

## What is the Value of Extension Training for Certified Pesticide Applicators?

Doug Young, Professor Emeritus, School of Economic Sciences, Washington State University, Pullman, WA, [dlyoung@wsu.edu](mailto:dlyoung@wsu.edu)

Carol Ramsay, Extension Pesticide Education Specialist, Washington State University, Pullman WA, [ramsay@wsu.edu](mailto:ramsay@wsu.edu)

### Abstract

Through an email survey, the authors estimate the annual value of certified applicator training programs range from \$6,787 (initial certification) to \$13,366 (recertification) per trainee. When trainee economic benefits were compared to program costs, the most conservative benefit to cost ratio is 20:1. Extrapolation to training provided by other Washington State University Extension faculty resulted in a 14:1 ratio. These high benefit to cost ratios provide strong justification for continuing certified pesticide applicator training. Survey respondents overwhelmingly reported that training had improved their personal safety, helped protect the environment and increased their awareness of, and compliance with pesticide regulations.

### Introduction

University Extension professionals frequently provide services in the public interest, but rarely estimate the monetary value of these services. An exception is McCorkle et al. (2009), who estimated that graduates of a 64-hour farm risk-management training program increased their perceived net income by more than \$33,000 per year.

In many states, Extension provides both initial certification (CERT) and recertification (RECERT) training. CERT training is aimed at people preparing to take state pesticide exams. RECERT training is aimed at certified applicators of restricted-use pesticides who wish to maintain their credential. Federal law requires CERT and RECERT training; in addition, all states have their own regulations for applicator certification (licensing) and recertification for the purchase, use, and supervision of use for restricted-use pesticides (USEPA, 1996; WSDA, 2010). Valuation of CERT and RECERT training is important for guiding University decision-making on allocating resources to continue this type of training. The objectives of this research are to 1) estimate the economic benefits and costs of the primary pesticide education training program provided by Washington State University (WSU) Urban Integrated Pest Management and Pesticide Safety Education (U-IPM-PSE), and 2) to estimate the benefits and costs for all WSU faculty and staff involved in pesticide safety education.

Washington State Department of Agriculture (WSDA) records show that 7,872 certified applicators received RECERT training in 2009 (Personal communication, Margaret Tucker, WSDA, December 3, 2010). Based on knowledge of the number of other trainers in the state as well as the average number of attendees in those programs, the authors estimate an additional 1,572 people received CERT training in Washington in 2009.

WSU Extension provides pesticide education through U-IPM-PSE, state-wide Extension specialists, and WSU County Extension educators. In 2009, WSU U-IPM-PSE provided CERT training to 615 individuals and RECERT training to 3,194 individuals. This program serves people who are otherwise not served by WSU County Offices, commodity groups, and professional organizations.

## Methods and Materials

A questionnaire (Appendix 1) was developed by the authors and then evaluated by three WSU faculty reviewers before being emailed in early July 2010 to 299 CERT and 1,220 RECERT trainees. Questionnaire recipients had attended WSU Extension's U-IPM-PSE sessions during calendar 2009 and provided their email addresses. The total numbers reported includes only those for which the email was not returned as undeliverable. A reminder was sent to non-responders in early August. These individuals represented 49 and 38 percent of U-IPM-PSE's total 2009 CERT and RECERT trainees, respectively.

Survey recipients were asked to value their WSU U-IPM-PSE training in terms of increasing business revenues and/or decreasing costs. For both measures survey recipients were asked to provide an estimate of that monetary value using a low to high range. The questionnaire also assessed whether the training had enhanced environmental protection, their personal safety, and knowledge of and compliance with pesticide regulations. An open-ended question solicited the basis for the attendee's monetary value estimates and general comments.

Alternatives to using trainees' self-reported valuations were considered. One alternative would be the calculated cost savings and revenue increases for farmer application of restricted-use pesticides on total acreage. However, it would be difficult to determine net savings by subtracting farmer's application costs from contractors' application costs for a large number of commercial crops and restricted-use pesticides. The same difficulty would apply to calculating revenue increases. Large data requirements would render this approach infeasible when considering pesticide applications in many non-agricultural areas, such as in public health, landscaping, golf courses, ports, schools, rights of way, and structures.

