Self-Reported Pesticide Label Use Behaviors of Ohio Certified Private Pesticide Applicators

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Abstract

Use of the pesticide label is intrinsic to safe and effective use of pesticide. A descriptive study of Ohio Certified Private Pesticide Applicators was conducted to measure the reported use of 11 label components, safety equipment used while mixing and loading pesticides and pesticides applied when growing corn and soybeans. Private applicators read the pesticide label at the beginning of the pesticide application season, if not more often. About 77 percent of survey respondents reported wearing chemical-resistant gloves when loading or mixing pesticides. Respondents most often used glyphosate and atrazine products.

Keywords: private, applicator, label, Ohio, safety, equipment, survey, PPE

Introduction

Pesticides are essential elements in modern agricultural production (Pope, Brown & Ellerhoff, 1998; Ozkan, 1992,) and are widely used in Ohio. Approximately 97 percent of Ohio's 3.5 million acres of corn and 4.4 million acres of soybeans received a pesticide (herbicide) application in 2005 (National Agricultural Statistics Service, 2006). Herbicides constitute the largest category (97.5 percent) of agricultural pesticides used by Ohio farmers (National Agricultural Statistics Service, 2006). Insecticides, the other major class of pesticides used in corn and soybean production in Ohio, constitute only 2.5 percent of total pesticide usage (National Agricultural Statistics Service, 2006).

It is imperative that pesticide applicators read and follow pesticide label directions in order to minimize the health and environmental risks associated with pesticide use (Fishel & Andre, 2001; Prochaska, 1993).

Agricultural extension personnel in Ohio expend large amounts of time and money on pesticide training, including sessions on interpreting and understanding pesticide labels (Waldron, 1991). This study provides educators and regulators with data on the use of pesticide label information and personal protective equipment (PPE) in a population growing corn and soybeans. The data can serve as a benchmark for measuring changes in applicator use behaviors related to pesticide labels and PPE that may be related to changes in educational programs or regulations.

Purpose and Objectives

The purpose of this study is to describe the reported pesticide label use, safety equipment behaviors and primary pesticides used by Ohio Certified Private Pesticide Applicators (OCPPA) when growing corn and soybeans; this study refers to members of this group as “respondents”. The target population of the study consisted of Ohio respondents growing corn and soybeans who were eligible to be recertified in 2005. A descriptive correlational study was

conducted to obtain reliable and valid information on pesticide label use and safety equipment use behaviors of respondents and the most common herbicides applied to corn and soybeans. The results of this study may be useful to educators and regulatory officials in planning future pesticide training events, as well as in evaluating current pesticide laws and regulations governing pesticide use.

Objectives of the study included:

1. Description of respondents' label use
2. Description of respondents' safety equipment use
3. Description of herbicides used by respondents in corn and soybean production.

Methods

A valid and reliable survey instrument was developed for an earlier study of respondents. This instrument, with very slight modifications, was used to obtain the pesticide label, herbicides and safety equipment use practices of respondents (Prochaska, 1993). A major part of the instrument was the description of respondents' pesticide label use. As such, the variable, "*_read pesticide label_"* was an 11-item measure of respondents pesticide label use. The following pesticide label adherence components were used in this measure:

- personal protective equipment instructions
- signal word; environmental hazards
- container disposal
- application use rates
- directions for tank mixes
- crop rotation
- emergency medical treatment
- pesticide storage
- field entry intervals
- pests controlled

Six responses were possible for each pesticide label item:

- I typically don't
- Only when I have an emergency
- When I am using a pesticide for the first time
- At the beginning of the season
- I usually read this part each time I use a pesticide
- I always read this part each time I use a pesticide

A frequency distribution, mean and standard deviation were calculated for each pesticide label component. In a review of the literature on the computation of a mean and standard deviation for the above data, which assumes interval data with the ordinal Likert scale items, Jaccard and Wan (1996) summarize, "…for many statistical tests, rather severe departures (to the assumption of interval from ordinal) do not seem to affect Type I and Type II errors dramatically." Further, Adams, Fagot and Robinson (1965) have suggested that statistical operations used on different levels of measurement are not right or wrong but are relative to the conclusions made about them. Conclusions drawn should be stable under transformation of the underlying scale.

Extension agricultural educators administered the survey instrument at county-level pesticide recertification sessions. Data were collected during the first three months of 2005 using a modified random cluster sampling approach. Counties were the sampling unit. However, because some counties offered only multi-county programs, or did not offer training due to the small number of applicators in the county, counties from a random cluster sample were initially selected then additional counties were added to obtain an adequate sample size. With the total private applicator population being slightly less than 20,000, a sample of sufficient size (297) was used to provide a 0.95 confidence interval for the population parameter with a sampling error of plus or minus seven percent.

The sampling frame of Ohio certified private pesticide applicators is maintained by the Ohio Department of Agriculture. Only corn and soybean pesticide applicators responded to the survey. Completion of the survey instrument was completely voluntary and the Ohio State University Human Subjects Research Review Board approved the study.

