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Research Study

Evaluation of Idaho Master Gardener Attitudes and Skills about Plant Protection

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Abstract

This study aimed to evaluate plant-protection/pesticide safety skills that Idaho Master Gardener volunteers have learned as part of their Idaho Master Gardener training program. The University of Idaho Extension Urban Pest Management Program (UPMP) designed, developed, and conducted a survey questionnaire using Qualtrics to address plant-protection training effectiveness. UPMP sent 500 surveys to current and previously trained Master Gardeners. A survey return rate of 40% indicated that over 80% of Master Gardeners (1) use science-based practices in their pest management recommendations, (2) have confidence in plant-protection training, and (3) promote environmental stewardship. In addition, the study found that Master Gardeners engage in and demonstrate plant protection that encourages healthy home gardens and landscape environments.

Keywords: environmental stewardship, Extension Master Gardener, integrated pest management, plant protection, program assessment

Introduction

Congress passed the Smith-Lever Act in 1914, which authorized land-grant universities (LGUs) to educate farmers through Extension programming about current science-based agricultural practices. However, as the nation became more urban, an interest in gardening and managing home landscapes caused a demand for horticulture Extension programming. To meet this urban need, in 1973, Washington State University (WSU) Extension Agents D. Gibby and B. Scheer created a volunteer program that supported Extension agents in answering horticulture questions for the public (Gibby et al., 2008).

After a successful pilot, this volunteer program was an immediate success. Cities and counties duplicated the program (now called the Extension Master Gardener program) across the U.S. and within Canada and South Korea (Anonymous, 2019). According to the Extension Master Gardener National Committee, in 2018, 49 LGUs participated in local Master Gardener programs. The National Extension Master Gardener program had over 79,000 active volunteers in 2023 that provided over 4.7 million hours of education to the public on horticultural topics (Anonymous, 2022).

In 1976, Ada and Canyon counties adopted the Extension Master Gardener program in Idaho (Anonymous, 2021). The University of Idaho (UI) Extension has 30 counties and

regions with active Master Gardener programs. Based on data collected between 2015 and 2021, there were approximately 500 new certified Idaho Master Gardeners and 200 advanced Idaho Master Gardeners that fulfilled educational and volunteer requirements each year. Since 1976, the Idaho Master Gardener Program has trained over 10,000 volunteers (Anonymous, 2021).

An Idaho Master Gardener must complete between 20 and 50 hours of classroom horticulture training. The horticulture curriculum teaches various gardening topics, including soil health, plant propagation, landscaping and landscape plants, integrated pest management (IPM), using pesticides safely, and other horticulture topics. Once the classroom portion of the Master Gardener training is complete, the program requires participants to volunteer by assisting the Extension educator with consumer horticulture education and information needs in local communities. The Idaho Master Gardeners must complete between 20 and 50 hours of this volunteer practicum during the next 12 months (Anonymous, 2021). Such a volunteer structure extends the outreach and distribution of university research-based horticultural information to local consumers (Peronto & Murphy, 2009).

Educating the public on pest management, pesticide safety, and environmental stewardship is essential, especially in urban areas. Fortunately, the UI Extension created the Idaho Master Gardener Program to address local educational needs. Whether a beginner or an experienced gardener, this program offers basic training in horticulture for anyone wanting to cultivate a beautiful and healthy garden. The Extension program provides valuable information and resources to help community residents become successful gardeners and learn how to use pesticides safely through IPM strategies.

According to the Idaho Master Gardener Program, in 2017, volunteers donated over 17,200 hours by providing horticultural information to their communities (Anonymous, 2021). By estimating the national value of each volunteer hour through the Nonprofit Leadership Center, the Idaho Master Gardener volunteer service has an annual financial value of about $546,000 (Anonymous, 2023). In addition, volunteer service has a viable and positive impact on the university Extension system by disseminating quality horticultural information (Takle et al., 2017).

This study aimed to determine the skills of current Master Gardeners with plant protection and their use of pest management practices and pest management recommendations. It also assessed their provision of science-based resources provided by their Extension educator, their environmental stewardship, and their conservation efforts in gardens or landscapes. The survey questionnaire addressed the following three thematic questions: (1) Are they using science-based practices in their recommendations? (2) Are they confident based on their plant-protection training? and (3) How conscious are they of environmental stewardship? The survey contained 25 questions addressing Master Gardener competency and identified topics that require additional plant-protection training.

Materials and Methods

UPMP developed a survey to determine Idaho Master Gardeners' aptitudes, skills, and attitudes about using pest control practices to protect Idaho plants in home gardens and landscapes and to ascertain plant-protection skills. In addition, UPMP focused on the success of Idaho Master Gardeners' plant-protection training, including using science-based research recommendations and recognizing sound environmental stewardship practices.

The UI Institutional Review Board approved the survey and assigned it as Exempt Category 2, indicating that the survey questions were appropriate for this study. Survey questions are in the appendix of this paper. UPMP used Qualtrics XM software to build and deliver this survey. This research software is desirable because of automated analytics, ease of data filtration, and its user friendliness. UPMP distributed the survey in two formats: desktop and mobile-ready.

UPMP contacted all UI Extension educators by email to request that their locally trained Master Gardeners complete the survey, suggesting that educators provide 30 minutes of volunteer credit to incentivize these Idaho Master Gardeners (Takle et al., 2017). UPMP distributed the survey using a two-tiered system (McCawley, 2009). First, they sent a letter and the questionnaire access link to the UI Extension educators, who then emailed these to local Idaho Master Gardeners.

