



Emerging Issues and Concerns in the Washington State Tree Fruit Industry

Spring 2016 Results from a Survey of Orchard Growers

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Introduction

The purpose of the *Emerging Issues and Concerns in Tree Fruit* was to provide growers an opportunity to share their opinions and help inform our understanding of the following issues. Growers' input will help guide future directions for the industry.

- **Pest Management:** Issues impacting pest control and Integrated Pest Management (IPM) programs include the arrival of brown marmorated stink bug (BMSB); changes in pest control including pheromones for codling moth control and potential registration changes for chlorpyrifos; and potential worker exposure to lime sulfur.
- **Worker Protection Standard (WPS):** Many revisions to this regulation took place on January 1, 2017, including changes in the content and frequency of trainings.
- **Heat Exposure:** The heat events during the summer of 2015 showed the importance of minimizing heat-related illness (HRI). Also playing a critical role in heat exposure is pesticide handlers' protective clothing.
- **Supervisor Training:** Several stakeholders from within the tree fruit industry have pointed to supervisory skills training as an important area where skills development can help improve operations and safety in the agricultural workforce.

This survey looks forward as the Washington State University (WSU) Tree Fruit and Research Extension Center (TFREC) and the University of Washington (UW) Pacific Northwest Agricultural Safety and Health Center (PNASH) complete their five-year partnership on the *Pesticide Safety: Translating Research and Overcoming Barriers* research project.

Methods

Topic areas and questions for the survey were developed based on input from industry stakeholders, pesticide safety educators, and researchers. The survey questions were qualitatively validated with the target population, those who make orchard management decisions or provide pest management decisions in one or more tree fruit orchard(s) in Washington (WA) state and are referred to as respondents in this report. Modifications were made based on feedback, including the recommendation to administer the survey in Spanish and English.

The Social and Economic Sciences Research Center (SESRC) at WSU led the survey design using the Tailored Design Method. The survey instrument contained 39 fixed-response and 9 opened-ended questions. To enhance survey response, it was administered using a mixed-mode model with both a 12-page paper pamphlet and online options for completing the survey. The survey was administered between May 2 and June 30, 2016 with up to five mail contacts to potential respondents. SESRC obtained the mailing list from the Washington Apple

Commission and cleaned the list to remove duplicate mailings to the same establishment (same addresses and/or last names). The contact sequence was as follows

- | | |
|---------------------------------|-----------------|
| 1. Introductory letter | May 2, 2016 |
| 2. First questionnaire mailing | May 10-13, 2016 |
| 3. Second reminder letter | May 20, 2016 |
| 4. Second questionnaire Mailing | June 8, 2016 |
| 5. Final reminder letter | June 15, 2016 |

All letters and the survey were in Spanish and English and included instructions for completing the survey online. The first mailing introduced the survey and included a \$2 bill as a pre-incentive. Repeat mailings were only sent to addresses from which a response had not been received. Only SESRC had access to the mailing list; PNASH and TFREC did not have access to the mailing list or participant identifiers. All study procedures involving human subjects were approved by the UW and WSU Human Subjects Institution Review Boards.

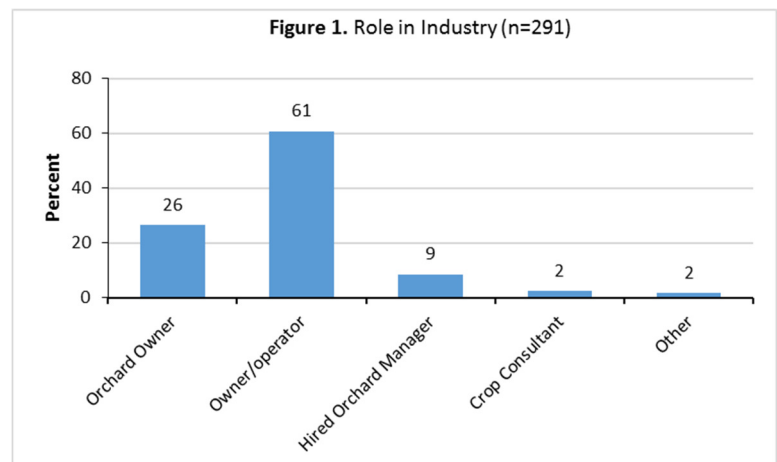
All paper surveys were returned to SESRC via pre-addressed and pre-paid envelopes. Online surveys and all data were housed on the SESRC server that is monitored by the WSU firewall. SESRC provided PNASH and TFREC with a final report detailing the survey methods, summary data tables, and Excel spreadsheets with the fixed and open-ended question results.

PNASH and TFREC staff translated open-ended responses completed in Spanish. The survey team reviewed, cleaned, and prepared the summary tables and figures with descriptive statistics provided in this report.

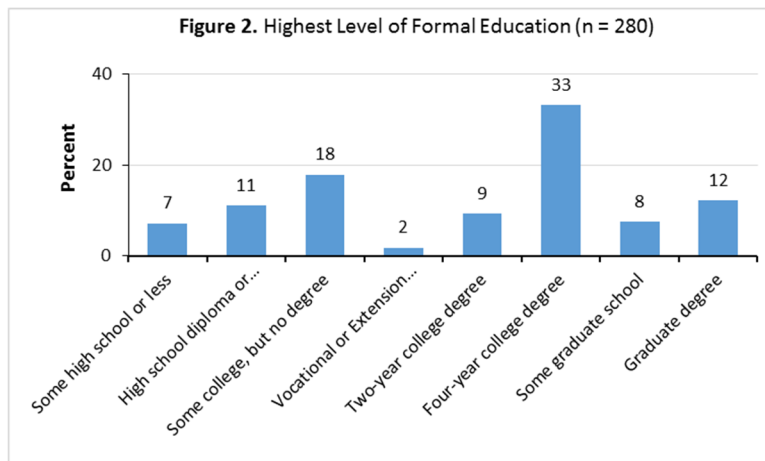
Survey Results and Discussion

Study Population

Response rate: From the initial mailing list, 1121 names/addresses were eligible to receive the survey and 310 were returned either partially or fully completed for a 28% response rate. Fifty-nine percent (59%) of the surveys completed on paper and 41% were completed online. Twelve Spanish paper surveys were completed and none were done online.