Non-response error can bias study results. To address this potential error, herbicide usage data on corn and soybeans, maintained by the United States Department of Agriculture for Ohio, was examined. Survey respondents over this key characteristic were similar to the Ohio farm population. Also, early responders were compared to late responders and were also found to be similar over this general population characteristic. Results of this study may be generalized to Ohio certified respondents growing corn and soybeans.

Results

Pesticide Label Use by Respondents

Frequency distributions were used to describe the pesticide label use of survey respondents. Each table represents the use of one of the 11 pesticide label components. The data in the frequency tables represents the number of respondents replying to the label component.

Most survey respondents read pesticide label components when a pesticide is initially used, if not more often. However, there are differences in how often each label component is used. When looking at the use of PPE (Table 1), 62 percent of respondents reported using label PPE information the first time the pesticide was used or at the beginning of the season, while 34 percent of respondents usually or always read this part of the label when a pesticide was used. Only 4 percent of respondents did not read PPE label information.

Environmental hazards label information (Table 2) was reviewed by 98.5 percent of respondents the first time a pesticide product was used or more often. Container disposal information was not used by 9.1 percent of respondents; but more than 90 percent of respondents do use this pesticide label component the first time a pesticide is used, or more often (Table 3). Application use rates (Table 4) and directions for tank mixes (Table 5) label component information were used on a regular basis more than all other label components, with 70.4 and 59.7 percent of respondents respectively usually or always reading these label components. No respondents reported not using these label components. In regards to crop rotation restrictions

(Table 6) and pests controlled information (Table 10), 96.5 percent and 99.0 percent of respondents respectively review this component the first time a pesticide is used, or more often.

Emergency medical treatment information (Table 7) on the pesticide label is used by almost 80 percent of respondents the first time a pesticide is used, or more often.

Pesticide storage information (Table 8) on the label was not used by 6.6 percent of respondents, with 93.7 percent reviewing this during an emergency or more often. Field re-entry interval (Table 9) label information was used by 95.5 percent of respondents the first time a pesticide was used, or more often. Only 3.5 percent respondents did not use this label component.

The signal word (Table 11) label usage information was accessed by 93.8 percent of respondents when a pesticide was initially used or more often.

Safety Equipment Worn By Respondents

This variable measured the use of different clothing and safety equipment worn by respondents when mixing and loading pesticides (Table 12). More than 76.9 percent listed using chemical-resistant gloves when loading or mixing pesticides. Another 8.3 percent indicated they wore leather or canvas gloves when loading or mixing pesticides. A long-sleeved shirt was listed as being worn when mixing or loading pesticides by 62.9 percent of respondents. Jeans were worn by 80.3 percent of respondents and cotton overall and disposable coveralls were worn by 13.5 percent of respondents when working with pesticides.

Goggles or a face shield were listed as being worn by nearly 40.6 percent of respondents. Rubber boots were listed as being worn by 17.2 percent of respondents during mixing and loading operations. Respirators were worn by 15.3 percent of respondents when pesticides were mixed or loaded. The predominant headwear worn by respondents was a baseball-style cap (65.5 percent).

The label-required PPE of two representative herbicides (by survey data) of the active ingredients of the dominant pesticides (Table 13) used by respondents show the following:

- Roundup WeatherMax (EPA Reg. 524-537): Wear long-sleeved shirt, long pants, shoes, socks, and chemical-resistant gloves (such as polyvinyl) when handling concentrate. Certain glyphosate products also mandate goggle usage.

Since, only 76.9 percent of respondents reported wearing chemical-resistant gloves when loading or mixing pesticides, it is probable that not all PPE requirements are being met by private applicators when glyphosate products are mixed or applied.

- Harness Xtra 5.6L (EPA Reg. 524-485): Wear long-sleeved shirt, long pants, shoes, socks, chemical-resistant apron and chemical-resistant gloves (such as polyvinyl) when handling concentrate.

Since only 9.2 percent of respondents report using a chemical-resistant apron and it is a PPE requirement of Harness Xtra (atrazine and atrazine mixes constitute the most common corn herbicides used), it is highly likely that respondents are not wearing all

prescribed safety equipment when using this pesticide. It should be noted that there is some variation among atrazine products and the PPE required by each label; some labels require chemical-resistant aprons while others list mandatory use of protective eye-ware.

Conclusions and Implications

The pesticide label was segmented into 11 components or use areas on which survey respondents reported usage. To analyze the data for this 11-component measure, a mean was calculated for each case (Table 14). Analysis of the pesticide label over the 11 components was also conducted via summation of the components and the calculation of a grand mean of 4.27 and a standard deviation of .90 for the sample (Table 14). The mean value of 4.27 indicates that respondents are primarily reading the pesticide label at the beginning of the season. A 1992 study in Ohio also found that certified private applicators primarily read the pesticide label at the beginning of the season (Prochaska & Noland, 1998).