UPMP distributed the survey via email in a total of four letters. First, they sent an initial letter to UI Extension educators requesting their support in distributing the survey to their Idaho Master Gardeners. This letter included an attachment containing the survey instructions and a link to access the online survey for distribution to the Master Gardeners. UPMP then repeated this process three weeks later as the second distribution of two letters to prompt the completion of the online survey.

UPMP contacted each UI Extension educator during the survey timeline via phone or email to promote Idaho Master Gardener participation in the state-wide administered survey because it was essential to have a broad geographic distribution of surveyed individuals. If there was low participation in a particular region or county, UPMP asked the UI Extension educator in that region to redistribute the second letter to local Idaho Master Gardeners. This process resulted in the distribution of over 500 questionnaires to the identified Idaho Master Gardeners. Respondents completed 200 surveys, which constitutes a 40% completion rate of the distributed surveys resulting in a statistically valid number of samples for data analysis (Loehnert, 2010).

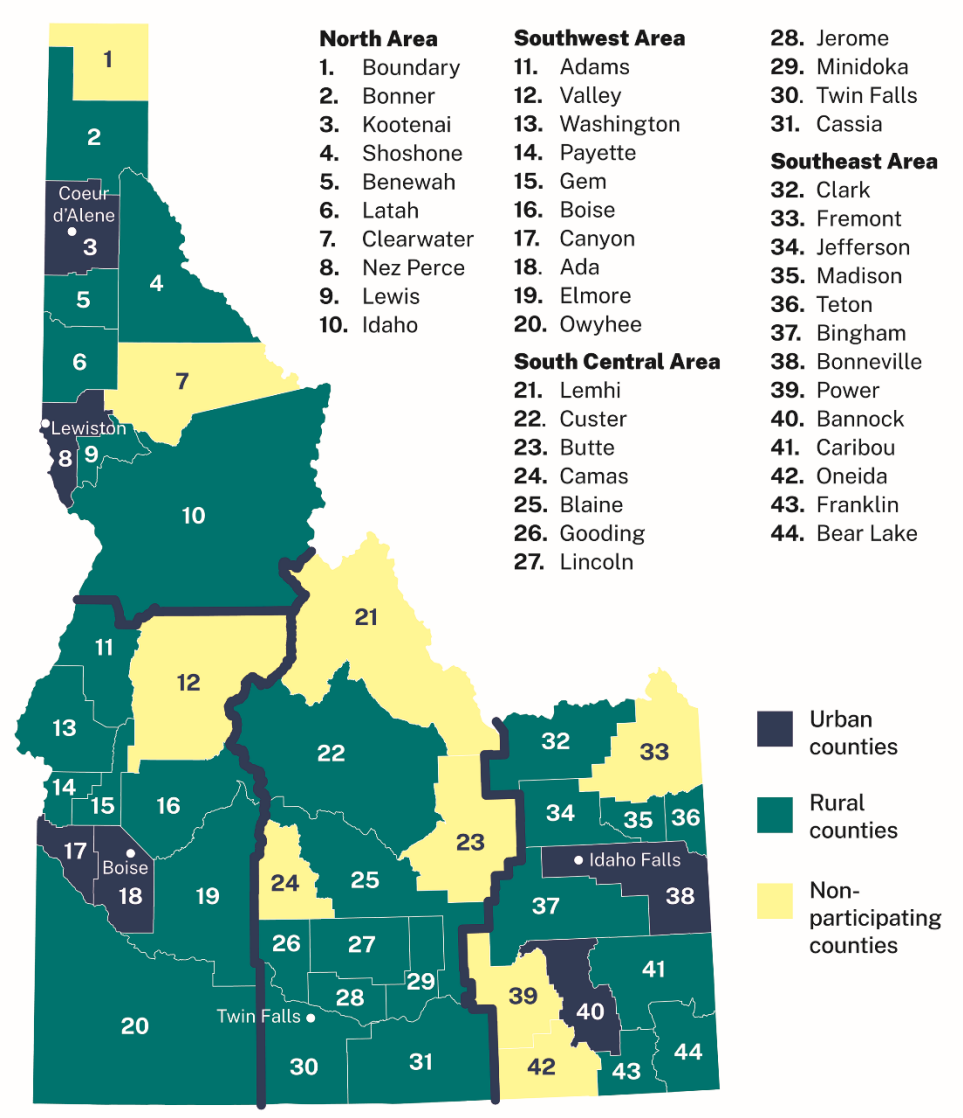
Results and Discussion

Demographic Information

Master Gardeners from 19 different Idaho programs participated in this study. Over 66% of the completed surveys came from the urban (populations greater than 40,000) areas

within Idaho, including Ada, Bonneville, Canyon, Kootenai, and Nez Perce counties (Figure 1). Even though Idaho is a rural state, UPMP expected a high response rate from urban counties because the most extensive Idaho Master Gardener Programs are in these urban areas. The other one-third of the completed surveys came from 14 Idaho Master Gardener Programs that served a more rural (populations less than 40,000) clientele base (Figure 1). Though survey results did not represent all Idaho state counties, there was significant representation in Idaho's geographic areas; North, Southwest, South Central, and Southeast (Figure 1).

Figure 1. Location of urban and rural counties in Idaho where Master Gardeners participated in the survey



Note: Colors in Figure 1 differentiate the Idaho Master Gardener Programs in the following ways: (1) dark blue counties are an urban environment with populations greater than 40,000, (2) green counties are a rural environment with populations less than 40,000, and (3) yellow counties did not participate in the survey.

