyed in 2013 were positive for AMV, an increase from 2% in 2012. During the last 10 years, AMV incidence was highest in 2009 when the virus was found in 19% of soybean fields sampled. Prevalence in 2010 and 2011 was also comparatively high at 13% and 12%, respectively. Alfalfa mosaic virus is aphid- and seed-transmitted and may contribute to reduced seed quality and marketability.

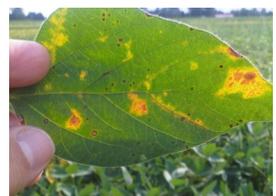


*Symptoms of alfalfa mosaic virus on soybean leaves*

## Soybean Dwarf Virus

Soybean dwarf virus is an aphid-vectored luteovirus which causes widespread economic damage in Japan. The first reported detection of SbDV in the United States was made in California in 1983 from clover, the first report on soybeans came from Virginia in 2000, and the first find on soybeans in Wisconsin was made in 2003. Subsequent annual surveys of soybean viruses in the state have shown an

Soybean vein necrosis-associated virus, first detected in Wisconsin last year, was found in 12% of soybean fields surveyed in 2013.



*Soybean vein necrosis-associated virus*

# PLANT DISEASE SURVEY continued...

## Soybean Cyst Nematode

No new counties were added to the soybean cyst nematode (SCN) map in 2013. The current counties where SCN is known to occur include 92% of the state's soybean acres. Canada has deregulated the nematode, thus reducing the need for current information on occurrence in Wisconsin for nursery growers and other exporters. With the substantial majority of soybean acreage in counties where the nematode has been detected and with deregulation by the state's number-one trade partner nation, DATCP will likely conclude its 33-year detection survey for this nematode.



*Browning of soybean stem due to Phytophthora sojae*

## Phytophthora Root Rot of Soybean

Continued survey work for soybean seedling root rots again yielded *P. sansomeana*, a newly described species first reported on soybean in Wisconsin in 2012. The organism was found in one soybean field each in Dane and Green counties and two in Outagamie (Figure 10). It was also isolated from corn plants collected from a Sheboygan County site which tested positive in 2012. Sampling was conducted in 50 soybean fields and two corn fields (formerly soybean) between June 17 and July 18.

Although the significance of *P. sansomeana* to soybean production remains under investigation, the susceptibility of both corn and soybean to infection is concerning given the common practice of corn-soybean rotation. Development of disease on corn has not been documented.

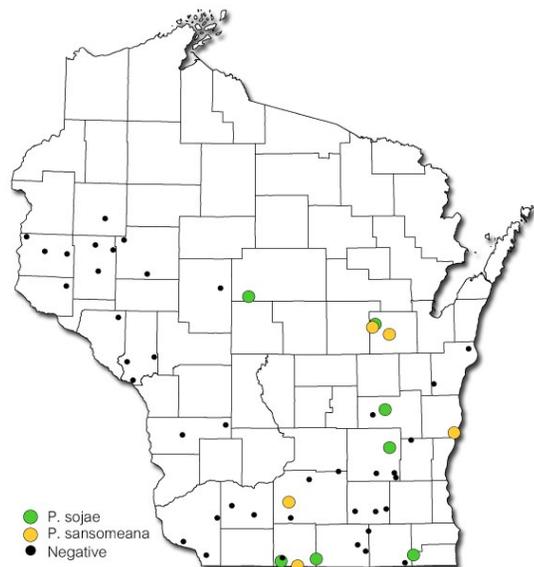


Figure 10. Soybean Phytophthora root rot survey, 2013.

In addition to *P. sansomeana*, the survey also found the endemic *Phytophthora sojae* in seven fields in Dodge, Fond du Lac, Green, Kenosha, Marathon, Outagamie and Rock counties. The other 40 fields sampled were negative for root rot (Figure 10).

## Cephalosporium Stripe of Wheat

On June 27, 2013 wheat stripe disease (*Cephalosporium gramineum*) was found in a Calumet County wheat field. This detection follows a first report in 2011 from Rock County. Cephalosporium stripe disease produces distinctive chlorotic stripes running the length of the leaf blade and sheath. Plants are infected through the roots, and systemic infections which occur early can lead to stunted wheat that ripens early and yields poorly. Disease development is favored by cool, wet spring weather.

## Seed Field Inspection

Crops grown for seed export (corn, cucurbits, garlic, onions, snap beans and soybeans) are inspected by DATCP during the growing season for pests and diseases of regulatory significance. Field inspection services are provided to seed companies and growers requesting assistance to meet the phytosanitary requirements of their international customers. In 2013, ninety seed production fields on 2,199 acres were inspected. Ninety-three leaf and soil samples were collected and tested for a range of bacterial, fungal, and viral diseases, as well as nematodes.

A second case of Cephalosporium stripe on Wisconsin wheat was confirmed this season, in Calumet County.



