2013 Plant Health Annual Report

Market Access & Certification Program Area

The Plant Health Program provides official field inspections and laboratory testing for Oregon's specialty seed, grass seed, and nursery industries. For other commodities, such as potatoes and wheat, we conduct surveys to establish pest-free status for the state of Oregon or for specific regions or counties. These inspections, surveys, and lab tests are required for shipment to interstate and international markets. The Program's pathologists also provide commodity groups and trade negotiation officials with official statements to facilitate the opening of new markets for Oregon's agricultural commodities.

The Plant Health Program is responsible for several state quarantines, control area orders, and other regulations for plant pathogens. These administrative rules are designed to prevent exotic pathogens from being introduced or becoming established in the state and to provide quarantine pest-free production areas for Oregon growers. Other regulations also facilitate market access by ensuring products are free of pests of concern to interstate and international customers.

In cooperation with USDA Animal and Plant Health Inspection Service - Plant Protection and Quarantine (APHIS/PPQ), the Plant Health Program conducts statewide surveys for exotic pathogens. These surveys are federally funded and help provide crucial data to keep interstate and international markets open to Oregon's agricultural products.

We are also active in helping to shape national policy on important and emerging issues such as the National Clean Plant Network and boxwood blight. Staff scientists are regularly consulted by APHIS/PPQ, and provide crucial input to national plant disease control efforts. Staff expertise is maintained and enhanced with a research program that develops and publishes new diagnostic protocols for regulated and emerging plant pathogens.

- The seed field inspection program continues to grow, with a 17% increase in the number of fields inspected over last year. Inspectors surveyed 35 different host crops in 20 counties for more than 100 different pathogens and other pests of regulatory concern.
- The Plant Health Program received a Specialty Crops Block Grant to implement a nursery cleanliness program for the recently introduced disease boxwood blight (*Cylindrocladium pseudonaviculatum*). This voluntary, audit-based program is designed to mitigate the risk of spreading boxwood blight through the movement of nursery stock.
- For the second year, Oregon blueberry growers shipped fresh blueberries into the Republic of Korea. The Plant Health and Shipping Point Inspection programs worked together to provide the official inspections and audits necessary to meet Korea's phytosanitary requirements for import.

With this consistently high workload, the staff sustained the high level of competence expected of our Program, maintaining a low laboratory test error rate of 0.03%. It is a privilege to serve with such an exceptional and dedicated group.

Thank you for all your hard work.

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Cooperative Agricultural Pest Surveys

Cyst nematode survey

The final component of the Cyst nematode survey (started in 2012) was completed in the spring of 2013. We surveyed the following Oregon State University potato research farms for *Globodera pallida* and *G. rostochiensis*: Department of Horticulture Research Farms - Corvallis (5.5 ac), Hermiston Agricultural Research and Extension Center (20.5 ac), Malheur Experiment Station (95 ac), and Central Oregon Agriculture Research Center – Powell Butte (64 ac). Composite soil samples of ~5 lbs (1 sample/acre) were collected from each research farm as described in the 2009 Pale Potato Cyst Nematode National Survey and Diagnostic Cyst Sample Forwarding Protocols. Nematode cysts were isolated from the soil using a USDA soil cyst washer. Any suspected cysts were collected and identified to genus and species. *Globodera*

ellingtonae was recovered from 36 acres at the Powell Butte research center. There were no *Globodera* species recovered from the other sites.

Oak/pine survey

This survey targeted several pathogens of national concern that affect oak and pine: *Raffaela quercivora*, *Gymnopus fusipes*, *Phytophthora quercina*, *Cronartium flaccidum*, and *Mycosphaerella gibsonii*. Nursery stock at five nurseries was surveyed at three different times during the 2012-2013 growing seasons. Samples were collected for laboratory identification as needed. Among the nurseries there were six to 11 varieties of *Pinus sp*. and eight to 17 varieties of *Quercus sp*. Two nurseries had *Pinus* or *Quercus* only. Samples were collected from two different pine species and six different oak cultivars from two nursery locations. None of the target pathogens were detected. Survey results were entered into the IPHIS database.

Karnal bunt survey

Karnal bunt (*Tilletia indica*) is a fungal disease of wheat originally reported from India. After its discovery in Arizona wheat fields in 1996, a federal quarantine was adopted and a national survey strategy implemented to ensure US wheat export markets remained open. Oregon has participated in the national survey since its inception in 1996.

In 2013, we collected a total of 66 samples from 12 counties (Gilliam, Linn, Malheur, Marion, Morrow, Polk, Sherman, Umatilla, Union, Wasco, Washington and Yamhill). All samples were shipped to the national Karnal bunt-testing laboratory in Phoeniz, AZ and were found to be free of Karnal bunt. This is the eighteenth consecutive year Oregon has tested free of Karnal bunt. Survey results were entered into the IPHIS database.

Apple Orchard Disease Survey

The focus of this survey was to conduct a survey of apple (*Malus* sp.) orchards and a nursery for pathogens of federal regulatory significance (apple proliferation phytoplasma (APP), *Candidatus* Phytoplasma mali, and Asiatic brown rot, *Monilinia polystroma*) and one pathogen of state concern (Japanese apple rust, *Gymnosporangium yamadae*). Orchards in the primary commercial apple growing areas (nine orchards total from Hood River, Umatilla, and Wasco counties) and a certified nursery in Marion County were visually inspected and 316 leaf samples collected for APP testing. None of the target pathogens were found. Results will be entered into the NAPIS database prior to the project end date (2/28/2014).

Small grains survey

This survey seeks to determine if the following nematodes and pathogen of federal regulatory concern are found in Oregon: *Heterodera filipjevi, H. latipons, Meloidogyne artiellia*, and *Peronosclerospora philippnensis*. The survey was started but not completed as of December 31, 2013. We anticipate completing this survey in early 2014.

Farm Bill Projects

Grapevine commodity survey

This survey focuses on three viruses of state concern that affect grapevines: Grape leafroll-associated viruses 1,3 (GLRaV), grapevine virus B/grapevine corky bark agent (GVB) and grapevine fanleaf virus (GFLV). Because environmental conditions affect the ability to detect different viruses within the grapevine, testing was divided between fall (GLRaV and GVB) and spring (GFLV). Fall testing was completed at 12 nurseries which sell certified grapevine nursery stock. A total of 221 composite samples were tested using ELISA and neither of the fall-tested viruses was detected. All certified cultivars sold by each nursery were free of GLRaV and GVB. GFLV testing of the same nurseries will be completed in spring 2014. Data will be entered into IPHIS upon completion of the spring testing.