Respondents: In response to the question “What best describes your role in the tree fruit industry?” 87% selected *I am an orchard owner* or *I am an orchard owner/operator* (Figure 1).



The average age of respondents was 59 years with a range of 20 to 91 years, most being male (94%). For ethnicity, 77% selected non-Hispanic/non-Latino, 10% Hispanic/Latino, and 13% declined to respond. Ninety-two percent (92%) reported English as their primary language, 7% reported Spanish, and 1% bilingual. The question, “*What is the highest level of education you completed?*” showed that 62% of

the 280 respondents had completed a minimum of a two-year college degree and 53% completed a four-year degree and/or had some graduate experience or held a graduate degree (Figure 2).

Growing Regions: We asked growers the following question “*In what region(s) is the tree fruit orchard you own, manage, or provide recommendations for located?*” so we could sort various responses by growing region. Table 1 shows that there was a good balance of respondents from major growing regions in Washington State.

Table 1. Number of Respondents by Growing Region

Region	Number	Percent
Wenatchee	59	17%
Chelan/Manson	57	16%
Upper Yakima Valley	57	16%
Lower Yakima Valley	56	16%
Columbia Basin	48	14%
Okanogan	38	11%
Tri-cities	26	7.3%
Columbia Gorge	6	1.7%
Ellensburg	4	1.1%
Other	5	1.4%

Production of different crops: We asked growers to identify the fruit crops produced and how many acres were conventional, organic, or transitional organic. Since the focus of this survey was to gather information from apple growers, most (80%) of the 100,479 acres represented by the survey were used for apple production. Percent acreage used for the production of tree fruit other than apples was 7% for pears, 13% for cherries, and less than 1% for other fruit crops.

Table 2. Fruit Crops, Orchard Type, and Acreage for Respondents

Crop	Type	Total acres	Ave. Acres/Grower	Percent
Apple	All	80221	258.8	
	Organic	66230	21.6	8.3%
	Transitional	3196	10.3	4.0%
	Conventional	70395	227.1	87.7%
Pear	All	7014	22.6	
	Organic	638	2.1	9.1%
	Transitional	322	1.0	4.6%
	Conventional	6055	19.5	86.3%
Cherry	All	12699	41.0	

Table 2. Fruit Crops, Orchard Type and Acreage for Respondents (Cont.)

Crop	Type	Total acres	Ave. Acres/Grower	Percent
	Organic	588	1.9	4.6%
	Transitional	95	0.3	0.7%
	Conventional	12016	38.8	94.6%
Peach/Nectarine	All	259	0.8	
	Organic	152	0.5	58.7%
	Transitional	1.0	0.0	0.4%
	Conventional	106	0.3	40.9%
Prune	All	27	0.1	
	Organic	1.6	0.0	6.0%
	Transitional	0.0	0.0	0.0%
	Conventional	25.0	0.1	94.0%
Apricot	All	259.1	0.8	
	Organic	68.2	0.2	26.2%
	Transitional	48.8	0.2	18.8%
	Conventional	142.1	0.5	54.8%

Pest Management

Pheromone Technology: Use of behavioral communication disruption technology, pheromones, to manage codling moth in Washington orchards has been a practice adopted by most apple growers. Prior to this survey, estimated use of pheromone technology has been based on feedback from commercial providers of this technology and, to a lesser extent, from grower input. To gain a better perspective on the use of pheromone technology to manage codling moth in Washington State, we asked the following question: “*Did you use or recommend pheromone mating disruption as part of a codling moth management program in 2015?*” Responses to this question were provided by 278 of the 310 individuals participating in the survey. Eighty-two percent (82%) of the question respondents indicated that they used one or more pheromone technologies to manage codling moth. However, the acreage of growers using pheromone technology totaled 74,142 acres, or 90.1% of all acres represented in the survey. These data agree with other information on the level of pheromone technology adopted by Washington apple growers since 2010.

We also asked, “*What percent of the bearing tree fruit acres you own, manage, or consult on were treated with pheromones as part of the codling moth control program in 2015?*” We could then compare the acres treated with pheromone technology relative to those not treated. On average, growers using pheromone technology treated 90.4% of their acres, or a total of 67,780 acres. Of the 67,780 acres treated with pheromone technologies, 9,730 acres, or 14.4% of all apple acres treated with pheromone, were organic or transition organic. The average farm size of growers who indicated they used a pheromone technology was 325 acres, whereas growers who did not use pheromone technology had an average farm size of 21 acres.

Growers were asked to identify the kind of pheromone product or products used to manage codling moth in apple orchards. Two hundred and twenty-four (224) responded to this request.

Most, 68%, identified using only one pheromone product while 25% identified using two pheromone products, 6% three pheromone products and 1% four or more pheromone products. Of the acres represented by growers identifying pheromone products used, those using only one pheromone product represented 18% (13,131) of the acres. Most growers used two (36% - 26, 146 acres), three (34% - 24,912 acres), or four (12% – 9,155 acres) pheromone products.

The hand-applied technologies (Cidetrac, Cidetrac combo, Checkmate, Isomate TT and Isomate Flex) accounted for 74.9% of products used as identified by growers, while 22.9% of the growers identified aerosol delivery technology as the technology they used (SEMIOS, Checkmate Puffer, Isomate MIST) (Table 3).

Table 3. Number and Percent of Growers Using a Pheromone Product

Pheromone Product	# of Growers Using Product	Percent
Isomate Flex (hand-applied)	100	32%
NoMate spiral (hand-applied)	47	15%
Isomate TT (hand-applied)	42	14%
Checkmate Puffer (aerosol)	38	12%
Isomate MIST (aerosol)	24	7.7%
Checkmate (hand-applied)	17	5.5%
Cidetrac combo (hand-applied)	16	5.2%
Cidetrac (hand-applied)	10	3.2%
SEMIOS (aerosol)	10	3.2%
Checkmate flowable (sprayable)	4	1.3%
Other	2	0.6%

Lime-sulfur use: Two-hundred ninety-six (296) growers responded to the question “Have you used lime-sulfur with or without oil in the past three years?” Most respondents (73%) indicated that they had used lime-sulfur during the last three years, whereas 27% reported not using lime-sulfur.