*Cephalosporium stripe of wheat*

# PLANT DISEASE SURVEY *continued...*

## Corn Wilt Diseases

Inspections for bacterial diseases of export significance were performed on 45 seed corn production fields in six Wisconsin counties. Goss's wilt infected eight fields (18%), compared to 5% the year before. Results for Stewart's wilt were negative for the third consecutive year. Despite the sharp increase in Goss's wilt, the prevalence in 2013 was still well below levels in 2010 and 2011 when the disease was found in 34% and 62% of fields, respectively. The outbreak 2-3 years ago was credited to heavy precipitation, wind damage and hail events. This year's Goss's wilt increase was probably influenced by abnormally cold, wet spring weather.

## Seed Corn Viruses

Analysis of corn leaf samples from the 45 seed corn fields inspected in 2013 found the fields to be apparently free from wheat streak mosaic virus (WSMV) and high plains virus (HPV). Wheat streak mosaic virus and its vector, the wheat leaf curl mite, are not known to occur in the state. Neither WSMV nor HPV has been detected in seed corn samples since testing began in 2005.

## Soybean Seed

Nine soybean seed fields totaling 162 acres in Fond du Lac, Green, Outagamie and Rock counties were inspected and tested for 10 soybean diseases: anthracnose stem blight, Asian soybean rust, bacterial blight, bacterial tan spot, brown spot, *Cercospora* blight, downy mildew, frogeye leaf spot, Phomopsis seed decay and *Phyllosticta* leaf spot. No diseases of regulatory significance were found.

## Vegetable Seed

A variety of vegetable crops were also inspected this year. The vegetable and number of samples collected was as follows: cucurbit (19), garlic and onion (three), pepper and tomato (six), and snap bean (two). Cucurbits were analyzed for such bacterial and fungal diseases as angular leaf spot, bacterial leaf spot, gummy stem blight and *Fusarium* wilt. Testing of garlic shipments for stem and bulb nematode, *Ditylenchus dipsaci*, was also provided in response to concerns about recent outbreaks in Minnesota and New York.



*Goss's wilt leaf blight symptoms*

*The prevalence of Goss's wilt in Wisconsin seed corn increased markedly this year, with 18% of inspected fields testing positive.*

# APIARY PROGRAM

The Apiary Program monitors the apiculture industry to prevent the introduction and spread of harmful honeybee parasites and diseases. Inspectors examine migratory bee colonies entering Wisconsin from states such as Alabama, California, Florida, Georgia, Michigan, Mississippi and Texas, and those leaving, if they are destined for states which require apiary health certification. Thirty-nine apiary inspection certificates were issued for 16,250 hives departing the state this year.

Program statistics showed a decrease in imported colonies and nucleuses, from 31,752 in 2012 (including hives imported for pollination) to 28,157 in 2013, and an increase in imported queens and packages, from 31,599 in 2012 to 52,317 in 2013. Colony losses over the winter months were estimated at 45%, a very high mortality rate that has become increasingly common in Wisconsin since 2006. Multiple factors—pesticides, fungicides, parasites and viruses—are believed to have caused the losses.

The state survey of apiaries found a decrease in varroa mite-infested hives from 89% in 2012 to 71% in 2013. This decline correlates with the substantial winter mortality that caused beekeepers to estab-



*Apiary inspection*

# APIARY PROGRAM continued...



*Small hive beetle trap*

lish new colonies with package bees. A total of 1,183 hives were inspected this year, 507 in spring and 676 in fall. Of the hives examined during fall, small hive beetle was found in 2.5% (17 hives) from nine counties: Brown, Columbia, Crawford, Dodge, Fond du Lac, Kenosha, Racine, Rock and Vernon.

Additionally, hives were inspected for a number of other common honeybee pests and diseases, including American foulbrood, European foulbrood (EFB), chalkbrood, sacbrood, deformed wing virus, as well as exotic pests like the Africanized honeybee and *Tropilaelaps* mite. Infestation rates of most of the major apiary pests decreased from 2012 to 2013, with the exception of EFB and sacbrood, which showed minor increases (Table 4). No Africanized honeybees, *Apis cerana* (Asian honeybee) or *Tropilaelaps* mites were detected during standard apiary inspections.

Table 4. Annual apiary inspection results, 2009-2013.

Year	2009	2010	2011	2012	2013
No. hives checked	1334	950	1045	1503	1184
Varroa mite	92%	89%	85%	89%	71%
Small hive beetle	2.6%	3.2%	3.4%	2.9%	1.4%
American foulbrood	4.5%	1.1%	4.0%	1.3%	0.9%
European foulbrood	0.5%	1.1%	1.3%	1.1%	2.1%
Chalkbrood	5.6%	2.4%	3.5%	3.2%	1.7%
Sacbrood	1.6%	1.1%	1.4%	1.2%	1.4%
Deformed wing virus	8.3%	7.6%	3.7%	5.9%	1.0%

Apiary colony losses over the winter months were very high at 45%, a 22% increase from the previous year .

# CHRISTMAS TREE INSPECTION

By licensing, inspecting and certifying Christmas trees as being reasonably free from injurious insects and diseases, the Christmas Tree Program provides a valuable service to interstate and international exporters who require certification to ship trees from Wisconsin. Growers of trees marketed locally also benefit by receiving routine inspections that identify incidence and severity levels of a wide range of non-regulated insects and diseases affecting their trees.