Stone fruit nursery survey

This survey focused on plum pox virus (PPV) testing of certified *Prunus* sp. nursery stock. Nurseries in Multnomah, Polk, Washington and Yamhill counties were surveyed (15 nurseries total). Leaf samples were collected and tested according the USDA APHIS work instructions for the detection of PPV. A total of 358 samples were tested. All results were negative and the data was entered into IPHIS.

Stone fruit orchard survey

This survey focused on two pathogens of national concern that affect stone fruit trees: plum pox virus (PPV) and European stone fruit yellows phytoplasma (ESFY). The primary commercial stone fruit growing areas in the state were surveyed by following a standardized protocol to determine the presence or absence of the pathogens within the orchards. Orchards were surveyed in Hood River, Jackson, Polk, Umatilla, Wasco, Washington and Yamhill counties (24 total orchards surveyed) in 2013. Leaf samples were collected and tested from each orchard. A total of 570 trees were tested. Neither of the target pathogens was detected. Survey results were entered into the IPHIS database.

Efficacy of using systems approaches in nurseries pilot study

The goal of this 3-year project was to evaluate the efficacy of three nursery certification programs, the audit-based US Nursery Certification Program (USNCP), Grower Assisted Inspection Program (GAIP) and the conventional shipping point inspection program (SPI), at mitigating pest risk within containerized nursery stock. The containerized plants grown within six volunteer nurseries (two USNCP, two GAIP, and two SPI) were randomly inspected for five target pests: Phytophthora root rot (PRR), Phytophthora foliar blight (PFB), bittercress, snails/slugs, and root weevils. Samples from irrigation water, potting media, used pots, and soil substrate were also tested for the presence of *Phytophthora* as prior research identified these as critical control points (CCP) where *Phytophthora* could be introduced into the nurseries. Testing

of these CCP samples was done using the USDA APHIS approved water- and soil-baiting techniques to determine the presence/absence of *Phytophthora*.

To determine pest incidence for the five target pests, the following strategy was used. Depending upon the nursery's size, a specific number of transects were walked within the nursery's container yard. Locations for transects were randomly selected. Three 1-meter survey plots were located equidistant along each transect. Within each survey plot, the presence/absence of bittercress, snails/slugs, and root weevils was determined by visual examination. To determine the presence/absence of PRR and PFB, foliar and root samples were collected from one symptomatic plant located within each survey plot. Foliar samples were tested with a commercial DAS-ELISA kit, while root samples were tested with the DAS-ELISA kit and *Phytophthora* identification verified with the 5.8S internal control primers of the USDA-approved Elicitin qPCR protocol.

Data from four survey periods (Fall 2011, Spring 2012, Fall 2012, and Spring 2013) are presented here. Pest incidence for each of the five target pests was calculated by dividing the number of survey plots in which a pest was detected by the total number of survey plots inspected at the nursery during that survey period. For *Phytophthora* incidence at CCP, the incidence was determined by calculating the number of positive samples.

Looking at samples collected from the four CCP (irrigation water, used pots, potting media, and native soil substrate), there was no significant difference in *Phytophthora* incidence at these hazards between the USNCP, GAIP, and SPI certification programs (Figure 1). This indicated the potential risk for *Phytophthora* contamination from these four hazards was approximately equal for all six nurseries, regardless of certification program. When test results were combined with no regard to certification program, significantly more *Phytophthora* was detected in samples from irrigation water and soil substrate (Figure 2). This is consistent with previous reports indicating the importance of these two known hazards as reservoirs for *Phytophthora* inoculum.

Table 1. The percentage of survey plots identified as infested with one or more target pests over the four survey periods in this study are shown for nurseries participating in the GAIP, USNCP, and SPI program; statistically significant differences ($p \leq 0.05$) between means are indicated by different letters.

Nursery certification program	**Percentage of survey plots found infested**				
	Fall 2011	**Spring 2012**	**Fall 2012**	**Spring 2013**	**Mean**
GAIP	57.76	39.84	57.72	62.60	54.58a
USNCP	74.87	47.98	75.76	71.21	67.46b
SPI	52.56	51.28	63.64	65.38	58.22ab
Mean	61.73b	46.37a	65.71b	66.40b	

Based on the total number of survey plots found infested with one or more target pests, the GAIP nurseries had significantly fewer infested plots than the USNCP nurseries, whereas the total number of infested plots found in the SPI nurseries was not significantly different from either the GAIP or the USNCP nurseries (Table 1). However, when looking at the average pest incidence

for each pest individually, significantly more PRR was detected in the SPI nurseries, significantly more snails/slugs in the USNCP nurseries, and significantly more bittercress in the GAIP nurseries (Table 2).

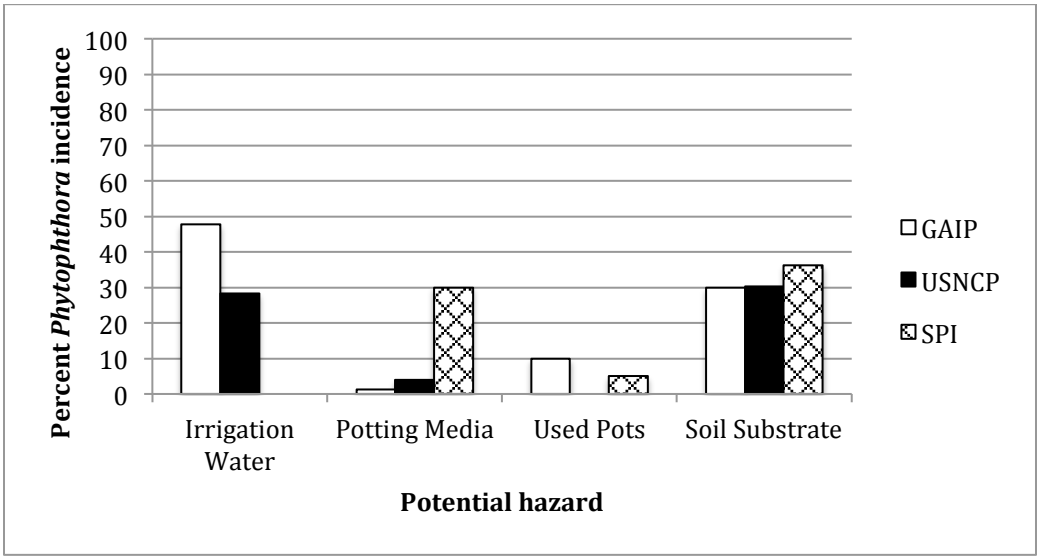

Figure 1. Average *Phytophthora* incidence at four known potential hazards for *Phytophthora* introduction in nurseries participating in the Grower Assisted Inspection Program (GAIP), US Nursery Certification Program (USNCP), and shipping point inspection (SPI) program.