In response to the question “Have farm crews working in your orchard been impacted by drift from applications of lime-sulfur with or without oil in the last three years?” the vast majority (98%) replied NO. The total acreage of the five respondents answering YES was 3,046. While there were few growers indicating a problem with drift of lime-sulfur, the number of acres impacted was 4% of total apple acres represented by this survey.

Stink bugs: When growers were asked “Did you apply or recommend insecticide sprays for control of stink bugs in 2015?” most (71%) responded YES (Table 4). This represents a significant increase in treatment for stink bugs in Washington State, at least based on previous surveys indicating that few growers targeted sprays for this pest group.

Table 4. Use Pesticides for Stink Bug Control

Response	Number	Percent
Yes	206	71%
No	85	29%

When growers were asked, “Have you heard of (or are aware of) the brown marmorated stink bug?” most (85%) of the 289 respondents answered YES. The brown marmorated stink bug is a relatively new exotic pest that is now present in eastern Washington. The fact that most growers were aware of this pest demonstrates the success of the educational outreach to inform the fruit industry of the new pest.

Table 5. Threat of Brown Marmorated Stink Bug to WA Tree Fruit Industry

Response	Number	Percent
Moderate threat	86	35%
Major threat	82	34%
I am not sure	51	21%
Minor threat	20	8%
Other, please specify	5	2%
Total	244	100

When growers were asked to define the threat to their production by answering the question “*In your opinion, what threat does the brown marmorated stink bug pose to the Washington tree fruit industry?*” most (69%) thought the brown marmorated stink bug was a major or moderate threat (Table 5).

Chlorpyrifos regulatory decisions: The US Environmental Protection Agency (EPA) is considering banning the pesticide chlorpyrifos (e.g., Lorsban). This organophosphate insecticide has been used for many years in the tree fruit industry, though its use has been restricted to pre-bloom use only. The loss of chlorpyrifos could mean changes in pest control programs. When growers were asked, “*Have you used or recommended chlorpyrifos (e.g., Lorsban) in the past three years?*” the majority (74%) of the 288 respondents answered YES.

Table 6. Impact of Loss of Chlorpyrifos on your Best Control Program

Response	Number	Percent
Major	127	44%
Moderate	96	33%
None	61	21%
Other	6	2.0%
Total	290	100%

When growers were asked, “*What impact would this change [The EPA elimination of chlorpyrifos (e.g., Lorsban) use in tree fruit production] make in your pest control program?*” most (77%) indicated it would have a major or moderate impact. Some, likely those growers not using chlorpyrifos, indicated loss of this product would have no impact on their pest control program (Table 6).

Revised Worker Protection Standard

As of January 1, 2017, the revised Worker Protection Standard (WPS) regulation¹ came into effect. These changes are intended to improve safety for and knowledge on the part of agricultural workers and pesticide handlers. However, the changes also bring additional responsibilities and challenges for employers. We wanted to find out what respondents knew about the upcoming WPS changes and where the industry might focus some awareness and training efforts. Survey questions covered knowledge of WPS changes, WPS training providers, languages for WPS training materials, take home materials, and challenges some respondents face when communicating with their workers about the WPS. Below are the responses to these questions.

Knowledge of WPS changes: When asked, “Before receiving this survey, were you aware that the Worker Protection Standard (WPS) has been updated, and most changes will go into effect January 1, 2017?” 58% of the 287 respondents selected YES and 42% selected NO. Those who responded YES (n=166) were then asked, “Have you already heard about the following changes in the WPS?” (Table 7). Most of the respondents who were aware of changes in the WPS were also aware of the change to annual training (82%) and the 18-year minimum age requirement for pesticide handlers (76%). Fewer respondents had heard of the requirement that agricultural workers will need to be trained before working (58%) and the need for applicators to stop applications if anyone enters the “Application Exclusion Zone” (49%). This last change may be particularly challenging to implement in some orchards. These changes and others in the regulation will require of growers more advanced planning and additional time for training. Smaller family operations are likely to benefit from the expanded training exemption for family members, but less than half (40%) of the respondents were aware of this change. It will be important for this information to reach these smaller family owned orchards.

Table 7. Number and Percent of Participants Aware of Five Changes in the WPS

Changes in the Worker Protection Standard	Yes Number (%)	No Number (%)
Workers will need to be trained yearly instead of every five years. (n=163)	134 (82%)	29 (18%)
Pesticide handlers and early entry workers will need to be at least 18 years old. (n=164)	124 (76%)	40 (24%)
Agricultural workers will have to be trained before working, with no 5-day grace period. (n=163)	95 (58%)	65 (42%)
Pesticide handlers will have to suspend applications if anyone enters the "Application Exclusion Zone." (n=162)	80 (49%)	82 (51%)
The training exemption for immediate family will expand to include more family members (i.e. cousins, stepchildren, and grandchildren. (n=161)	65 (40%)	96 (60%)

*Total percent is greater than 100 as respondents could select all that applied.

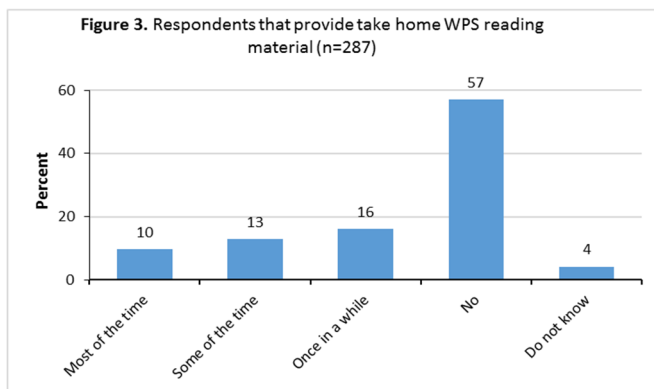
WPS training providers: We asked, “Do any of the following people provide WPS training to your agricultural workers and handlers?” The most frequent YES response for was a “certified applicator employed by your company” at 60%, with “Others who have completed an approved train the trainer course” next at 39% (Table 8). Next were “trained (but not certified) handler employed by your company” (34%), “supervisor or other person who is not a WPS trainer (for agricultural workers only)” (29%), and “state/tribal/federal approved trainers” (15%). Also, the “WSDA [Washington State Department of Agriculture] Farmworker Education Program trainers” was noted by 31% of the respondents. This popular training course available in Spanish and English includes specific pesticide handling, decontamination, and safety procedures, as well as the WPS training required for handlers.