Over 51% of the Idaho Master Gardeners taking the survey had joined the Master Gardener program within the last three years. Conversely, 48% of the survey respondents have been associated with the program for four or more years. This distribution provided a favorable mix of experience levels. More than 70% of questioned Idaho Master Gardeners were female. UPMP expected this result because over 65% of trained Idaho Master Gardeners are female. Almost 75% of surveyed Master Gardeners were at least 60 years of age. Again, UPMP anticipated this because 75% of the trained Idaho Master Gardeners are over 60. The gender and age demographics indicate that the survey sample was representative of members participating in the Idaho Master Gardener training program.

General Findings

Table 1 shows the assessment of Master Gardeners' general plant-protection knowledge and skills. To measure the impact of volunteer responses, UPMP designated the percentage of agreement with survey statements with letter A, B, or C (column 3). For example, encouraging beneficial insects in the landscape or garden had a >98% agreement by Idaho Master Gardeners. This statement received letters A and B because the agreement was above 65% and 75%, respectively. Discussed in the following sections are the agreements with specific plant-protection statements. These survey results allow UPMP to identify successes and gaps in the training. In general, Idaho Master Gardeners have better than average skills in plant-protection training based on their survey responses.

Table 1. Idaho Master Gardener answers for plant-protection questions based on survey conducted in 2022

Statement	Yes	No	Relevance*	Sample Size
	—%—	—%—		Count
Recommend rotating plants to manage pests	93.2	6.8	A B	190
Read pesticide product label prior to purchase	96.4	3.6	A B	192
Read pesticide product label prior to application	96.9	3.1	A B	191
Understand pesticide labels are legally enforceable documents	90.3	9.6	A B	187
Wear required clothing for pesticide application	75.5	24.5	A B C	188
Rotate pesticides to reduce pesticide resistance	85.4	14.6	A B C	185

Understand reducing pesticide drift is important	99.0	1.0	A	B		191
Feel confident identifying a pest	62.0	38.0		B	C	187
Feel confident managing a pest	69.8	30.2		B	C	189
Feel confident in UI's pesticide policy	92.6	7.4	A	B		189
Use mulch to reduce weed infestations	87.4	12.6	A	B		190
Encourage beneficial insects in landscape/garden	98.4	1.6	A	B		192

Note: *Paper relevance: A = showing good general knowledge agreement exceeds 65%; B = showing excellent Master Gardener knowledge agreement exceeds 75%; C = showing training is adequate but needs improvement because agreement is less than 65%.

Knowledge of Integrated Pest Management

Since 1976, IPM has been a critical component in the training of the Idaho Master Gardener. The IPM program requires students to read the published Idaho Master Gardener Handbook (McCammon et al., 2019) Chapters 9, 11, and 14 discussing IPM science. These readings along with class presentations cover science-based approaches while using all available pest control methods. Other training opportunities include attending additional presentations, participating in hands-on activities, and engaging in hosted garden or landscape tours.

During local lectures, Idaho Master Gardeners received handouts, outlines, and publications to enhance their learning environment. Through the engaged activities, they gained applied knowledge by experimenting and experiencing the reviewed material. While attending hosted tours, the Idaho Master Gardeners have learned from productive gardens and landscapes that used IPM. The observance, use, and discussion of these resources enhance Master Gardeners' IPM knowledge and ability to deal effectively with pest problems.

Based on the Master Gardeners' answers to questions shown in Table 1, these students successfully acquired many of the skills stressed in the Idaho Master Gardener Program's learning objectives. These skills based on affirmative answers to survey questions include:

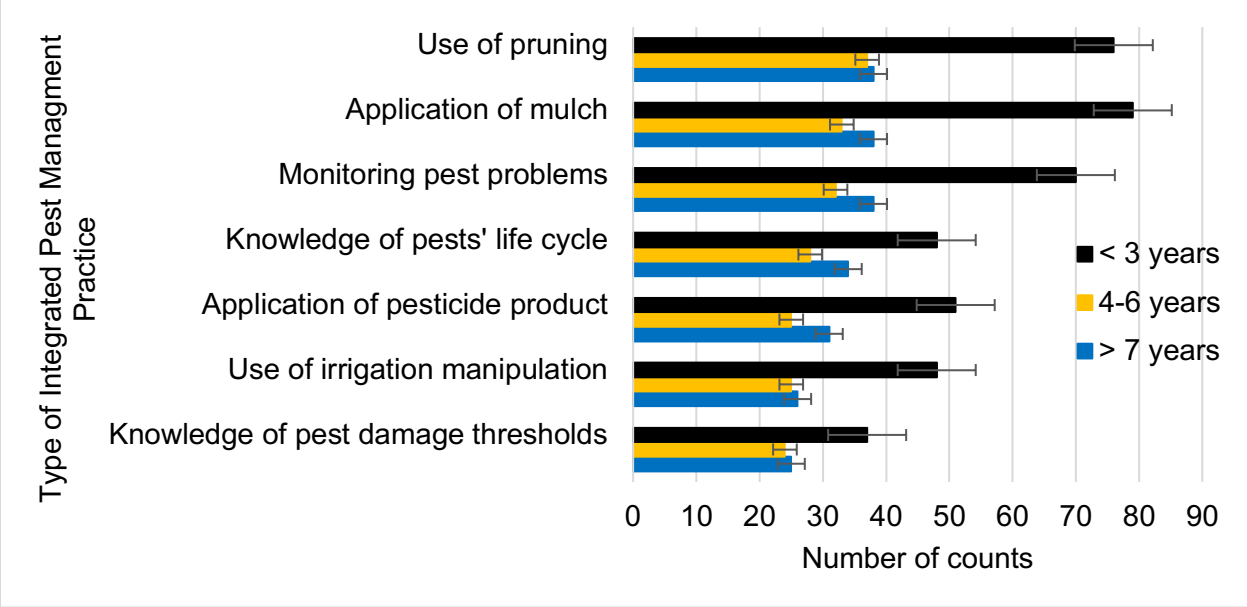
- Understanding that pesticide labels are legally enforceable documents (90.3%).
- Reading the pesticide product label prior to purchase (96.4%).
- Reading the pesticide product label prior to application (96.9%).
- Understanding that reducing pesticide drift is important (99.0%).