Thirteen percent (40 people) of CERT recipients and 25% (301 people) of RECERT recipients responded to the questionnaire. While the response rates are modest, they are typical for email and Internet surveys (Dillman et al., 2009; Schaefer & Dillman, 1998). Dillman et al. (2009) report a 12.7% response rate to an Internet survey. By comparison, Langland (2004) achieved a 22% response to a mailed survey to 3,593 licensed pesticide applicators in Florida.

## Results and Discussion

Table 1 describes the type of license (certification) and the area of work of the respondents. Eighty-nine percent (324 of 366) of the respondents to this question obtained private and/or commercial licenses. Some had more than one type of applicator license and worked in more than one area of pest control, which explains the total of 366 licenses. This is consistent with 483 total areas of work reported; a number which exceeds the 341 (40 CERT plus 301 RECERT) respondents. Agriculture, landscape/nursery, and rights of way were the top three areas of work. WSU Extension U-IPM-PSE reaches a very broad group of trainees, which explains the frequency of landscape/nursery (30%), rights of way (22%) and other areas (28%), in addition to traditional agriculture (22%). Of Washington's 6.5 million people, approximately 4.5 million reside in the highly urbanized Puget Sound region; urban areas rely on many non-agricultural pesticide applications.

**Table 1.**

Type of Pesticide License and Area of Work for All Trainees

License Type	No.	Declared Work Area	No.
Private and/or Commercial Applicators	324	Agriculture	100
Dealer Manager	21	Landscape/Nursery	144
Consultant	21	Rights of Way	104
		Aquatics	37
		Other	98
<b>Totals</b>	<b>366</b>	<b>Totals</b>	<b>483</b>
Rate of Response	99%	Rate of Response	99%

Notes: "Rate of Response" shows the response rate to this question as a percentage of those responding to the questionnaire and "No." indicates the total responses in this category. Some respondents marked more than one category for both License Type and Work Area. The term "Commercial" includes all certified applicators other than private applicators.

Table 2 reports the years respondents held a pesticide license and the number of continuing education credits earned annually from WSU Extension. Surprisingly, CERT course attendees reported they had held certified applicator licenses for an average of 7 years. This may indicate that licensed applicators are attending CERT courses in order to retest instead of attending RECERT courses to accrue continuing education credits. Alternatively, it might indicate that respondents attend CERT courses in order to add a license type or examination category. Respondents attending RECERT courses reported they had held certified applicator licenses from 1 to 40 years with the average being 13 years. CERT and RECERT respondents averaged 5 and 12 credits per year of pesticide training, respectively. The response rate to these questions was 88% for CERT respondents and 97% for RECERT respondents.

**Table 2.**

Number of Years with a WSDA Pesticide License and Number of Credits (Hours of Presentation) from WSU Extension for both Initial Certification (CERT) and Recertification (RECERT) Trainees

Measure	Years		Credits/year	
	CERT	RECERT	CERT	RECERT
Average	7	13	5	12
Minimum	0	1	1.5	0
Maximum	25	40	8	45
n	36	268	36	295
Rate	88%	88%	88%	97%

Notes: WSDA = Washington State Department of Agriculture, WSU = Washington State University, "Rate" shows the response to this question as a percentage of those responding to the questionnaire, "n" indicates the total responses in this category.

Table 3 lists dollar ranges of self-reported savings estimates of RECERT trainees after taking WSU U-IPM-PSE's training program. Many trainees reported annual values for both their initial CERT training and their current RECERT training. As an important caution, the response rates for these monetary valuation questions were low—11% for CERT training and 16% to 22% for RECERT training. Total responses to these questions were six or fewer for those taking CERT training only and were judged too small a sample to report. The lower and upper ranges of annual net monetary returns from CERT training averaged between \$8,966 and \$13,156.