*Balsam gall midge*

Annual inspections begin after the gypsy moth egg mass deposition period, usually by early September. In addition to Christmas tree fields, program staff closely examine fencerows and woodlots adjacent to fields for evidence of gypsy moth and pine shoot beetle. Growers who request plant health certification for interstate export of trees are given priority.

In 2013, the number of fields inspected increased by 8% (Table 5). Four more Christmas tree fields were infested with gypsy moth (GM) than in 2012, while pine shoot beetle (PSB) was not detected at any site compared to six in the previous year. White pine blister rust, *Lirula* needlecast and broom

# CHRISTMAS TREE INSPECTION continued...

rust were the most prevalent diseases observed. The most common insects noted during inspections were the balsam twig aphid, balsam gall midge and white pine weevil.

Table 5. Christmas tree inspection results, 2009-2013.

Year	No. Fields Inspected	No. Fields with GM	No. Fields with PSB
2009	617	26	2
2010	663	20	1
2011	689	18	3
2012	702	6	6
2013	767	10	0



White pine blister rust

Top 10 Christmas tree pests found in 2013, followed by number of fields affected out of 702:

**DISEASES & ABIOTICS:** White pine blister rust (73), *Lirula* needle cast (63), broom rust (44), *Rhizosphaera* on spruce (38), deer damage (28), pine gall rust (25), drought damage (21), spruce needle drop (15), *Rhizosphaera* on fir (13), and *Phytophthora* root rot (9).

**INSECTS:** Balsam twig aphid (304), balsam gall midge (221), white pine weevil (81), Eastern spruce gall adelgid (41), Zimmerman pine moth (17), pine needle scale (14), ants (10), pine bark adelgid (8), needleminer (8), and root collar weevil (6).

White pine blister rust and *Lirula* needle cast were the most common diseases affecting Wisconsin Christmas trees this year.

# POTATO ROT NEMATODE

During the 59-year period since the potato rot nematode (PRN) was first identified in Wisconsin, the overall incidence of this pest has decreased significantly. From 1953-1963, a total of 68 infested fields were detected, but only 41 have been found in the last 50 years. Program specialists inspect an average of 13 fields per year and detect about one infested field annually. Today, there are a total of 3,049 acres with a history of PRN infestation. Of these acres, 95% are located in Langlade County, the largest seed potato production area in the state.

Nine fields totaling 433 acres were inspected in 2013. Two of the fields were previously infested with PRN. One was released for certified seed after fumigation and two successive potato crops showed no evidence of the nematode. The other seven fields were new to the seed certification program and required preliminary inspection. All fields were negative for PRN.

The Potato Rot Nematode Inspection and Quarantine Program has played a major role in limiting the spread of PRN since 1953. Due to the program's effectiveness, this pest has never been intercepted in shipments of commercially grown potatoes or seed potatoes from Wisconsin.



Potato harvesting

# SEED CONTROL



Lawn grass seed mixture

The Seed Control Program monitors and enforces labeling, germination and purity requirements to assure quality agricultural seed is sold in Wisconsin. Seed that does not conform to the standards of the state's seed law may be removed from the marketplace and sellers may be subject to other penalties. Field inspectors in the program perform a range of duties, such as evaluating labels for compliance, issuing stop sale orders, and collecting official samples for analysis.

Three hundred and seventy-five samples from 103 (14%) labelers were collected by DATCP inspectors in 2013, a 40% increase from 2012. A total of 189 (26%) of the state's 725 licensed labelers were inspected (Table 6). Seed labelers with poor compliance records or an increasing number of violations, as well as those not sampled in the last two years, were targeted for sampling. The annual violation rate was 8%, which represents a 3.3 percentage point decrease from last season. Of these violations, six were rated as *technical*, 11 were *minor*, and 13 were *serious*.

All licensed labelers in the state are sampled or inspected on a three-year rotation. Labelers must register annually with DATCP. The program currently inspects an average of 32% of the 725 labelers each year and samples approximately 14%.

Table 6. Number of seed labelers inspected, samples collected and violation rates, 2004-2013.

Year	Labelers	Samples	Violations	% Violation	% Labelers Inspected	% Labelers Sampled
2004	700	406	53	13.1%	37%	14%
2005	691	340	44	12.9%	36%	15%
2006	689	333	37	11.1%	30%	14%
2007	685	332	40	12.1%	36%	17%
2008	690	242	24	9.9%	33%	11%
2009	675	280	27	9.6%	34%	15%
2010	685	308	38	12.3%	33%	15%
2011	725	336	33	9.8%	23%	13%
2012	729	335	38	11.3%	30%	12%
2013	725	375	30	8.0%	26%	14%

**SEED COMPLIANCE ACTIONS TAKEN IN 2013:**

- **23** seed lots were relabeled to meet compliance standards
- **3** lots were removed from sale by the labeler
- **2** lots were returned to the labeler
- **1** lot was ground up for feed