Table 8. Providers of WPS Training for Agricultural Workers and Handlers

WPS Training Providers for Agricultural Workers & Handlers	Number (Percent)*		
	Yes	No	Do not know
Certified applicator employed by your company (n=256)	154 (60%)	92 (36%)	10 (4%)
Others who have completed an approved train the trainer course (e.g., Farm Bureau, private consultants) (n=238)	92 (39%)	122 (51%)	24 (10%)
Trained (but not certified) handler employed by your company (n=236)	80 (34%)	143 (61%)	13 (6%)
WSDA Farmworker Education Program trainers (for pesticide handlers only) (n= 233)	73 (31%)	135 (58%)	25 (11%)
Supervisor or other person who is not a WPS trainer (for agricultural workers only) (n=236)	68 (29%)	144 (61%)	24 (10%)
State/Tribal/Federal approved trainers (n=230)	35 (15%)	166 (72%)	29 (13%)
Other (n=18) Most other respondents do their own spraying and do not hire others.			

*Total percent is greater than 100 as respondents could select all that applied.

Languages for WPS training materials: The two languages respondents selected that would be the most helpful to have for WPS training materials were English (265 or 96%) and Spanish (253 or 92%). Seven (4%) of the respondents would find materials in Mixteco helpful. Nine other languages were mentioned once or twice, including Thai, Mandarin/Cantonese, Russian, French, Greek, Arabic, German, Madyar (Hungarian), and “Spanglish.” Participants did not select the Trique and Hmong languages.



Take home WPS materials: Of the 287 responses to the question, “Do you provide agricultural workers or handlers with take-home reading materials about WPS topics?” most answered NO (57%). Only 10% reported providing such materials most of the time (Figure 3). At least for the WA tree fruit industry, efforts should focus on developing other types of training materials.

WPS Communication challenges: To understand some of the challenges managers had with providing WPS training, we asked the open-ended question “Please describe any WPS training topics you have found to be difficult or problematic to communicate with others.” Seventy-six respondents provided 82 comments (some provided more than one comment). Thirty-two percent (32%) of the respondents indicated they had no problems communicating WPS topics. The rest provided comments (Table 9). Challenges described most frequently were: 1) all topics because they did not speak Spanish or did not know what training they needed to provide; 2)

communicating label PPE and respirator requirements and workers not understanding or trusting the labels; and 3) re-entry intervals (REIs) as the workers did not want time off work until they could work in the treated area. Respondents also took the opportunity to describe problems communicating other pesticide handling topics, for example calculations or math, and other health and safety and workplace issues.

Table 9. Challenging WPS and Other Communication Issues (n=72)

Type of Problem	Number of Responses	Percent*
No problems communicating WPS topics	23	32%
Problems communicating WPS topics	24	33%
Problems communicating other pesticide handling topics	9	12%
Did not employ workers requiring training	6	8%
Problems communicating other work-related H&S topics	10	14%
N/A or non-workplace H&S topic	10	14%
Total	82	114%

*Percent was calculated based on the number of mentions of a specific topic divided by the number of respondents. Some respondents provided more than one topic. Total percent is therefore greater than 100%.

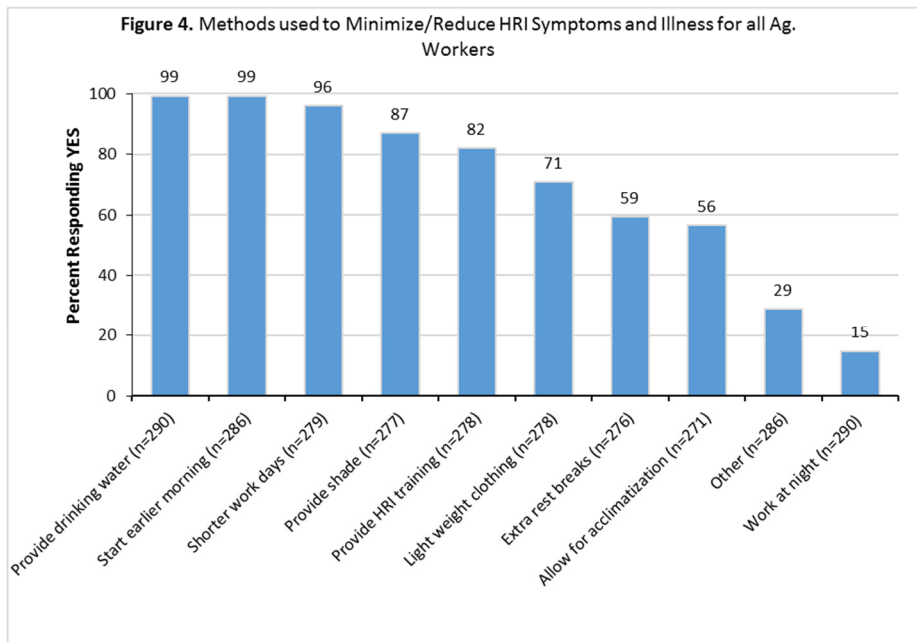
Owners’ and operators’ responses to the revised WPS questions can provide some guidance for outreach and training activities by and for the industry. First, at the time of the study, only 58% of the respondents were aware of upcoming changes. Of those, fewer knew about some specific changes like training frequency requirements (i.e. increased frequency of providing training once a year and training before starting work in the orchard, which eliminates the 5-day grace period). Some of the communication challenges, for example not speaking Spanish and workers not trusting the labels, could be reduced if Spanish language labels were readily available. The US EPA has been working on this issue and a few pesticide registrants are providing US Spanish language labels with an EPA registration number. Manufacturers in other some Spanish speaking countries have produced Spanish labels. However, these labels do not have an EPA registration number and the Spanish is not equivalent to the English US labels.