- Having confidence in the UI pesticide policy (92.6%).
- Encouraging beneficial insects in their home landscape or garden (98.4%).
- Using mulch to reduce weed infestations (87.4%).

These survey answers demonstrate that Idaho Master Gardeners learned IPM approaches to apply in their gardens and home landscapes. In addition, they learned essential research-based plant-protection practices they can disseminate to the public in their role as garden educators.

When the survey asked Idaho Master Gardeners to choose the IPM practices utilized in their own garden or landscape, the answers were varied but scientifically sound (Figure 2). For example, the application of mulch in the landscape or garden is an effective weed barrier (McCammon et al., 2019). Also, IPM practices mitigate landscape pests using consistent cycles of pest prevention and plant protection. The data indicate that Master Gardeners are confident with most of these practices (e.g., pruning and monitoring pest problems) and illustrate that plant-protection training and using pesticide products are two of several pest management tools. Idaho Master Gardener behaviors reflected in the survey data are consistent with educational efforts resulting in less chemical reliance and overuse, thereby reducing risk of developing pesticide resistance (R4P Network, 2016). Interestingly, the most recently trained Master Gardeners (one to three years in the program) are more likely to use the practices shown in Figure 2 than active Master Gardeners trained more than three years ago. This observation suggests that the Idaho Master Gardener Program should offer refresher training in IPM practices every three to five years for active Master Gardeners.

Figure 2. Idaho Master Gardener confidence in specific integrated pest management practices based on years of service



Idaho Master Gardeners believe that insects and weeds are the most common pest management problems they encounter (Figure 3). Most UI Extension educators would agree and consider weeds and insects to be the two major horticulture pest problems in Idaho and throughout the Pacific Northwest. To assess survey respondents' level of knowledge when dealing with these pests, UPMP asked Idaho Master Gardeners which type of control practices ─ conventional pesticides, organic pesticides, or biological organisms — they recommend for insect and weed management (Table 2).

Figure 3. Greatest pest problem identified by Idaho Master Gardeners based on urban status

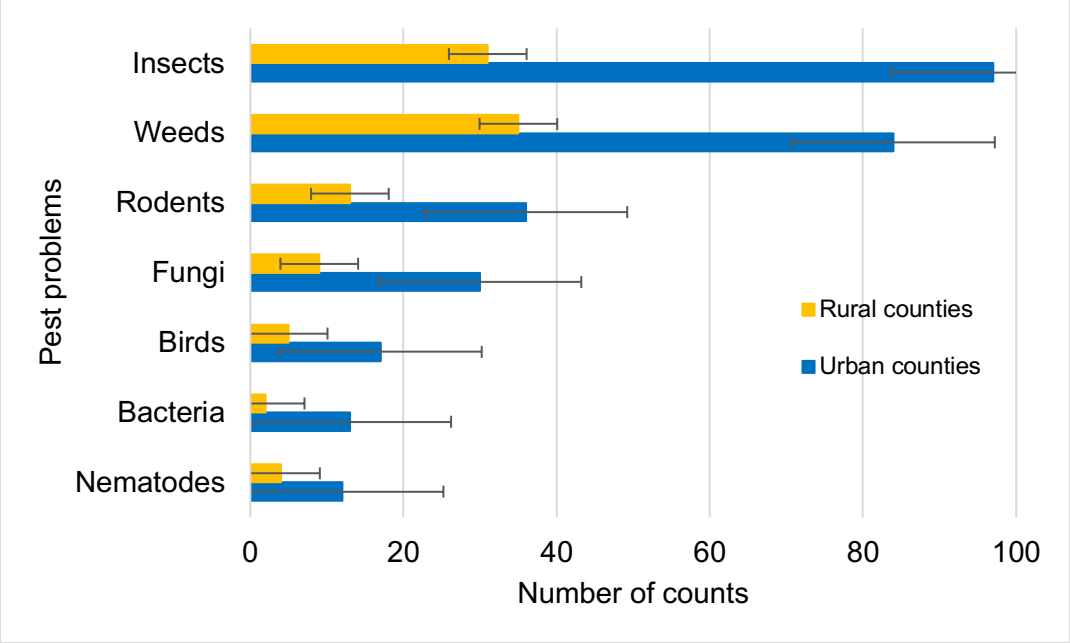


Table 2. Idaho Master Gardener recommendations for use of specific pest control practices

Recommendation	Pest Control Practice			
	Conventional Pesticides	Organic Pesticides	Biological Organisms	Traps
	%	%	%	%
Use these products to control insects	23.4	26.4	25.1	25.1
Use these products to control weeds	44.5	29.2	20.8	5.5

For insect management, Idaho Master Gardeners recommended each of the suggested control practices at about the same frequency (Table 2). They indicated that the best insect control starts with more straightforward methods and progresses to include all

types of control (McCammon et al., 2019). Based on survey results, most Idaho Master Gardeners understood the basics of these insect control strategies and the importance of IPM (McCammon et al., 2019).

Idaho Master Gardeners are more likely to lean on chemical control due to biological organisms' limited availability and success in managing weeds (Table 2). Master Gardener training emphasized that using a combination of control practices at different weed-growth stages is the most efficient and environmentally safe approach (McCammon et al., 2019).