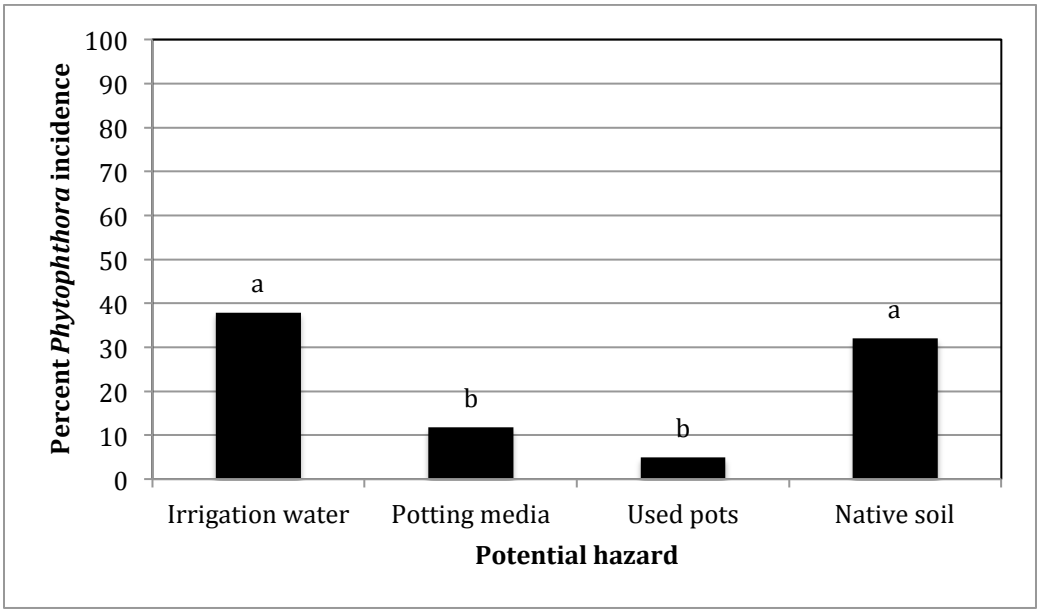

Figure 2. Average *Phytophthora* incidence at four known potential hazards for *Phytophthora* introduction into nurseries.

In this project, we compared the effectiveness of two audit-based systems approaches to pest risk mitigation in nursery stock to the current regulatory standard. When looking at overall pest incidence without regard to the specific pest(s) found, the audit-based GAIP provided the

greatest pest risk mitigation for nurseries growing plants in containers. However, none of the certification programs included in this study was consistently the most effective against all five of the pests surveyed for. This indicates that additional work must be done to identify the potential hazards for pest introduction and the appropriate best management practices to reduce the risk at those hazards. Since this project focused only on nursery stock grown in containers, similar research should be conducted in nurseries that grow field stock.

Table 2. The average pest incidence for five common pests in nurseries participating in the GAIP, USNCP, and SPI program; statistically significant differences ($p \leq 0.05$) between means are indicated by different letters.

Nursery certification scheme	Mean percent incidence				
	Phytophthora root rot	Phytophthora foliar blight	Bittercress	Snails/slugs	Root weevils
GAIP	17.39a	4.14	20.70b	29.39b	7.05
USNCP	18.48a	6.94	8.50a	49.22a	6.60
SPI	31.25b	3.45	7.10a	33.90b	12.28

A manuscript presenting this and other data collected over the course of the project was submitted to and accepted for publication by the Journal of Environmental Horticulture on November 7, 2013. It will be published in the journal in 2014.

In addition to the comparison study, an education and outreach effort made with the help of the Oregon State University (OSU) Extension Service provided training to nursery personnel on how to use the systems approach to develop practices to prevent and detect plant problems. Dr. Luisa Santamaria led this effort for OSU. Six workshops were held, with each workshop held on-site at a commercial production nursery. A total of 108 nursery workers participated in the training. At the request of the nurseries, the workshops were conducted in Spanish and English. The trainings were a combination of lecture and hands-on activities to reinforce lecture information. Key accomplishments included training workers on potential sources of pathogen contamination, on the importance of water management for pathogen mitigation, and how to develop a flow chart identifying a nursery's CCP for pathogen introduction and practices used to mitigate risk at those CCP. The response to the workshop trainings was overwhelmingly positive. Based on course evaluations (scale 1 to 5, with 1 = low and 5 = high), attendees stated that their understanding of causes of plant diseases, the importance of sanitation practices, the systems approach, critical control points, and preventing diseases from becoming introduced into plants improved from a score of 2.5 to 4.2 over the course of the workshop.

Boxwood blight nursery cleanliness program

In the fall of 2012, the Plant Health Program, in cooperation with the Nursery & Christmas Tree Inspection Program, was awarded funds through the Specialty Crop Block Grant program to develop an audit-based nursery cleanliness program for the new disease, boxwood blight (caused by *Cylindrocladium pseudonaviculatum*). This disease was first reported on the East Coast of the United States in late 2010 and has since spread to nine states and three Canadian provinces. The pathogen spreads very quickly, completing its life cycle within a week if environmental

conditions are favorable. It can also kill highly susceptible cultivars of *Buxus*, *Sarcococca*, and *Pachysandra terminalis*.

Our goal was to establish a nursery cleanliness program for boxwood blight that would be accepted nationally and internationally, with a benchmark of establishing a program that helped nurseries meet customer demand for *Buxus* and *Sarcococca* nursery stock free of the disease. Our performance measures for the project focused on three areas: education and outreach, acceptance of the program by Oregon customers, and adherence to the program requirements by the nurseries.

The ODA subcontracted with Oregon State University Extension to provide the educational workshops. In all, three workshops (one in Spanish) were held, with a total of 77 participants. On a 5-point rating scale, audiences found the workshops useful (4.2-4.7 average rating), of good quality (4.2-4.9 average rating), and informative (4.0-4.2 rating). The comprehension of the material improved from a low (2.2) initial awareness about the disease to a high/moderate awareness (4.0). This was slightly below our target for comprehension (a score of 4.25).

The 21 nurseries that participated in the program were surveyed towards the end of the initial project year to determine if the program met its target of 95% acceptance by receiving states/customers. Fourteen participating nurseries returned their surveys by the August 31 deadline. Nine nurseries had participated in the program for >6-months, four for 3- to 6-mo, and one for <3-mo. Four nurseries had sent <25 shipments of boxwood, three had sent 26-50 shipments, three had sent 51-100 shipments, and four had sent >100 shipments. None of the nurseries reported any rejections of their shipments for boxwood blight, indicating 100% acceptance by the receiving states.