Exposure to Heat and Handler Protection

Heat Related Illness (HRI) prevention: HRI has become a focus for many of the state’s outdoor industries including agriculture. The Washington State Outdoor Heat Exposure Rule¹ applies to the tree fruit industry and includes both training and prevention measures. Handlers often have an extra heat burden from wearing additional protective clothing and from riding on tractors that also generate heat. Following are the results from questions covering these topics.

Methods used for reducing potential HRI: Figure 4 shows the percent of respondents who answered YES to the different options for the question “Are the following methods used at your company to minimize the possibility of heat-related symptoms and illness (HRI) for agricultural

workers and pesticide handlers?” Almost all respondents provide potable drinking water (99%), start work earlier in the morning (99%), and schedule shorter work days (96%). These three methods are important elements of an HRI prevention program and the tree fruit industry has had success in broad scale implementation of these measures.



Eighty-seven percent (87%) of the respondents provide shade, 82% provide HRI training, and 71% recommend lighter weight and colored clothing. Extra rest breaks (59%) and acclimatization (56%) follow in decreasing frequency. Only 15% work at night, however, this practice is limited by the need for adequate lighting. Support for growers

who do not currently provide HRI training, shade, extra rest breaks, acclimatization, and other measures would help them protect workers from HRI and meet the Outdoor Heat Exposure rule requirements.

Pesticide handling has additional factors that can contribute to a worker heat load including additional layers for protective clothing and heat from the tractors. Tractors with cabs are used by 18% of 274 respondents, 64% of 273 apply pesticides at night, and 40% of 276 help keep handlers cooler by hosing down the waterproof protective clothing they wear. Sixty-six percent (66%) of 274 respondents provide their handlers with training on the difference between the symptoms of HRI and over exposure to pesticides. Understanding these differences is important for early recognition and first response to these exposures.

Protective clothing for handlers. In response to the question “When applying pesticides, what type of work clothes or work clothes + coveralls do your handlers wear most often?” more than half (53%) of the 240 respondents selected “Reusable chemical protective suit, i.e., a ‘rain suit,’ over work clothes” (Table 10). This is despite very few pesticide labels requiring this higher level of protection. Reasons for overuse of rain suits could be a combination of the simplicity of only having one type of PPE, considering that this is the best protection possible, or a habit from earlier times when more pesticides required this type of PPE. Thirty-two percent (32%) reported using single use chemical protective suits with or without taped seams. Eight percent (8%) wore “regular work clothes, i.e., long pants and long sleeved shirt” and 3% used cotton

type coveralls over work clothes. Of note are four respondents that selected “other” and wrote that their handlers followed the label requirements for protective clothing.

Table 10. Work Clothes or Work Clothes + Coveralls Worn Most Often by Handlers

Handler Clothing and/or Coveralls	Number	Percent
Reusable chemical protective suit, i.e., a “rain suit,” over work clothes	126	53%
Single use (disposable without taped seams) chemical protective suit over work clothes	43	18%
Single use (disposable with taped seams) chemical protective suit over work clothes	34	14%
Regular work clothes, i.e., long pants and long sleeved shirt	20	8%
Cotton type coverall over long pants and long sleeved shirt	5	2%
Cotton type coverall over short pants and short sleeved shirt	2	1%
Other: (4 respondents specified they wore what was required on the label)	10	4%
Total	240	100

Changes in protective clothing for handlers. Thirty-four (34%) percent of the 291 respondents answered YES to the question “Has the type of work clothes and/or coveralls handlers wear when handling pesticides at your orchard changed over the last 5 years (2011 – 2016)?” Of these, 80% provided responses to the open-ended question “What changes were made?” Responses fell into four primary topics areas. Categories 1 & 4 were broken down further as shown in Table 10. Most responses described a “**decreased use or a change away from using reusable ‘rain suits’.**” The most common change was categorized as replace with or increase use of disposable suits (39%). Other related changes included use of lighter weight, cooler, and/or breathable material suits (11%); label and pesticide use changes which reduce protective clothing requirements (10%); general comments on better suits/more types (8.8%); and change to using cotton and/or long sleeve shirts and pants (10%). Eighteen percent (18%) of the responses were in the category, **increase in rain suit use, maintenance, or replacement.** Ten percent (10%) of the responses covered reports of **increase in or more consistent use of protective clothing.** Though not part of the changes in protective clothing, **other protective equipment or methods** related to pesticide safety were mentioned including **increased/improved respirator use, eye protection, and gloves.** Three respondents mention using **tractors with cabs** for application.

Table 11. Reported Changes in the Type of Work Clothes and/or Coveralls Handlers wore when handling Pesticides at your Orchard over the last 5 years

Changes made (n= 80)	Percent*
1. Decreased use of or changing use away from reusable “rain suits”	
• Replace with or increase use of disposable suit	39%
• Use lighter weight, cooler, and/or breathable material	11%
• Label/pesticide use changes which reduce protective clothing	10%
• Better suits in general/ more types	8.8%
• Change to cotton/ long sleeve shirt pants	3.8%
2. Increase in rain suit use, inspection, or replacement	18%

3. Increase in or more consistent use of protective clothing	10%
4. Other protective equipment or methods	
• Increased/improved respirator use	8.8%
• Eye protection	3.8%

Table 11. Reported Changes in Type of Work Clothes and/or Coveralls Handlers wore when handling Pesticides at your Orchard over the last 5 years over past five years (Cont.)