**Table 3.**

Perceived Range of Annual Monetary Values of Initial Certification and Recertification Training

Item		Average \$	Min \$	Max \$	n	Rate
<b>...initial certification training for recertification respondents...</b>						
Increased Net Monetary Return						
	Low	8966	0	50000	34	11%
	High	13156	200	80000	34	11%
<b>...recertification training for recertification respondents...</b>						
Increased Gross Revenue						
	Low	4069	5	60000	50	16%
	High	8560	0	80000	50	16%
Reduced Costs						
	Low	2718	1	30000	67	22%
	High	4806	100	50000	68	22%
Increased Profits						
	Low	6787	6	90000	50-67	16-22%
	High	13366	100	130000	50-68	16-22%
Notes: "n" denotes the number of responses to the particular question. "Rate" shows the response to this question as a percentage of those responding to the questionnaire.						
All "Average \$" are greater than zero at the 0.01 statistical significance level.						

The total value of RECERT training was determined in two steps.

1. Influence of training on increasing gross revenues; for example, by improving crop yield and quality, or by increasing landscaping business revenues; and
2. Influence of training on reducing costs; for example, by reducing labor costs through using in-house applicators to spray rather than hiring a contractor.

Increased profit equals the sum of these two influences. Based on the averages presented in Table 3, RECERT respondents' estimated annual profit increase ranged from \$6,787 (\$4,069 plus \$2,718) to \$13,366 (\$8,560 plus \$4,806). The maximum profit increase reported for this training was \$90,000 to \$130,000 indicating that one respondent perceived gains well beyond the average. More respondents answered the question on cost efficiencies (22%) than on revenue gains (16%). Comments received in the open-ended comment box suggested the former was easier to estimate. The majority of respondents who did not provide monetary valuations cited several reasons. Some worked for public institutions and did not feel that revenue increases were applicable. Many simply felt unable to put a dollar value on the training.

Recognizing that the valuations in Table 3 were collected from a sample of WSU U-IPM-PSE's trainees, we first examined the benefits and cost of this program alone. A total of 3,194 and 615 individuals received U-IPM-PSE RECERT and CERT training, respectively, in 2009. Valued at the conservative lower bound of \$6,787 per RECERT trainee, just under \$22 million (3,194 times \$6,787) in annual benefits were realized. Multiplying 615 CERT trainees by \$8,966 yields an additional conservative gross value of just over \$5 million. Combining both CERT and RECERT, the overall annual benefits were estimated at just over \$27 million for 2009.

The direct costs of U-IPM-PSE's training were calculated by using 2009 cost records. Annual salaries and benefits of program faculty and staff totaled \$523,360. These funds pay for work on program management, marketing and policy issues as well as course instruction. Travel, administrative overhead,

and printed educational materials add another \$157,500, for a total of \$680,860 in direct expenses. In 2009, U-IPM-PSE recovered \$485,000 in fees and surcharges. Thus, net annual expenses in 2009 totaled \$195,860.

Another major cost is incurred by trainees and/or the firms employing them. These costs include the value of lost productivity (estimated at \$200) while attending training, travel costs (estimated at \$25), and fees (estimated at \$75) for the training. Based on the author's estimates of average travel costs and lost productivity, the cost for CERT and RECERT groups averages \$300 per trainee. Consequently, the total trainee cost is \$1.14 million [(3,194 RECERT + 615 CERT) x \$300].

The total 2009 program costs plus trainees' costs are nearly \$1.34 million [\$195,860 + \$1,142,700]. Based on these calculations, U-IPM-PSE creates just over \$27 million in annual benefits versus \$1.34 million in annual costs, representing a benefit to cost ratio of 20:1.

Since the primary motivation for this research was WSU administrators questioning the impact of WSU faculty and staff engagement in pesticide training, an extrapolation was calculated based on the findings from the U-IPM-PSE program. The extrapolation is based on estimates of time and travel for faculty and staff to present information at a CERT or RECERT training event, or to coordinate a CERT or RECERT training event. The authors estimate that non-U-IPM-PSE faculty and staff reach 285 CERT trainees and 1,497 RECERT trainees (40% of Washington's certified applicators who attend training), for an annual benefit of over \$12.7 million [(\$6787 x 1,497) + (\$8,966 x 285)]. With no cost reimbursement (i.e., attendee fees paid to WSU), total costs were calculated at \$870,254. Dividing the \$12.7 million in benefits, by \$0.9 million in costs, results in a benefit to cost ratio of 14:1. While this is still a very strong benefit to cost ratio, it falls below that for U-IPM-PSE because the latter program serves more people and receives more cost reimbursement.