All 21 nurseries were also audited for compliance with the mandatory requirements of the cleanliness program. Results from the nursery audits were collated and overall compliance with the program requirements determined. The target for this performance measure was an average of 95% compliance. Overall, the average nursery compliance was 94.2%, below our target. Looking at subsets of the program requirements, nursery inspectors found 100% compliance with the program's general requirements. For the requirements for handling of host plant buy-ins, the inspectors found 92.5% compliance, with the most common non-compliance issue being a lack of required inspection records. For handling of host nursery plants on hand, the inspectors found 93.7% compliance, with the most common non-compliance issue being a lack of training of nursery personnel on disease recognition and program requirements. For nursery sanitation, the inspectors found 89.3% compliance, with the most common non-compliance issues involving a lack of regular sanitation in nursery blocks and poor watering practices. For responses to detections of boxwood blight, the inspectors found 99.4% compliance, with the sole non-compliance issue being a nursery failing to report a positive detection to ODA in a timely manner. Based on these results, further emphasis will be placed on helping the nurseries understand the requirements for host plant buy-ins, for handling nursery stock on hand, and for sanitation.

One major lesson learned was that the best management practices included in the compliance agreement are geared primarily for container-grown plants; they are less effective for field-

grown plants. One primary concern for participating nurseries was the mitigation of boxwood blight inoculum from field soil. We requested and were granted an extension to address this concern.

Harmonized national standard for strawberry nursery stock certification project

In September of 2013, funding was received to develop a harmonized state level model regulatory standard for the certification of strawberry nursery stock as virus-tested. This project is being done in collaboration with the National Clean Plant Network (NCPN, see below). Similar efforts have been completed or are underway for virus-tested ornamental and fruit tree nursery stock, blueberry nursery stock, grapevine nursery stock, and other commodity groups operating under the auspices of the NCPN.

Several minor objectives were completed for this project by December 31, including hiring a student worker dedicated to the project, identifying relevant state and international (Regional Standards for Phytosanitary Measures) standards for strawberry or nursery stock certification, identifying published scientific research that could impact the draft national standard, and identifying an initial list of potential stakeholders that may be interested in helping develop the standard.

In 2014, we anticipate holding a regulatory workshop with interested stakeholders from academia, the nursery industry, the strawberry grower industry, state and federal regulators, and subject matter experts. The goal of the workshop will be to develop a formal draft of the state level model regulatory standard for the certification of strawberry nursery stock for public comment.

Treating soil with steam for *Phytophthora ramorum* project

In 2013, the program entered into a joint project with Washington State University (WSU) to test steam as a treatment for *P. ramorum* infestations in native soil in nurseries. This project represents a technology transfer from the National Ornamentals Research Site - Dominican University of California (NORS-DUC). Previous research done at NORS-DUC indicated steam-treating soil to a temperature of 50 degrees Celsius for 30-minutes was adequate to eliminate *P. ramorum* infestations. However, the soil types in Washington and Oregon differ from those found in California. The objective of this project is to determine if such a steam treatment also works on our native soils and to establish parameters to enable the use of steam treatment on any soil type.

Funding for this project was awarded on August 1. As of December 31, the objectives completed for this project included purchasing a Sioux SF-11 Steam-Flo Generator, soil temperature and moisture sensors, temperature monitors, data loggers and related software. Two nurseries with *P. ramorum* infestations in their native soil have been identified. We are awaiting appropriate weather conditions to attempt the treatments. We anticipate the nurseries' soil will be treated by the spring of 2014.

Field Inspection and Certification Programs

Allium White Rot Inspection

In 2013, ODA staff inspected a total of 54 garlic (*Allium sativum*) fields (1,586 acres) in seven counties for the presence of white rot caused by *Sclerotium cepivorum*. The program offers a 100% visual inspection designed to find single strikes or plants infected with white rot in the field. Allium white rot was found in eight fields in 2013, with most infested fields found in Central Oregon (Crook and Jefferson counties) (Table 3).

Table 3. Allium white rot inspection results for 2013.

County	Fields inspected (#)	Acres inspected	Infested fields (#)
Crook	2	180	1
Jefferson	26	709	6
Klamath	11	135	0
Marion	4	255	1
Morrow	8	143	0
Polk	1	78	0
Sherman	2	86	0

Mint Verticillium Wilt Inspection

The ODA offers a mint (Mentha spp.) rootstock field inspection service to detect Verticillium wilt (*Verticillium dahliae*) in established control areas. Under the provisions of the control area order, any fields confirmed as infected with *V. dahliae* cannot be used as a rootstock source. In 2013, the ODA staff inspected one field (53 acres) in Klamath County with no Verticillium wilt found.

Potato Late Blight Inspection

In 2013, the ODA staff conducted field surveys for late blight of potato (*Solanum tuberosum*) for the export of fresh potatoes to Taiwan. A total of 163 fields (11,058 acres) from four counties were inspected for *Phytophthora infestans*, the causal agent of late blight (Table 4). No potato late blight was found.

Table 4. Potato late blight inspection results for 2013.

County	Fields inspected (#)	Acres inspected	Results
Klamath	111	6733	No late blight detected
Morrow	10	574	No late blight detected
Umatilla	39	3605	No late blight detected
Washington	3	146	No late blight detected

Seed Crop Field Inspections

In 2013, the ODA staff inspected 1,055 seed crop fields (21,630 acres) for the presence of seed-borne or seed-associated pests of concern (Figure 3). Inspectors surveyed for the presence of more than 100 different pathogens and other pests associated with 35 different host crops in 20 counties. Around 18% (190 fields) of the inspected fields were found with at least one pest of concern. The five most commonly observed diseases were onion scape blight (*Botrytis* sp.), pea downy mildew (*Peronospora viciae*), carrot bacterial leaf blight (*Xanthomonas hortorum* pv. *carotae*), cabbage Sclerotinia stem rot (*Sclerotinia sclerotiorum*), and corn common smut (*Ustilago maydis*). Their disease incidences were 50%, 44%, 26%, 19%, and 11%, respectively (Table 5).