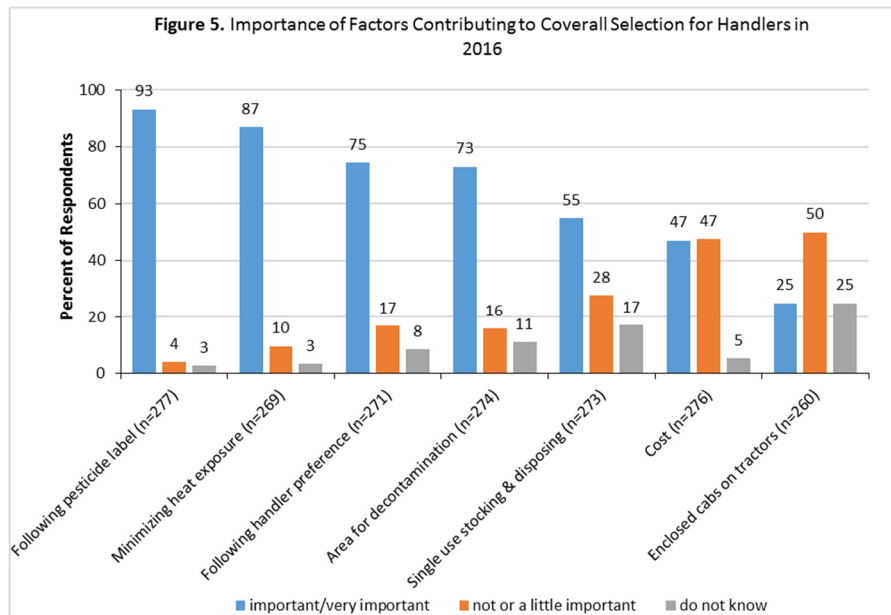
Changes made (n= 80)	Percent*
• Tractors with cabs	3.8%
• Gloves	2.5%

*Sum of percentages is greater than 100% because some respondents included more than one topic in their response.

Seventy-one percent (71%) of respondents also provided reasons why changes were made (“Why did you make the changes?”). This was an open-ended question as well. Responses fell into three primary topics areas **1) General comments; 2) Disposable chemical resistant suits; and 3) reusable rain suits.** The most frequent comment was about improved worker safety, health, or protection (30%). Also under general comments were changes in regulations and labels and the introduction of Global GAP (8.5%). These were followed in decreasing frequency by new knowledge, benefit for workers or workers requested changed, and retirement of older generation. Twenty percent (20%) commented that they changed to disposable chemical resistant suits for user comfort; 17% less heat stress; 14% for convenience; and 4.2% because the suits were breathable but more chemical and water resistant. Comments on reusable rain suits included maintenance or replacement and using them for lime sulfur applications.

Coverall selection factors.

Survey respondents were asked “Please rate each factor as to its importance in contributing to your coverall selection for pesticide handlers in 2016.” The question included seven factors and a four-point scale and “I do not know.” For data analysis, the four importance rankings were summed into two categories, *not or a little important* and *important or very important* (Figure



5). For five of the seven factors, respondents selected “important or very important” by a greater percentage than those rating the factors as “not or a little important.” These factors were “following the pesticide label requirements” (93%) and “minimizing heat exposure” (87%). Next were “following pesticide handler preference” (75%), “maintaining facilities for

decontamination storage of reusable chemical protective suits i.e., ‘rain suits’ (73%), and “stocking and disposing of single use chemical protective coveralls” (55%). “Cost” was neither more “important or very important” or less “not or a little important” at 47% each. For “Using enclosed cabs on tractors” 50% selected “not or a little important” and 25% selected either “important or very important” or “does not apply.”

Supervisor Training

A broad-based group of tree fruit stakeholders met during 2014-2016 and identified supervisory training as a key opportunity for improving orchard efficiency, work environment, and safety climate across the industry. The following questions were designed to solicit more detail from the participants about what kinds of supervisory skills training they already provide, what needs they see, and what additional training resources they might be interested in.

Supervisors’ skill and knowledge. In response to the question, “How well prepared, in terms of skills and knowledge, do you feel that your supervisors are to effectively perform their duties?” 91% of respondents reported that their supervisors were prepared or very prepared to perform their duties, 7% reported their supervisors were unprepared or very unprepared, and 2% did not know (n=287). Even so, 80% of the respondents indicated an interest in additional resources to help their supervisors improve their skills; when asked, “What would help your supervisors become better prepared to effectively perform all aspects of their duties?”, the top two responses were “more trainings” and “materials for training” (Table 12). Both of these categories included bilingual resources.

Table 12. What Would Help Supervisors be better Prepared?

Category of Response	Number of Responses	Percent
More trainings (including bilingual)	53	46%
Materials (including bilingual)	22	19%
Less government regulations/documentation	14	12%
More experience/investment in supervisors	8	7.0%
Overcome language barrier (by learning Spanish or English)	7	6.1%
Clearer labels for ease of application	3	2.6%
More time	3	2.6%
Higher returns on fruit (so more money for training)	2	1.8%
Good equipment (so fewer accidents)	2	1.8%
Sub total	114	100%
Does not apply (including don’t have supervisors)	18	–
None (including existing training sufficient)	10	–
Total	142	–

Additional training for supervisors. The following question, “Would your supervisors benefit from more training in the following areas?” provides direction for areas to emphasize when selecting future training. Between 255 and 259 respondents provided a YES, NO, or DO NOT KNOW for 11 different training areas (Table 13). The top three training areas that respondents