The survey asked Master Gardeners to prioritize their garden or landscape management goals between plant protection and environmental stewardship. The survey responses indicated that Idaho Master Gardeners prioritized environmental stewardship over plant protection (Table 3). For example, personal responsibility to protect oneself and the environment is most important while handling and applying a pesticide product (McCammon et al., 2019). By choosing environmental stewardship as the higher priority, Idaho Master Gardeners take an active role in their garden or landscapes, which protects plants and the environment.

Table 3. Idaho Master Gardener priorities of using plant protection and environmental stewardship

Management Goals	Higher Priority	Lower Priority
	%	%
Plant Protection	24.8	75.2
Environmental Stewardship	50.3	49.7

Impacts of Length of Service and the Idaho Geography

The length of service of Idaho Master Gardeners impacted how they reacted to pest management considerations (Table 4). A chi-square (X^2) test of independence with a 95% level of confidence showed that there was a significant association between Idaho Master Gardeners with more than six years of experience and those with less experience through the following statements (Table 4):

1. Feel confident identifying a pest, $X^2(2, N=170) = 7.15$, $p = .03$
2. Feel confident managing a pest, $X^2(2, N=171) = 7.66$, $p = .02$

Table 4. The impact of Idaho Master Gardener length of service on agreement with the pest management statements

Statement	Length of Service Significance	Highest Agreement
Recommend rotating plants to manage pests	NS	
Read pesticide product label prior to purchase	NS	
Read pesticide product label prior to application	NS	

Wear required clothing for pesticide applications	NS	
Feel confident identifying a pest	$X^2(2, N=170) = 7.15, p=.03$**	> 6 years
Feel confident managing a pest	$X^2(2, N=171) = 7.66, p=.02$**	> 6 years
Feel confident in university's pesticide policy	NS	
Understand pesticide labels are legal documents	NS	
Rotate pesticides to reduce pesticide resistance	NS	

Note: NS = not significant, N = total number, ** significant at the 0.05 level, *p* = probability.

Table 5 shows the impact of geography on Idaho Master Gardeners' agreement with pest management statements. Refer to Figure 1 for the Idaho state map depicting the urban and rural counties. There is a significant association through a chi-square test of independence with a 95% confidence level between the geographical areas. Idaho Master Gardeners answered the following statements differently when they were from the North and Southwest Idaho areas compared to the South-Central and Southeast areas (Table 5):

1. Feel confident identifying a pest, $X^2(2, N=170) = 7.15, p = .03$
2. Feel confident managing a pest, $X^2(2, N=164) = 7.99, p = .02$

Table 5. The impact of Idaho Master Gardener urban status on agreement with the pest management statements

Statement	Region Significance	Highest Agreement
Recommend rotating plants to manage pests	NS	
Read pesticide product label prior to purchase	NS	
Read pesticide product label prior to application	NS	
Wear required clothing for pesticide application	NS	
Feel confident identifying a pest	$X^2(2, N=163) = 8.17, p = .02$**	North, Southwest
Feel confident managing a pest	$X^2(2, N=164) = 7.99, p = .02$**	North, Southwest
Feel confident in university's pesticide policy	NS	
Understand pesticide labels are legal documents	NS	
Rotate pesticides to reduce pesticide resistance	NS	

Note: NS = not significant, N = total number, ** significant at the 0.05 level, *p* = probability.

Conclusion

The three primary, central questions evaluated in this study indicated that the Idaho Master Gardener Programs provide adequate plant-protection training. In addition, Idaho Master Gardeners were engaged and demonstrated the plant-protection knowledge and skills required for program certification. The following are significant outcomes of this survey study:

- Idaho Master Gardeners with more than six years of experience were more likely

to be confident identifying and managing a pest. Data indicate that the Idaho Master Gardeners who continue with the program are valuable to the Master Gardener program, as their confidence and abilities grow with experience.

- Idaho Master Gardeners in the North and Southwest areas of Idaho were more likely to be confident in both identifying and managing a pest than those in South-Central and Southeast Idaho. The conclusion of this observation is that the UI Extension UPMP should tailor plant-protection programming and training for the different regions of the state.

- Idaho Master Gardeners use research-based information for their plant-protection recommendations. Over 93% of Idaho Master Gardeners recommend rotating plants to manage pests and recommend various practices to control the identified pest problems. This combination of control practices is an effective and environmentally safe approach to pest management.

- Idaho Master Gardeners have confidence in the UI pesticide policy. Over 92% of the respondents agreed that this policy provides practical guidelines on providing pesticide recommendations to the public. In addition, the survey results indicate that Idaho Master Gardeners recognize the importance of utilizing research-based information when dealing with plant pests.

- Idaho Master Gardeners prioritized environmental stewardship over plant protection. This observation demonstrates that Idaho Master Gardeners value stewardship when representing the Idaho Master Gardener Program.

- Only 62% of Idaho Master Gardeners are confident in identifying a pest. To improve confidence in pest identification training, the UI Extension UPMP should develop identification keys for the top 25 insect and weed problems for gardeners and homeowners in Idaho.

- UI Extension UPMP could improve the Idaho Master Gardener Program by developing study guides to identify Idaho's significant garden and landscape pests – a result shown by survey data as a major shortcoming.
- UI Extension UPMP could improve the survey for future assessment by keeping questions direct, ensuring the questions refer to the program goals and learning objectives.

Acknowledgments

We would like to acknowledge the University of Idaho Extension educators and staff members who provided advice and participated in the distribution of this survey. We appreciate the outstanding statistical expertise provided by Dr. William Price.