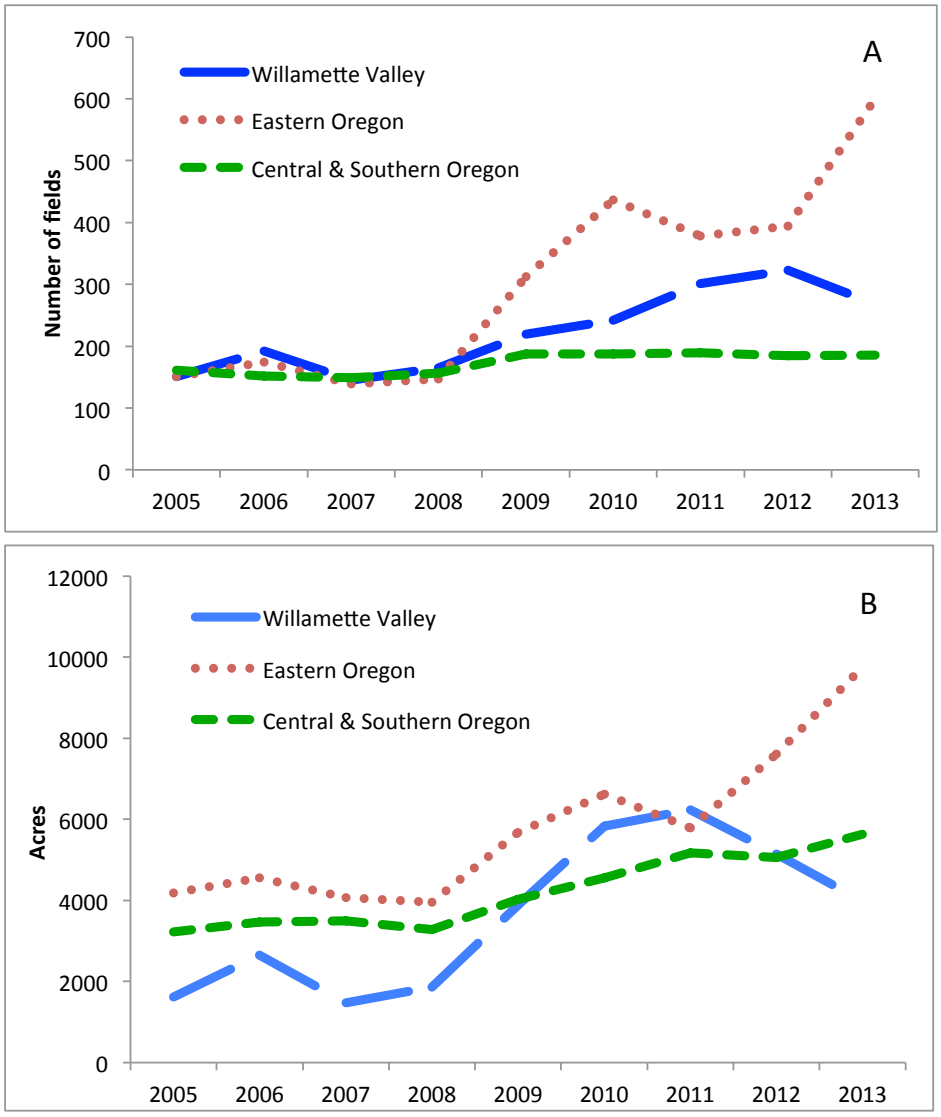

Figure 3. Number of fields (A) and acres (B) inspected in three regions of Oregon for the Seed Field Inspection Program (2005-2013).

Table 5. Seed crop field inspection results by crop and county for 2013.

Crop	County	# Fields inspected	Acreage inspected	Pests of concern detected (No. of fields)
Alfalfa (*Medicago sativa*)	Gilliam	3	300	*Cirsium arvense* (3)
	Malheur	32	90	*Alfalfa mosaic virus* (7), *Ditylenchus dipsaci* (7), *Cuscuta* spp. (5)
	Umatilla	1	47	
	Union	5	154	*Aphelenchoides* spp. (2), *C. arvense* (2)
Allium – Garlic (*Allium sativum*)	Crook	1	87	
	Jefferson	16	469	
	Klamath	1	30	
	Marion	2	95	
Allium – Onion (Allium cepa)	Jefferson	6	66	*Botrytis* sp. (6)
	Lane	1	7	
	Linn	5	67	*Botrytis* sp. (2)
	Malheur	6	67	
	Marion	26	152	*Botrytis* sp. (14), *Peronospora destructor* (1)
	Polk	1	20	*Botrytis* sp. (6)
	Sherman	1	15	
Allium – Shallot (*Allium cepa* var. *aggregatum)*	Malheur	6	161	
Bean (*Phaseolus vulgaris*)	Baker	1	1	*Xanthomonas axonopodis* pv. *phaseoli* (1)
	Linn	1	1	
	Malheur	24	496	*Cirsium arvense* (1)
	Umatilla	4	91	
Azuki bean (*Vigna angularis*)	Malheur	3	131	
Beta - Swiss chard (*Beta vulgaris*)	Marion	3	28	
Bigtrefoil (*Lotus uliginosus)*	Linn	1	8	
Carrot (*Daucus carota*)	Crook	8	178	*Xanthomonas hortorum* pv. *carotae* (2)
	Deschutes	6	85	*X. hortorum* pv. *carotae* (3)
	Jefferson	145	4610	*Alternaria radicina* (11), *X. hortorum* pv. *carotae* (39)
	Malheur	10	41	*Cuscuta* spp. (1)
	Marion	2	4	
Clover (*Trifolium* sp.)	Benton	1	70	
	Linn	3	268	*Cirsium arvense* (1)
	Marion	1	55	
	Multnomah	1	35	
	Umatilla	1	5	
	Washington	4	125	
Coriander (*Coriandrum sativum*)	Linn	3	85	
	Malheur	1	12	
Corn (*Zea mays*)	Malheur	47	655	*Ustilago maydis* (2)
	Morrow	17	661	*U. maydis* (1)
	Umatilla	358	5,373	*U. maydis* (42), Virus symptoms (3)

Brassica – Arugula (*Brassica eruca*)	Lane	1	15	
	Marion	2	20	
Brassica – Cabbage (*Brassica oleracea*)	Benton	6	34	*Sclerotinia sclerotiorum* (1)
	Clackamas	6	51	
	Lane	8	38	*Alternaria brassicae* (1)
	Linn	8	42	*A. brassicae* (1), *Mycosphaerella brassicicola* (6), *S. sclerotiorum* (1)
	Marion	15	110	*M. brassicicola* (1), *Peronospora parasitica* (2), *S. sclerotiorum* (3)
	Polk	1	3	
	Washington	2	8	
	Yamhill	1	5	*S. sclerotiorum* (1)
Brassica – Canola (*Brassica napus*)	Morrow	2	213	
Brassica – Kale (*Brassica oleracea*)	Marion	3	75	*Alternaria brassicae* (1), *Mycosphaerella brassicicola* (1), *Sclerotinia sclerotiorum* (1)
	Washington	1	25	
Brassica – Komatsuna (*Brassica rapa*)	Marion	2	20	
Brassica – Mustard (*Brassica* sp.)	Malheur	1	12	
Brassica – Pak Choi (*Brassica rapa*)	Marion	1	4	
Brassica – Turnip (*Brassica rapa)*	Malheur	6	121	
Cucurbit - Cucumber (*Cucumis sativus*)	Clackamas	1	3	
	Linn	4	36	
	Marion	8	62	
Curcurbit – Pumpkin (*Curcurbita* sp.)	Marion	1	3	Zucchini yellow mosaic virus
Curcurbit – Squash (*Curcurbit* sp.)	Linn	2	18	
	Marion	1	10	
	Yamhill	1	10	
Dill (*Anethum graveolens*)	Malheur	4	37	
	Marion	1	3	
Lettuce (*Lactuca sativa*)	Malheur	4	36	
	Morrow	1	26	
Oat (*Avena sativa*)	Polk	3	26	
	Washington	1	15	
Parsley (*Petroselinum crispum*)	Lane	2	13	*Septoria petroselini* (1)
	Linn	5	52	*S. petroselini* (3)
	Marion	5	37	*S. petroselini* (1)
Pea (*Pisum sativum*)	Clackmas	1	15	
	Lane	5	79	Pea enation mosaic virus (1), *Peronospora viciae* (3)
	Linn	7	110	*Pea enation mosaic virus* (1), *P. viciae* (3)
	Malheur	9	116	