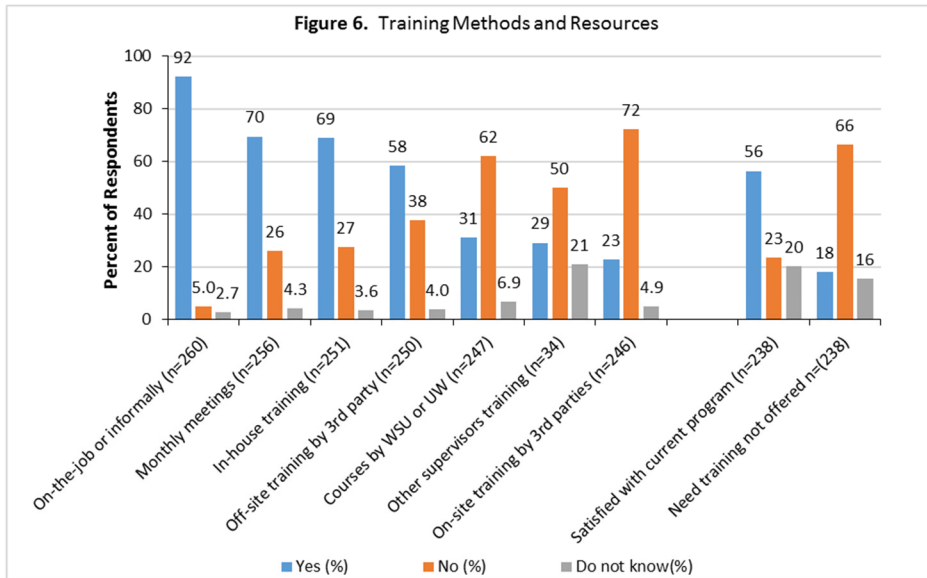
felt their supervisors would benefit from were safety and accident prevention (69%), regulations/documentation (67%), and teaching techniques (66%). Leadership skills, technical skills, and professional communications and conflict management were next, all at 63%. In decreasing order of percent YES response were personnel management (58%), literacy and cross-cultural communications (56%), respect and ethics (52%), financial skills (46%), and sexual harassment (42%). Forty-nine percent (49%) of respondents felt that their supervisors were already sufficiently trained in all the above areas (n=250).

Table 13. Areas that Supervisors would Benefit from Additional Training

Training areas	Yes Number (%)	No Number (%)	Do not know Number (%)
Safety and accident prevention e.g., ladder safety, tractor safety, PPE use, promoting a positive safety attitude (n=257)	177 (69%)	61 (24%)	19 (7.4%)
Regulations and documentation e.g., H2A, WPS, L&I, food safety (n=259)	174 (67%)	62 (24%)	23 (8.9%)
Employee training e.g., teaching techniques (n=254)	167 (66%)	61 (24%)	26 (10%)
Leadership skills e.g., motivating employees (n=258)	162 (63%)	72 (28%)	24 (9.3%)
Technical skills e.g., sprayer calibration, horticulture, tractor operations (n=256)	161 (63%)	73 (29%)	22 (8.6%)
Professional communications e.g., managing conflict (n=256)	160 (63%)	73 (29%)	23 (9%)
Personnel management e.g., hiring, dismissing, promoting, disciplining, evaluating performance (n=259)	150 (58%)	82 (32%)	27 (10%)
Literacy and cross-cultural communications (n=255)	144 (56%)	77 (30%)	34 (13%)
Respect and ethics, e.g., preventing abuse of authority, bullying, favoritism (n=258)	133 (52%)	101 (39%)	24 (9.3%)
My supervisors are already sufficiently trained in all of the above areas. (n=250)	122 (49%)	85 (34%)	43 (17%)
My supervisors are already sufficiently trained in all of the above areas. (n=250)	122 (49%)	85 (34%)	43 (17%)
Financial skills e.g., budgeting, increasing productivity (n=255)	118 (46%)	101 (40%)	36 (14%)
Sexual harassment (n=256)	108 (42%)	117 (46%)	31 (12%)
Other area your supervisors would benefit from more training (n=25)	18 (72%)	7 (28%)	

Methods and resources for supervisor training. When asked, “Do you currently use any of the following methods or resources to train your supervisors?” respondents reported a clear preference for four methods or resources on-the-job or informally (92%), monthly meetings (70%), in-house training provided by company personnel (69%), and off-site training provided by third parties (58%). (Figure 6). Three methods were selected at about 30% or less, university courses (31%), other methods (29%), and on-site training by third parties (23%). Fifty-six percent (56%) of the respondents felt that their current training programs were sufficient and 18% saw a need for training currently not provided.

Additional resources. When asked, “Would you be interested in any of the following training resources?”, respondents answered YES for resources to use for in-house training (65%), more



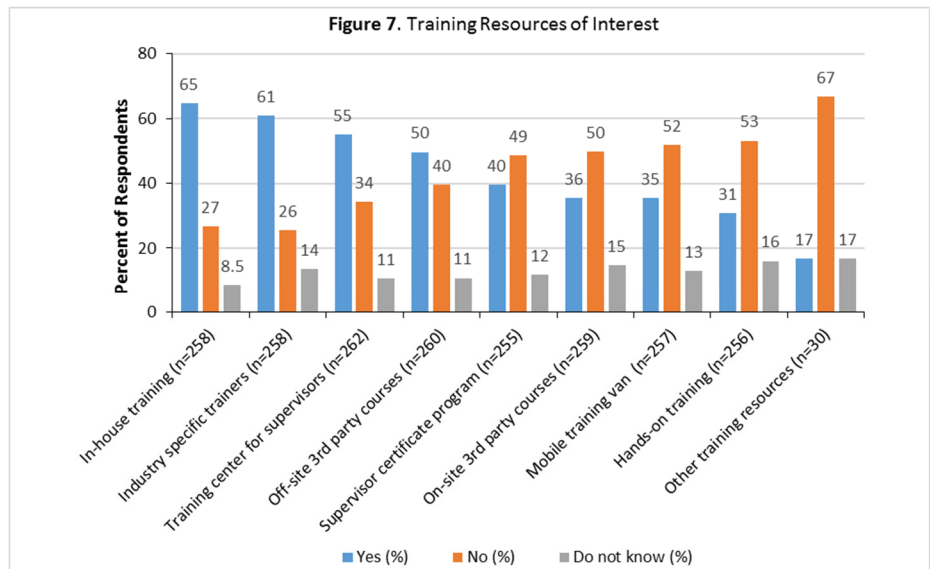
trainers that fit the industry (61%), a training center to send supervisors to (55%), and off-site courses provided by third parties (50%) (Figure 7). YES responses that were less than 50% were certificate program in supervisory skills (40%), on-site individual courses

by third parties (36%), a roving training van to bring training to where it is needed (35%), and hands-on or role-play type training (31%).