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Appendix

The survey questions for the plant-protection section were as follows:

Part I. Answer yes or no to the following statements:

1. I rotate plants to manage pests.
2. I recommend rotating plants to manage pests.
3. When a pesticide treatment is needed, I hire a professional applicator.
4. Before making a pesticide application, I read the product label.
5. Before purchasing any pesticide product, I read the product label.
6. When applying a pesticide product, I always wear the minimum clothing required.
7. As a Master Gardener, I feel confident identifying a pest.
8. As a Master Gardener, I feel confident managing a pest.
9. As a Master Gardener, I feel confident in the University of Idaho's pesticide policy.
10. In my landscape/garden, I use mulch to reduce weed infestations.
11. In my landscape/garden, I use fabric row covers to reduce insect infestations.
12. In my landscape/garden, if I have a weed infestation, I use herbicides to control weeds throughout the entire landscape/garden.
13. In my landscape/garden, if I have an insect infestation, I use insecticides to control insects in the entire landscape/garden.

Part II. Choose true or false for the following statements:

14. Pesticide product labels are legally enforceable documents.
15. Rotating pesticide products will reduce pesticide resistance.
16. Using genetically modified organisms to manage pests is acceptable to me.
17. According to science-based research, glyphosate does not cause cancer.
18. Certified organic pesticides are less toxic than synthetic pesticides.
19. I understand that pesticide drift is when chemicals move away from the intended target.

Part III. Choose whether you agree or disagree with the following statements:

20. I encourage beneficial insects in my landscape/garden.
21. Reducing pesticide drift is important to me.

Part IV. Tell us about your personal use of pesticide products. Choose all that apply. Choices: conventional pesticides, organically approved pesticides, biological organisms, or traps.

22. I use these products to control insects in my landscape/garden.
23. I use these products to control weeds in my landscape/garden.
24. I use these products to control fungi in my landscape/garden.

Part V. Tell us about the pesticide product information you provide to community members. Choose all that apply. Choices: conventional pesticides, organically approved pesticides, biological organisms, or traps.

25. I recommend the use of these products to control insects in their landscape/garden.
26. I recommend the use of these products to control weeds in their landscape/garden.
27. I recommend the use of these products to control fungi in their landscape/garden.

Part VI. Choose all the types of pest control that apply.

28. As a Master Gardener, I am confident with which of the following integrated pest management practices?

    - Knowledge of pests' life cycle.
    - Knowledge of pest damage thresholds.
    - Regular pest monitoring.
    - Use of irrigation manipulation.
    - Use of pruning.
    - Application of mulch.
    - Applications of pesticide products.

29. My most difficult to manage pest(s) is (are):

    - bacteria.
    - birds.
    - fungi.
    - insects.
    - nematodes.
    - rodents.
    - weeds.

Templates and Tools

Acronyms Related to Pesticide Safety Education

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Abstract

Acronyms are abbreviations designed to make communication more efficient amongst members of a professional discipline. Unfortunately, the volume of acronyms in the field of pesticide safety can feel overwhelming to new educators trying to learn the various aspects of their new job. This document was compiled to be a “cheat sheet” to help novice educators translate common acronyms they will encounter.

Keywords: abbreviations, acronyms, definitions, glossary, pesticide educators

Acronyms are a literary device to make communication of complex terms or titles more efficient. Every professional discipline develops acronyms that become part of the lexicon of its members. Since acronyms are tied to a professional subculture, they can be quite confusing to the uninitiated and to novices entering the profession. We compiled the following list of acronyms and their definitions to help novice pesticide educators translate, and ultimately incorporate, these acronyms into their vocabulary.

The acronyms are organized into three main domains that comprise the source or usage of the acronym. They are listed alphabetically within each domain. The first domain consists of agencies found within the federal government of the United States, with special attention to the Environmental Protection Agency (EPA). While acronyms sourced from non-U.S. locales could have been added, our focus was on making a document useful for pesticide educators within the United States. The second domain of acronyms consists of nonfederal organizations associated with pesticides and/or safety education. The final domain comprises terms related to pesticides, pesticide testing, and key legislation that regulates pesticides.

With the volume of new pesticide educators entering the profession coupled with the number of expected retirements, we would encourage seasoned educators to add this document to their new employee packets. We are confident that the new educator will appreciate the assistance it will provide.

EPA and Other Federal Agencies

AAPCC American Association of Poison Control Centers

APHIS Animal and Plant Health Inspection Service (USDA)

CDC Centers for Disease Control and Prevention (Department of Health and Human Services)

ChemSAC Chemical Science Advisory Council (EPA)

FDA	Food and Drug Administration
HED	Health Effects Division (EPA)
IDS	Incident Data System (EPA)
IR-4	Interregional Research Project No. 4 (USDA minor use program)
NIOSH	National Institute for Occupational Safety and Health
NWRC	National Wildlife Research Center (Fort Collins, CO)
OECA	Office of Enforcement and Compliance Assurance (EPA)
OPP	Office of Pesticide Programs (EPA)
PESP	Pesticide Environmental Stewardship Program (EPA)
PRD	Pesticide Re-Evaluation Division (EPA)
ROCKS	Residues of Concern Knowledge Base Subcommittee (EPA)
USDA	United States Department of Agriculture
USDA-OPMP	USDA Office of Pest Management Policy
USGS	United States Geological Survey
WS	Wildlife Services (USDA)

Nonfederal Organizations

AAPCO	Association of American Pesticide Control Officials (states, tribes, and territories)
AAPSE	American Association of Pesticide Safety Educators
ACPA	American Crop Protection Association (aka CropLife America)
AFBF	American Farm Bureau Federation
AFOP	Association of Farmworker Opportunity Programs
ASPCRO	Association of Structural Pest Control Regulatory Officials (states)
CLA	CropLife America
CTAG	Certification and Training Assessment Group
FAO/WHO	Food and Agriculture Organization/World Health Organization
NAAA	National Agricultural Aviation Association
NASDA	National Association of State Departments of Agriculture
NPIC	National Pesticide Information Center
NPMA	National Pest Management Association (pest control industry)
NPSEC	National Pesticide Safety Education Center