	Marion	14	217	Pea enation mosaic virus (1), *P. viciae* (7), Multiple virus symptoms (1)
	Union	4	140	*P. viciae* (1)
	Washington	1	50	
	Yamhill	2	22	*P. viciae* (2), Pea enation mosaic virus (1)
Pepper (*Capsicum annuum*)	Marion	1	0.3	
Radish (*Raphanus sativus*)	Benton	9	76	
	Clackmas	11	160	
	Lane	10	111	
	Linn	7	214	
	Malheur	11	336	
	Marion	23	527	
	Yamhill	7	180	
Rocket (*Eruca sativa*)	Marion	2	20	
Rough bluegrass (*Poa trivialis*)	Jefferson	2	53	
Safflower (*Carthamus tinctorius*)	Umatilla	4	193	
Spinach (*Spinacia oleracea*)	Benton	1	15	
	Clackmas	1	20	
	Marion	15	349	
	Washington	1	37	
	Yamhill	1	20	
Sunflower (*Helianthus annuus*)	Benton	1	5	
	Klamath	1	50	
	Morrow	3	282	
	Umatila	2	190	
	Union	29	1,990	
Total: 35 crops	**20 counties**	**1,055**	**21,630**	**18% (190) of the inspected fields with at least one pest of concern**

Laboratory Seed Testing

Export seed

In 2013, Plant Health staff conducted tests to detect specific seed-borne fungi, bacteria, nematodes, viruses, pests, weeds, and other miscellaneous problems. Seed were tested according to standard, officially accepted protocols for the target organism(s). A total of 11,657 tests were conducted on 7,973 seed lots from more than 15 different crops, mainly grasses and vegetables. Compared to 2012, this represents a 10% increase in the number of seed lots tested. About 5% of the lots tested positive for one or more organisms of regulatory concern (Table 7). The seed lots were tested at the request of Oregon seed exporters to meet the phytosanitary requirements of their international and interstate customers.

Endophyte testing

In 2013, the Plant Health Laboratory received 97 seed lots of forage grass seed varieties to be tested for the presence of the endophyte fungus, *Epichloe* sp. Endophyte species grow in the grass tissue and produce alkaloids that can be toxic to livestock. To qualify for an endophyte tag, no more than 5% of the seeds in a lot can be infected with the fungus. Nine seed lots tested positive for *Epichloe* sp. and were ineligible to receive the endophyte tag.

Table 6. Laboratory tests conducted on grass, vegetable, and other seed lots in 2013.

Pathogen/pest test	# Tests conducted	# Tests passed	# Tests positive
GENERAL PEST & DISEASE ANALYSIS (Including soil testing)	7013	6756	257
FUNGI			
Israel wash	51	42	9
Korea wash	423	363	60
Tilletia sp.	1055	1033	22
Urocystis sp.	147	116	31
Ustilago sp.	2	2	0
Gloeotinia sp.	188	181	7
Phoma/Kabatiella grow out	61	61	0
Other fungi	127	122	5
Total:	2054	1920	134
NEMATODES			
Anguina sp.	817	811	6
Ditylenchus sp.	69	69	0
Other nematode	1021	1008	13
Total:	1907	1888	19
BACTERIA			
Corynebacterium rathayi	204	203	1
Clavibacter sp.	18	18	0
Pseudomonas sp.	31	24	7
Xanthomonas sp.	14	14	0
Total:	267	259	8
WEEDS & PARASITIC PLANTS			
Orobanche minor	81	81	0
Glyceria declinata	28	28	0
Total:	109	109	0
VIRUS	11	11	0
GRAND TOTAL	11,657	11,219	438

Official certification and testing programs

Virus certification of nursery stock

Twenty-seven nurseries participated in Oregon's virus ornamental and fruit tree certification program in 2013. *Malus* (apples and crabapples), *Prunus* (fruiting and ornamental cherries,

fruiting and ornamental plums, peaches, apricots, etc.), *Pyrus* (domestic pears, Asian pears, and flowering pears), and *Cydonia* (quince) are included in the testing program.

Individual *Prunus* mother trees (scions) and rootstock are tested each year for prune dwarf virus (PDV) and Prunus necrotic ringspot virus (PNRSV). *Malus*, *Pyrus*, and *Cydonia* scions and rootstocks are tested for tomato ringspot virus (ToRSV). Foliar samples were collected in the spring and tested for the target viruses using commercially available ELISA test kits. About 0.15% of the field samples were PDV-positive (1954 samples)), 1.43% were PNRSV-positive (1954 samples), and 0.00% were ToRSV-positive (5678 samples). In addition, no positives were found during a spot check of *Malus* for apple chlorotic ringspot virus (629 samples) this season. Field inspections were also conducted to ensure compliance with current regulations (OAR 603-051-0855 to 0859). Growers were notified of any areas of non-compliance. Follow-up visits by ODA staff are underway to document the corrective actions taken.

A summary of the virus-free varieties grown by each participating nursery is sent yearly to state, federal, and Canadian officials to facilitate the movement of the nurseries' products.

Blueberry virus testing

We continued the official testing program of blueberry nursery stock for blueberry scorch virus and blueberry shock virus in 2013. This program was implemented in 2004 at the request of nurseries to comply with the regulatory requirements of other states and countries. Nursery inspectors collect official samples from participating nurseries and submit the samples to the laboratory for testing. All testing is done with commercially available ELISA test kits. The sampling protocol was updated to streamline testing and provide for more uniform sample collection this year.