Summing the benefits and costs of the two components of WSU Extension's pesticide training program produces an 18:1 state-wide benefit to cost ratio.

It is also useful to estimate the implied trainee value per credit of pesticide training. Dividing the conservative lower bound value estimates from Table 3 by the average number of CERT and RECERT credits from Table 2 gives:

- \$1,793 per CERT credit
- \$566 per RECERT credit

The monetary estimates in this research relate only to measurable market-based cost reductions and revenue increases associated with pesticide education. The estimates do not include changes in human and environmental protections, aesthetics, or other nonmarket costs or benefits.

To account for these nonmarket impacts, the authors sought input via the questionnaire about specific knowledge gained from the training (Table 4). Among RECERT respondents, 95% stated that the training improved their personal safety, 93% stated that it helped them to protect the environment, and 98% stated that it increased their awareness of and compliance with pesticide regulations. Most CERT respondents also ranked improved personal and environmental protection high on their list of benefits. Overall response rates ranged from 85% to 95%.

**Table 4.**

Respondents' Perception of Improved Environmental Protection, Improved Personal Safety, and Improved Awareness and Compliance with Pesticide Regulations

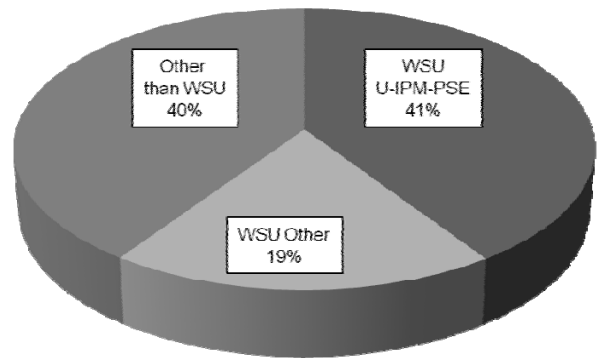
Item	CERT + RECERT		% Yes	
	n	% Yes	CERT	RECERT
Improved safety	328	95	97	95
Improved environmental safety	323	94	97	93
Improved awareness and compliance with regulations	292	85	Not Requested	98

Notes: "n" = number of responses; "% Yes" is relative to those answering the question. CERT=prelicense training and RECERT= recertification training.  
All "% Yes" results are greater than zero at 0.01 statistical significance level.

These results were supported by respondent's open-ended comments which complimented both the content and instructional quality of the training. Some respondents emphatically stated that they wanted the program to continue. Positive comments outnumbered critical comments by a ratio of more than 4 to 1. Critical comments focused on the repetitive content of the training from year-to-year and being forced by state regulations to take training. Many respondents stated that it was unreasonable to expect them to provide monetary valuations. Several respondents offered constructive suggestions for improving the training, especially targeting it more specifically to their area of work, such as ornamentals, structures, forestry, and organic agriculture. Some suggested using online modules or other educational delivery methods for specialized topics. U-IPM-PSE does offer online recertification. Some respondents suggested changing the number of continuing education hours and course locations.

In addition to WSU trainings co-sponsored with industry partners, it's important to note that Washington applicators are also served by industry-only sponsored trainings. The authors estimate industry-only sponsored training serves 40% of Washington's certified applicators. Figure 1 illustrates the estimates made by the authors for the sources of recertification training in Washington during 2009.