PACT	Pesticide Applicator Certification and Training
PERC	Pesticide Educational Resources Collaborative
PIPs	plant incorporated protectants
PIRT	Pesticide Inspector Residential Training
PPLS	Pesticide Product Label System
PREP	Pesticide Regulatory Education Program
PRIA	Pesticide Registration Improvement Act
PSEP	Pesticide Safety Education Program (land grant universities)
RISE	Responsible Industry for a Sound Environment (registrants)
SFIREG	State FIFRA Issues Research and Evaluation Group (AAPCO)
TPPC	Tribal Pesticide Program Council
TPSA	The Pesticide Stewardship Alliance

General Terms

ADA	Americans with Disabilities Act
ADI	acceptable daily intake (defunct term for reference dose (RfD)
a.i.	active ingredient
ALD	approximate lethal dose
C&T	certification and training
CBI	confidential business information
CFR	Code of Federal Regulations
CNS	central nervous system
CWA	Clean Water Act
DRA	draft risk assessment
DT	degradation time
DWEL	drinking water equivalent level
ED	effective dose
EEC	estimated environmental concentration
EIS	environmental impact statement
EP	end-use product
ESA	Endangered Species Act
EUP	Experimental Use Permit
FFDCA	Federal Food, Drug, and Cosmetic Act

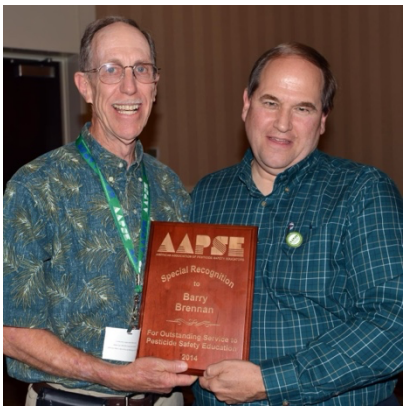
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FOIA	Freedom of Information Act
FQPA	Food Quality Protection Act
GHS	Globally Harmonized System of Classification and Labeling of Chemicals
GMO	genetically modified organism
GRAS	generally recognized as safe (as designated by FDA)
HA	health advisory
HDT	highest dose tested
HHRA	human health risk assessment
IPM	integrated pest management
LC_{50}	average lethal concentration
LD_{50}	average lethal dose
LD_{lo}	lethal dose-low (lowest dose at which death occurs)
LFP	lethal feeding period
LLD	lowest lethal dose
LOC	level of concern
LOD	limit of detection
LOEL	lowest observed effect level
LOQ	limit of quantification
MATC	maximum acceptable toxicant concentration
MCL	maximum contaminant level (Safe Drinking Water Act standard)
MCLG	maximum contaminant level goal (used by EPA to regulate drinking water contaminants)
MLD	median lethal dose
MLOD	minimum limit of detection
MOA	memorandum of agreement
MOE	margin of exposure
MOU	memorandum of understanding
MRID	master record identification (number)
MRL	maximum residue limit (international equivalent of a U.S. tolerance)
MTD	minimum toxic dose
NAFTA	North American Free Trade Agreement

NOAEC	no observed adverse effect concentration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	no observed effect level
NPDES	National Pollutant Discharge Elimination System
OP	organophosphate
PADI	provisional acceptable daily intake
PAG	pesticide assessment guidelines
PAM	Pesticide Analytical Manual
PHED	Pesticide Handler Exposure Database
PHI	preharvest interval
PID	proposed interim decision
ppb	parts per billion
PPE	personal protective equipment
PRN	pesticide registration notice
RED	reregistration eligibility decision
RfD	reference dose
RS	registration standard
RUP	restricted-use pesticide
SLA	state lead agency
SLITS	State Labeling Information Tracking System
SLN	special local need
TC	toxic concentration
T&E	threatened and endangered species
TEP	typical end-use product
TGAI	technical grade active ingredient
TLV	threshold limit value
TMRC	theoretical maximum residue contribution
WOE	weight of evidence
WP	wettable powder
WPS	Agricultural Worker Protection Standard

Commentary – AAPSE Legacies and History

Michael J. Weaver, Professor Emeritus & Former Director of Virginia Tech Pesticide Programs, Virginia Tech, Department of Entomology, Blacksburg, VA, mweaver@vt.edu

Life Member - Tribute – Barry Michael Brennan



Barry Brennan (left) with AAPSE President Mike Weaver at 2014 AAPSE National Workshop in Harrisburg, PA. Barry was awarded special recognition for his years of service to AAPSE, including his most recent service as JPSE Associate Editor.

Cherished Friend, Colleague, Mentor

Described by many as the "**father of the American Association of Pesticide Safety Educators (AAPSE),**" Dr. Barry Brennan was one of the early founders of the organization. Had it not been for Barry, the organization might not exist today. He was the catalyst that started AAPSE. Barry along with his colleagues started the discussion to form a pesticide safety educator organization in 1991. That year a charter was drafted to establish the precursor to AAPSE -- the National Association of Pesticide Educators (NAPE). AAPSE became a reality officially in 1993 - members signed the second charter in a New Orleans PACT workshop.

Barry and Mike Weaver came up with the idea of AAPSE hosting an academic journal. The Journal of Pesticide Safety Education (JPSE) was first published in 1999.

Dr. Brennan served in multiple leadership roles, including president. Barry's leadership will forever be known as a significant contribution to pesticide safety education.