In 2013, 41,866 leaf samples from thirty nurseries were tested. Of the composite samples tested (each sample represents 10 individual plants), 0.77% were infected with Blueberry Shock Virus. The infected samples came from thirteen nurseries. The nursery owners were informed of the positive samples. No samples were positive for Blueberry Scorch Virus.

Fresh blueberries to Korea program

Fresh Oregon blueberries were shipped to the Republic of Korea again in 2013, the second year of shipping to this new market. Orchards and packing houses exporting blueberries had to meet specific phytosanitary requirements for seven pests and diseases (*Phytophthora ramorum*, tobacco ringspot virus, tomato ringspot virus, *Monilinia vaccinii-corymbosi*, *Argyrotaenia citrana*, *Choristoneura rosaceana*, and *Grapholita packardi*) that were a concern to Korea before they were allowed to ship.

For *P. ramorum*, tobacco ringspot virus, and tomato ringspot virus, Korea requires a specific percentage of blueberry orchards be visually inspected and, if necessary, samples tested for the pathogens. In 2013, 33 orchards in 10 counties (Benton, Clackamas, Douglas, Marion, Morrow, Multnomah, Polk, Umatilla, Washington, and Yamhill) were surveyed for the three pathogens. Because federal funding was received to support this program, at least 40 samples were collected

from each orchard for testing in the laboratory. None of the target pathogens was detected. The survey data were entered into NAPIS.

For the remaining four organisms of concern, Korea requires the orchards and packing houses to adopt and implement specific mitigation measures that decrease the risk of these pests infesting fresh fruit. The ODA conducted official audits at all orchards and packing houses exporting fruit to Korea to ensure these mitigation measures had been implemented correctly. An orange tortrix larvae was intercepted by Korean quarantine officials on a shipment sent late in the shipping season. The grower and packing house were immediately suspended from the program by USDA APHIS. Follow-up investigations identified improvements that could be made to the program to prevent a recurrence of this issue. These improvements will be implemented for the 2014 shipping season.

In 2013, 16 orchards and six packing houses met the requirements to ship fresh blueberries to Korea, a decrease from the first year of the program. We anticipate similar numbers of orchards and packing houses will participate in the program in 2014.

Survey and Disease Containment Programs

Phytophthora ramorum - Curry County

This year represented the first full year of the new *Phytophthora ramorum* Survey and Containment Program in Curry County. The program underwent significant changes last year, in response to expansion and intensification of the disease within the quarantine area; the expansion was attributed to work stoppages due to inadequate funding to complete eradicative treatments in 2009 and later. In 2013, the quarantine area expanded to 264-sq. mi. The significant changes made to the State quarantine included: 1) establishing a generally infested area (GIA) within the quarantine area where *P. ramorum* is considered established and is no longer required to be treated; 2) allowing increased utilization of tanoak within the quarantine area; and, 3) concentrating treatments efforts on the leading edge of the infestation to slow further spread (OAR 603-052-1230).

At the start of 2013, the GIA was established as a 48-sq. mi. area in and around the town of Brookings based on survey data from the previous year (Fig. 4). Because of an expansion of the disease over last summer, the GIA was expanded to 56-sq. mi. in October. Aerial, ground, and stream-bait surveys detected several new infested sites within the quarantine area, but outside of the GIA. These areas were treated by Oregon Department of Forestry and USDA Forest Service work crews to limit further spread of the pathogen.

The continued goal of the *P. ramorum* program is to slow further spread of the disease by early detection and rapid eradication of epidemiologically important sites, reduce inoculum levels through cost-share programs, and improve education and outreach to educate landowners about best management practices that can help limit disease spread.

Much of this data was provided by the Oregon Department of Forestry. We continue to be unable to enter the Curry County survey and monitoring data into NAPIS or IPHIS. USDA is aware of the issue.

P. ramorum – nurseries

As of 12/31/2013, 22,550 samples from 552 grower sites were collected and tested in the laboratory using federally approved protocols to meet the federal requirements for interstate movement of nursery stock (7 CFR 301.92). *Phytophthora* species were detected at 238 of the sites surveyed. *Phytophthora ramorum* was detected in 10 growing areas on the following plants: *Camellia* 'April Dawn', *Camellia* 'Rosehill Red', *Choisya ternata, Gaultheria shallon, Kalmia* sp., *Parrotia persica, Pieris japonica* 'Forest Flame' (three times), *P. taiwaneosis* (twice), *Rhododendron* cultivars Anah Kruschke, Baden Baden (twice), Boule de Neige, Cheer (twice), Cunningham's White (twice), Orange Leopard, and Unique (three times), *R. bathyphyllum* (twice), *Rhododendron* sp. (four times), *Trachelospermum jasminoides, Viburnum tinus* 'Spring Bouquet', *and Viburnum* sp. Delimitation surveys within the *P. ramorum*-positive nurseries detected additional positives on *Magnolia grandiflora*, *Rhododendron* cultivars Baden Baden (twice), Blewbury, Goldkrone, Lee's Dark Purple, Magret's Garden, Pohoob's Daughter, Raisa Dogwood, Rekka, and Unique, *Rhododendron* spp. (six times), *Viburnum* 'Pink Dawn', and in soil from an infected pot, in substrate soil (twice) and in a cull pile (twice). All of the nurseries have undergone the USDA Confirmed Nursery Protocol (CNP). Two nurseries have *P. ramorum* present in the native soil that was beneath infected plants. The nurseries have agreed to allow us to test steam as a treatment for their infested soil. The steam treatments are expected to take place in 2014.

The ODA conducted trace out investigations at nine sites with 12 samples collected for testing. No *P. ramorum* was detected at any of the sites investigated.

The ODA also participated in a regulatory workshop hosted by USDA APHIS in December 2013. The goal of the workshop was to examine the existing federal regulation for ways to improve the national *P. ramorum* certification program. This included targeting those specific nursery locations where the pathogen is known to occur and providing additional safeguards to prevent further spread. We anticipate the proposed changes to the federal regulation will take place in 2014.

The data from the nursery certification survey were entered in NAPIS.

Other Programs

Columbia root knot nematode

Nursery inspectors collected 73 soil samples for nematode testing from Oregon production nurseries in 2013. This annual survey is conducted at the request of Canadian agricultural officials to demonstrate that Oregon production nurseries are free of Columbia root knot nematode (CRKN, *Meloidogyne chitwoodii*). Plant-parasitic nematodes were detected in 71% of

the samples with *Pratylenchus* spp. being the most abundant (present in 45% of the samples). *Meloidogyne hapla* was detected in five samples. No CRKN were detected in Oregon nurseries based on morphometric analysis of juveniles. Other nematodes detected included *Paratylenchus*, *Mesocriconema*, *Xiphinema*, *Tylenchorhynchus*, *Hemicyclophora*, *Trichodorus*, *Scuttelonema*, *Heterodera*, and *Longidorus* in order of most to least abundant. In addition, 11 root samples of *Malus* rootstock being exported to Canada were submitted, tested, and found free from CRKN.