Agricultural Labor Skills and Safety Program. The last supervisor question asked, “Are you aware of the new Agricultural Labor Skills and Safety Program offered through the OIC of Washington and sponsored by the Washington Farm Bureau and the Association for Farmworker Opportunity Programs [ALSSP]?”

Eighteen percent (18%) of the 283 respondents replied YES, and of those, 71 % were interested in using

these services for pesticide handlers, 74% for supervisors, and 53% for agricultural workers. Few respondents knew about the program, but those who did showed a relatively high level of interest, especially for their supervisors and pesticide handlers. It could thus be beneficial for the program’s sponsors and growers to reach out to each other.



Overall, most respondents seemed to feel confident in their supervisors’ abilities but were also interested in additional resources – primarily bilingual trainings and materials. The greatest interest for trainings was on safety, regulations, teaching techniques, leadership skills, technical skills, and communication and conflict management. Most respondents reported training their supervisors on-the-job or through monthly meetings, in-house training, or off-site training

provided by third parties, and as such, more than half were interested in additional resources to use for in-house training, more trainers that fit the industry, a training center to send supervisors to, and/or more off-site courses provided by third parties. Presumably, training needs also differ by size of operation and location and could be developed and offered to fit the needs of the different kinds of orchard operations.

Other Emerging Issues and Concerns

At the end of the survey, respondents were given the opportunity to provide their own thoughts and feedback. They were asked to *“Please list any other emerging issues and/or upcoming changes regarding tree fruit orchard management in Washington State that concern you.”* Sixty respondents (19%) of the full sample (N=310) provided comments. Of these, 10 commented to explain why the survey did not apply to them (e.g., retired, sold the farm, very small orchard). The other 50 respondents (83%) provided comments that fell under one of four broad themes 1) specific emerging issues and other concerns; 2) small and family orchards; 3) regulations and rules; and 4) the orchard industry workforce. We appreciate the time and thought that respondents put into their answers. Below is a summary of the responses frequently using the respondents’ own words. The results reported below are the percent of those responding to this question. The total percent is greater than 100% because some respondents provided more than one comment. These comments can serve to inform educators, agencies, the industry, and research when making plans for future endeavors within the tree fruit industry. Thank you.

Specific emerging issues and concerns.

Emerging issues included,

- it is “important to stay on top of BMSB [brown marmorated stink bug]”
- “spotted wing drosophila”
- “... more emphasis on programs that improve farming efficiency in pesticide use, water management, and fertilizer management, etc.”
- “upgrade of water storage in the alpine wilderness area”
- “water run-off management”
- spray drift, specifically, “lime sulfur damage to cherry trees drifting from organic orchards.”

Concerns included,

- *Safety*: specifically, “Safety is paramount” and “Everyone applying pesticides should have a license, not just be trained. Many of them do not know what they are spraying, [or] the dangers they are involved with.”
- *Financial*: including, “the increased cost of production” and a method for more predictable income by evening out prices from year to year.
- *Horticultural*: including, “GMO apples may ruin the apple industry and the problems associated with the need to generate new varieties at a phenomenal rate hoping for huge short-term profits.”

Small and Family Orchards. About one-quarter of the respondents were specifically concerned about the future of small and family orchards, as well as the slim chances for a new young farmer to succeed. As mentioned below, the regulatory burden is proportionally greater for the small farm as they are not “vertically integrated like the corporations” that are able to hire people just for managing the regulations and rules. Some expressed that all the research and other activities related to the future of orchards are focused on the big operations and there is “...no interest in smaller operations.”

Regulations and rules. This was the dominant theme from the respondents to this question. Mentioned were regulations from L&I, WSDA, WPS, and USDA, as well as the Food Safety Modernization Act, organic production, and water quality. Rules raised were those generated from the intermediate and retail end of the industry, such as Global Gap and specific retailers. Most frequently mentioned were Global Gap and food safety. Food safety was viewed in a positive light, as one grower put it, “food safety is paramount.” Some respondents commented on the time away from orchard work needed to complete paper work—time they did not have and for which they did not receive compensation. Many respondents expressed that they were overregulated, as one respondent said, “the new WPS is overkill, and a burden, especially to smaller farms.” Another respondent summarized the overall situation as “the big issue for our industry is how to balance between regulations and the ability to run a profitable business.”

About 28% of the respondents expressed frustration about the growing collection of regulations and rules through the manner in which they provided their comments. Though not explicitly stated, the frustration may reflect that growers sense of a lack of respect for their work, business, and industry. Two thoughts related to respect were expressed 1) the general population’s distrust of producers and farmers, and 2) “More credit should be given to the honest operators.”

Orchard industry workforce. Approximately one-third of the comments covered the orchard industry workforce. Besides the ongoing issue of labor shortages (especially for smaller operations), concerns included the labor costs, lack of skills and motivation among available workers, and alcohol use during or after work hours affecting job performance and safety. Addressing alcohol use, while it impacts the tree fruit industry, will require a coordinated and concerted effort by many groups within the community at large. It is an issue where the industry could have a seat at the table.

Five *specific training needs* for this workforce were reported. These can help inform decisions about future training development and delivery for the orchard industry. These were

- 1) *First-aid training needs to be more available.*
- 2) *More training in Spanish.*
- 3) *Training for trainers.* “As an industry, we must do a better job training the trainers. Then trainers must communicate the same message to our employees.” “It seems like we must re-train crews when they move from one employer to the next.”

- 4) *“Improving the skilled workers we have”* and not focusing on education for the entry level worker. This respondent recommended “providing educational job and industry related opportunities to regularly improve and learn new skills.” Another respondent provided specific examples, focusing on modern horticultural methods, including thinning techniques, interpretation of soil moisture monitoring, and bloom flower pollination and readiness for pollination.”
- 5) *WPS training usability*. Training that had “more straight forward teaching materials with all of the things I need to cover.” This respondent found the training manual available online, “rather cumbersome and not that easy to teach.”

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i Washington Administrative Code (WAC) 296-62-095 Outdoor Heat Exposure Rule