- AAPSE President's Award (2018)
- Associate Editor of JPSE (2009-14)
- AAPSE Special Recognition (2014, 2001, 1999, 1997)
- AAPSE Life Member (2009)
- AAPSE Fellow (2005)
- Immediate Past President - 1999-2001
- AAPSE President – 1997-99
- President-Elect - 1995-97
- AAPSE Charter Officer, Member – 1993-1997
- AAPSE Founder (1991,1993)
- Multiple committee chair and memberships, JPSE author, reviewer, editor

Dr. Barry Michael Brennan was born April 20, 1944.

Barry served in the Army for 20 years, including in Thailand from 1970 to 1972, where several lifelong friendships were forged. His connections served AAPSE well. Part of our national workshop in Honolulu in 1999 was hosted at a military hotel on Waikiki Beach. Barry was instrumental in that location serving the organization.

Dr. Brennan had a long and illustrious career in the College of Tropical Agriculture and Human Resources (CTAHR) at the University of Hawaii at Mānoa. Barry came to Hawaii in 1967 after graduating with his bachelor's degree in zoology from Arizona State University. He studied in the University of Hawaii entomology department (now part of the Department of Plant and Environmental Protection Sciences), earning his master's degree in 1969 and Ph.D. in 1975.

Barry Brennan was the University of Hawaii's pesticide coordinator and the pesticide applicator training coordinator from 1976 until 2001. He was a member of and chaired the Department of Environmental Biochemistry. He took leave from August 1997 to January 1999 to work in Washington, D.C., as associate national program leader for pesticide applicator training for the USDA/CSRS. His connections there helped AAPSE and his colleagues. Barry was an excellent ambassador for the program. He was appointed as CTAHR associate dean and associate director for Cooperative Extension for three years prior to his retirement in 2004. Barry also spent years in the Army Reserves.

In 2001, Brennan served as the principal investigator (PI) for a Western Region IPM Center grant (American Pacific Pest Management Information Program). Pest management issues are often unique to this region because of its crops, cropping systems, environmental conditions, and pests. Regulatory decisions affecting crop production practices can have a major impact on minor crop production as is found in the Pacific. The American Pacific Pest Management Information Network allowed stakeholders to respond to federal regulations that affect use and usage of pesticides.

He was the co-PI (along with Lee Yudin) of the 1994 train-the-trainer project. From 2003 to 2006 Brennan served on the Western Region IPM Center Steering and Advisory committees. He obtained funding from Tropical and Subtropical Agriculture Research (T-STAR) program to conduct Pest Management Strategic Plans (banana, papaya, coffee) and crop profiles (banana, taro, coffee, pineapple, watercress) for several crops grown in the Pacific.

Brennan also served as the lead editor of the book *Hawaii's College of Tropical Agriculture and Human Resources: Celebrating the First 100 Years*. He and his wife, Barbara, endowed a fund within the UH Foundation to support the agrosecurity program.

In retirement, Barry remained active in his college as an emeritus professor. As a colleague, he took pride in his work. He was known as a hardworking person and came to work regularly after his retirement, devoting his time to ensure the college's sustainability for as long as he could contribute. Barry will be remembered most for his kindness, patience, sense of humor, philosophical conversations, and quiet demeanor. He was always deeply grateful for the love shared by family and friends.

In 2019, he was recognized as the CTAHR Outstanding Alumnus.

Barry Brennan passed away at home in the early morning of January 27, 2021. He is survived by his wife, Barbara; daughter Kathleen; son Brian (Aileen); grandsons Kainoa and Kenji; brothers Pat (Mary Anne) and Mike (Cindy); and sisters Sheila Titus (Steve) and Bonnie Puckett.

Statement by AAPSE President Mike Weaver upon presenting Barry with the 2014 Recognition Award for his many contributions to the organization and its journal

"Barry Brennan is one of those people who has served AAPSE in practically every way possible. One of AAPSE's founders, early presidents, fellow, and leader of practically every aspect of the organization, Barry retired in 2009. At least we think he did. At the time, we were able to convince him to serve as associate editor of the Journal of Pesticide Safety Education. Barry has contributed to JPSE as an author, reviewer, editor, and founder. His other career involved his service as PSEP coordinator, and later, an Extension administrator at the University of Hawaii, Mānoa. After years of distinguished service, Barry has passed the baton as associate editor to Fred Whitford. The role of associate editor is the most demanding job associated with JPSE. This editor must clock in all the submissions; work with the authors, reviewers, and other editors; read each manuscript; and provide feedback at every step in the review and editorial process. It is a very consuming job. Barry did it well and yet took a great deal of flak from authors and reviewers in trying to do his job. Being the patient and congenial person that he is, the process worked very well. The number of articles submitted to the journal during his tenure has risen significantly, in no small part because Barry has promoted the journal and made the editorial process flow. With Barry's retirement from the journal board, Fred is going to have to fill some mighty big shoes. It was Barry who convinced Fred to replace him. In doing so, Barry put JPSE in very good hands. With this recognition, AAPSE thanks Barry for his dedication to and hard work for the organization through his most recent support of JPSE, the AAPSE anniversary in 2011, and working with the AAPSE Board to organize this year's national workshop."

References

Barry Michael Brennan. Obituary. Star Advertiser, Honolulu, HI
https://obits.staradvertiser.com/2021/03/07/dr-barry-michael-brennan-07032021/

Hawaii Cooperative Extension Turf Management - Barry and Barbara Brennan Agrosecurity Endowment-Fund #204-6640-3. To support educational programs and recognition awards for turfgrass managers, groundskeepers and landscapers. Support projects and programs to manage turfgrass pests.
https://giving.uhfoundation.org/funds/20466403