National Clean Plant Network

The Plant Health Program has taken a leading role in the development and governance of the National Clean Plant Network (NCPN). The goals of the NCPN are to 1) protect US specialty crops, such as grapes, berries, and apples, from the spread of economically harmful plant pests and diseases, and, 2) ensure the global competitiveness of US specialty crop producers by creating high standards for our clean plant programs. Currently, there are five commodity groups that are a part of the NCPN, the Fruit Tree Clean Plant Network (NCPN-FT), the Hops Clean Plant Network, the Citrus Clean Plant Network, the Berries Clean Plant Network, and the Grapevine Clean Plant Network (NCPN-Grapes). The ODA has representatives on the Tier 2 Governing Boards for both the NCPN-FT and NCPN-Grapes.

The NCPN-FT developed a harmonized national standard for the virus certification of *Malus, Prunus, Pyrus, Chaenomeles,* and *Cydonia* nursery stock. In 2013 and after consultation with our affected nurseries, the ODA amended our state regulations to match the language of the national standard.

The NCPN-Berries Commodity Group developed a draft harmonized national standard for virus certification of blueberries. A member of the Plant Health Program participated on the subcommittee charged with developing the national standard. The ODA also arranged a tour of blueberry nurseries for members of the NCPN-Berries subcommittee. The subcommittee discussed the draft national standard with the nurseries, including the requirements for participation in an official certification program.

The NCPN also held a workshop in Davis, California, in conjunction with the 17th Meeting of the International Council for the Study of Virus and Virus-Like Diseases of Grapevine. The goal of the workshop was to develop a template and other guidance documents to aid commodity groups in the development of their own national standards for virus certification. One major accomplishment of this group was to develop a universal glossary for all harmonized national standards; this glossary is available on the NCPN web site, http://nationalcleanplantnetwork.org/Glossary/. A member of the Plant Health Program participated in this workshop.

The Plant Health Program has also been tasked with developing a draft national standard that harmonizes state programs for certification of strawberry nursery stock (see above). This effort began late in 2013.

The Plant Health Program expects to continue to play a prominent role in the development and governance of the NCPN as this network continues to develop.

NPDN and WPDN

The National Plant Diagnostic Network (NPDN) was established in 2002 by legislative mandate in response to the need to enhance agricultural security through protection of the health and productivity of plants in agricultural and natural ecosystems in the U.S. The specific purpose of the NPDN is to provide a nationwide network of public agricultural institutions with a cohesive, distributed system to quickly detect high consequence pests and pathogens that have been introduced into agricultural and natural ecosystems, identify them, and immediately report them to appropriate responders and decision makers. The NPDN also worked with the USDA APHIS Center for Plant Health Sciences and Technology to develop the System for True, Accurate, and Reliable Diagnostics (STAR-D), an accreditation system for diagnostic laboratories that will be federally recognized.

The Western Plant Diagnostic Network (WPDN) is one of five NPDN centers. WPDN is a consortium of land grant institutions and state departments of agriculture throughout the western United States and the U.S. territories in the Pacific that provide services for plant disease diagnosis, plant identification, and insect/pest identification. WPDN uses a common software interface to process diagnostic requests and share information among diagnostic laboratories.

ODA was a sub-contractor to the WPDN prior to this year. However, budgetary cuts at the federal level resulted in a lack of funding for the ODA in 2013. Regardless, ODA staff continued to participate in WPDN monthly conference calls, communicating with other states regarding new disease outbreaks, first detector training, and disease diagnostic protocols. The ODA also took advantage of diagnostic training opportunities provided by the NPDN. The Plant Health Program also continues to work toward STAR-D accreditation.

Plant Health laboratory diagnostics

Plant samples are submitted to the Plant Health laboratory for disease assessment to meet export requirements or for general diagnostics. In 2013, 277 samples were submitted to meet export requirements, certification program requirements, Oregon importation requirements, federal traceback surveys, and/or general diagnostics. Of the 46 samples submitted for general diagnostics, 38% had problems caused by fungi, 28% by abiotic/environmental problems, 8% by nematodes, 7% by bacteria, 1% by viruses, and 1% by insect pests. No pests were detected in the remainder of the samples. The laboratory also tested 56 samples for the presence of the Liberty Link® PAT/bar gene to support the export of non-genetically engineered rice from California to India. All samples tested free of the gene.

Quarantines and control area orders

Several regulations were reviewed and updated in 2013. The *Phytophthora ramorum* quarantine was updated to reflect a new containment strategy for Curry County (OAR 603-052-1230). The hop quarantine was amended to harmonize Oregon's regulations with Washington's; civil penalty authority was also added (OAR 603-052-1020). The onion white rot control area order for Malheur County was updated to require the department receive mandatory notifications from growers importing onion bulbs, sets, and seedlings from Maricopa County, AZ (OAR 603-052-

0347). The regulations describing the official certification program for virus tested ornamental and fruit tree nursery stock were amended to reflect the terminology used in the State Level Model Regulatory Standard: Virus-tested Certification Program for *Prunus*, *Malus*, *Pyrus*, *Chaenomeles*, and *Cydonia* Nursery Stock Production Systems and to update the testing requirements for participation in the program (OAR 603-051-0855 to -0859).

Permit reviews

The Plant Health Program continues to provide reviews of federal permits to import plants, pathogens and parasites, and genetically modified (bioengineered) organisms to our state. The permits are reviewed for compliance with existing Oregon quarantines and regulations. In all, 119 permits were reviewed; 70 for live pests and noxious weeds, 11 for plants for post-entry quarantine, one for prohibited plants imported for experimental purposes, four for soil, three for importing restricted or unauthorized plants, and 30 for genetically engineered organisms. Staff members also participated in federal inspections of facilities and fields where permitted organisms, such as genetically engineered organisms or a regulated pathogen, were to be received and/or grown.

Exported timber inspections

In 2013, staff from the Plant Health and Nursery & Christmas Tree Inspection programs inspected three shipments of conifer logs bound for South Korea and forty shipments bound for China. China requires that all conifer log shipments also be tested for the presence of pine wilt nematode (PWN, *Bursaphelenchus xylophilus*) prior to importation. Inspectors are required to collect a composite sample of wood shavings from the shipment for laboratory testing. The number of logs sampled depends upon the size of the shipment, with a maximum of 29 logs sampled per shipment. Thus, 40 composite samples were officially tested for PWN using a modified pie pan method. No PWN was found.

Publications

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