**Figure 1.**  
Estimated Source of Recertification Training for Licensed Applicators



### Summary and Implications

The ratio of trainees' self-reported economic benefits to the computed costs for WSU's U-IPM-PSE certified pesticide applicator training was 20:1. The extrapolated benefit to cost ratio of non-U-IPM-PSE training was 14.1. The benefit to cost ratio for all WSU Extension training averaged 18:1. Although based on modest response rates typical of email surveys, such favorable benefit to cost ratios provide strong justification for WSU Extension to continue providing certified pesticide applicator training. Indeed, some respondents offered strong, unsolicited support for continuing the training.

A secondary finding showed other benefits:

- 95% of RECERT respondents stated that the training improved their personal safety;
- 93% stated that it helped protect the environment; and
- 98% stated that it increased their awareness of and compliance with pesticide regulations.

These findings indicate a benefit to the individual applicator as well as to society in areas of health and environmental protection. Respondents suggested the use of online modules for areas of pest control that appealed to small audiences. Although not confirmed, it seems plausible that some of the conclusions from this research would transfer to other states. Reporting these results for Washington might encourage similar assessments elsewhere.

### Acknowledgments

A special thank you goes to the pesticide applicator trainees who took the time to respond to the survey. The authors wish to acknowledge WSU's Urban IPM and Pesticide Safety Education Program professional staff and their accomplishments in designing and delivering quality pesticide education: Carrie Foss, Becky Maguire, and Wendy Sue Wheeler. In addition, several county educators and state specialists support pesticide education with hours of preparation, travel and program delivery. We recognize the importance of our excellent relationship with Washington State Department of Agriculture's Pesticide Management Branch. We gratefully acknowledge WSU's Department of Crop and Soil Sciences and Urban IPM and Pesticide Safety Education Program for funding. We also are grateful for useful suggestions for improving the rigor and clarity of the article from three WSU College of Agricultural, Human and Natural Resource Sciences reviewers; anonymous journal reviewers; and, from the journal editors.

### References

- Dillman, D., Phelps, G., Tortora, R., Swift, K., Kohrell, J., Berck, J., & Messer, B. (2009). Response rate and measurement differences in mixed-mode surveys using mail, telephone, interactive voice response, and the Internet. *Social Science Research*, 38(1), 1-18. Retrieved January 26, 2011 from <http://www.irss.unc.edu/odum/content/pdf/Dillman%20Mixed%20Mode%20Soc%20Sci%20Research%202009.pdf>
- Fishel, F., Langeland, K., & Ferrell, J. (2009). Old-school extension programming: a simple user survey provides the impetus to a new and successful regional program opportunity. *Journal of Extension* [On-line], 47(5) Article 51AW7. Available at: <http://www.joe.org/joe/2009october/iw7.php>
- Langeland, K. (2004). What you said: survey results from restricted use pesticide applicators concerning continuing education needs and preferences. *Aquatics*, 26(4):14-22.
- McCorkle, D., Waller, M., Amossen, S., Bevers, S., & Smith, J. (2009). The economic impact of intensive commodity price risk management education. *Journal of Extension* [On-line], 47(2) Article 2RIB7. Available at: <http://www.joe.org/joe/2009april/rb7.php>
- Schaefer, D. & Dillman, D. (1998). Development of a standard email methodology: results of an experiment. *Public Opinion Quarterly* 62: 378-397.
- U.S. Environmental Protection Agency (USEPA) (1996). Summary of the Federal Insecticide, Fungicide, and Rodenticide Act. Retrieved January 26, 2011 from <http://www.epa.gov/regulations/laws/fifra.html>

Washington State Department of Agriculture (WSDA) (2010). Pesticide/pest inspector licensing fact sheet. Retrieved January 26, 2011 from <http://agr.wa.gov/pestfert/docs/Form4375.pdf>

**Keywords:** certified pesticide applicator, pesticide training, valuation of extension services, value of training

Appendix 1. WSU Urban IPM and Pesticide Safety Education Questionnaire - 2009

**What is the Value of Training for Maintaining Certified Pesticide Applicator Status?**

**Introduction:** As you know, Washington State University Extension staff provide initial certification (licensing) training for Washington State Department of Agriculture (WSDA) pesticide licensing. Extension staff also provides continuing education training usually qualifying for recertification credits to maintain your certified applicator status. WSU Extension has provided this service since 1990 and no current consideration is being given to terminating or charging for this service. Training includes topics related to pesticide laws, understanding labels, personal and environmental safety, safe handling, pest (weed, insect, fungi, etc.) identification, IPM practices, equipment calibration, and application principles. WSU Extension county educators and state specialists (weed scientists, entomologists, plant pathologists, safety educators, and others) offer pre-license training. WSDA recertification credits are also generally available as part of field days, workshops, and other educational programs. Due to increasing accountability requirements, WSU is trying to determine the **value of this training for you** as licensed applicators, operators, dealers, or consultants. The objective of this short questionnaire is to ascertain the monetary and behavioral outcomes--what you gained--from attending pre-license or recertification training.

**Professional Information**

Your type of WSDA pesticide license (X or check mark. Indicate more than one if appropriate.)

- \_\_\_\_\_ Private, Commercial or Private/Commercial Applicator/Operators
- \_\_\_\_\_ Dealer Manager
- \_\_\_\_\_ Consultant

Your area of work (mark all that apply)

- \_\_\_ Agriculture
- \_\_\_ Landscapes/Nursery
- \_\_\_ Rights of Way
- \_\_\_ Aquatics
- Other (Specify) \_\_\_\_\_

\_\_\_\_\_ Number of years you have had a WSDA Pesticide License

**Attended training for recertification credits**

How many WSDA recertification credits (hours of presentations) do you receive from classes given by WSU instructional staff (weed scientists, entomologists, plant pathologist, safety educators, nematologists, others) annually? \_\_\_\_\_ credits (hours)

Please provide your best estimate of the **range** of annual monetary values for receiving pesticide recertification training from WSU staff:

- a. Increase gross revenues for my organization/business due to improved insect, weed, and/or pathogen control  
\$/yr \_\_\_\_\_ to \$/yr \_\_\_\_\_ **or** Not Applicable \_\_\_\_\_
- b. Save my organization/business money by improving pest management efficiencies (time, labor)  
\$/yr \_\_\_\_\_ to \$/yr \_\_\_\_\_

Have you made adjustments in how you handle products that improve personal or environmental safety?

- a. Better protect the environment now, compared to before the training:  
\_\_\_\_\_ Yes \_\_\_\_\_ No
- b. Better protect myself and others now, compared to before the training:  
\_\_\_\_\_ Yes \_\_\_\_\_ No
- c. More aware and compliant with state and federal pesticide regulations (even if I don't agree with them) now, compared to before the training: \_\_\_\_\_ Yes \_\_\_\_\_ No

**Attended pre-license training**

Obtained a pesticide license: \_\_\_\_\_ Yes \_\_\_\_\_ No

***(if No, please skip to the "Please comment ...." Section below)***

Please provide your best estimate of the **range** of annual monetary values to initially being licensed?

- a. Increase the capability of the company/farm to apply (or consult regarding) herbicides, insecticides, fungicides, etc. Annual monetary return:  
\$/yr \_\_\_\_\_ to \$/yr \_\_\_\_\_
- b. Increased my salary/profit. Annual monetary return: \$/yr \_\_\_\_\_ to \$/yr \_\_\_\_\_

Have you made adjustments in how you handle pesticides that improved personal or environmental safety?

- a. Better protect the environment now, compared to before the training: \_\_\_\_\_ Yes \_\_\_\_\_ No
- b. Better protect myself and others now, compared to before the training: \_\_\_\_\_ Yes \_\_\_\_\_ No

**Please comment on the factors which underlie the range of monetary values you estimated.** What causes the values to vary by type of educational session, type of commodity or land use, type of pesticide(s) covered, quality of speakers, and other factors? Comment on difficulties, if any, in estimating the monetary values. Extend your answer beyond the space below if necessary.

Please email your response to [dlyoung@wsu.edu](mailto:dlyoung@wsu.edu), mail to Doug Young, School of Economic Sciences, Washington State University, Pullman WA 99164-6210, or Fax to Doug Young at (509) 335-1173. If you have any questions, please call Doug Young at (509) 335-1400.