The data show that private applicators read some components of the pesticide label more often than others. Application use rates, directions for tank mixes and pests controlled label components were more often used each time a pesticide was used (see Tables 4, 5 and 10). This conclusion follows well, considering the following information: 1) 97 percent of agricultural pesticides used are herbicides, 2) glyphosate and atrazine pesticide products constitute the largest percentages of materials applied on corn and soybeans respectively, 3) glyphosate is often tank-mixed with other herbicides in both corn and soybean production, 4) multiple applications of glyphosate (using different rates and tank mix partners) are commonly made in Ohio corn and soybean production systems (for example: burn-down, early post-emergence, late post-emergence and fall treatment of winter annual weeds are all possible herbicide applications under certain tillage and weed scenarios). With multiple applications being made, changing label use rates and tank mix information and different pests (weeds) controlled, these label sections would likely be consulted more often. All other label components were generally reviewed at the beginning of the season. The information associated with these components would be stable over multiple usages of individual pesticides. Only 76.9 percent of respondents report using chemical-resistant gloves while mixing and loading pesticides. All other PPE was used less often. Respondents are not presently using all label-prescribed safety equipment for the predominate pesticides used in corn and soybean production. State and federal laws mandate the use of label-prescribed PPE. While the need to use, safety equipment when applying pesticides has been taught at Extension training sessions, this practice has not been fully implemented by private applicators. The question is this: Should training methods and/or regulations be changed to encourage greater PPE usage? Outcomes might include additional training exercises, redesigned training exercises, further regulation, or better labels.

We as educators should re-examine our methods in regard to teaching PPE usage to applicators. This conclusion is further buttressed by the data in that 96 percent of respondents reported using PPE label component information the first

time a pesticide was used or more often. Thus, awareness of label safety equipment mandates appears not to be an issue in the lack of PPE use by respondents. Even though respondents are reporting high levels of reading **this individual label component**, actual use of PPE at high levels does not always follow, which also suggests the need for further study into the attitude towards or barriers to PPE usage by this population to explain PPE usage by private applicators.

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Table 1. Respondents' Use of Pesticide Label Component Personal Protective Equipment (PPE) Instructions.

	Frequency	Percent
I typically don't	8	4
Only when I have an emergency	0	0
When I am using a pesticide for the first time	65	32.5
At the beginning of the season	59	29.5
I usually read this part each time I use a pesticide	38	19.0
I always read this part each time I use a pesticide	30	15.0
Total	200	100%

Table 2. Respondents' Use of Pesticide Label Component Environmental Hazards.

	Frequency	Percent
I typically don't	1	0.5
Only when I have an emergency	2	1.0
When I am using a pesticide for the first time	64	32.3
At the beginning of the season	75	37.9
I usually read this part each time I use a pesticide	26	13.1
I always read this part each time I use a pesticide	30	15.2
Total	198	100

Table 3. Respondents' Use of Pesticide Label Component Container Disposal.

	Frequency	Percent
I typically don't	18	9.1
Only when I have an emergency	0	0
When I am using a pesticide for the first time	52	26.3
At the beginning of the season	69	34.8
I usually read this part each time I use a pesticide	28	14.1
I always read this part each time I use a pesticide	31	10.4
Total	198	100

Table 4. Respondents' Use of Pesticide Label Component Application Use Rates.

	Frequency	Percent
I typically don't	0	0
Only when I have an emergency	0	0
When I am using a pesticide for the first time	14	7.0
At the beginning of the season	45	22.6
I usually read this part each time I use a pesticide	69	34.7
I always read this part each time I use a pesticide	71	35.7
Total	199	100

Table 5. Respondents' Use of Pesticide Label Component Directions for Tank Mixes.

	Frequency	Percent
I typically don't	0	0
Only when I have an emergency	0	0
When I am using a pesticide for the first time	30	14.9
At the beginning of the season	51	25.4
I usually read this part each time I use a pesticide	54	26.9
I always read this part each time I use a pesticide	66	32.8
Total	201	100

Table 6. Respondents' Use of Pesticide Label Component Crop Rotation Restrictions.

	Frequency	Percent
I typically don't	6	3.0
Only when I have an emergency	1	0.5
When I am using a pesticide for the first time	41	20.5
At the beginning of the season	62	31.0
I usually read this part each time I use a pesticide	42	21.0
I always read this part each time I use a pesticide	48	24.0
Total	200	100

Table 7. Respondents' Use of Pesticide Label Component Emergency Medical Treatment.

	Frequency	Percent
I typically don't	5	2.5
Only when I have an emergency	35	17.6
When I am using a pesticide for the first time	38	19.1
At the beginning of the season	67	33.7
I usually read this part each time I use a pesticide	30	15.1
I always read this part each time I use a pesticide	24	12.1
Total	199	100

Table 8. Respondents' Use of Pesticide Label Component Pesticide Storage Instructions.

	Frequency	Percent
I typically don't	13	6.6
Only when I have an emergency	3	1.5
When I am using a pesticide for the first time	58	29.3
At the beginning of the season	78	39.4
I usually read this part each time I use a pesticide	28	14.1
I always read this part each time I use a pesticide	18	9.1
Total	198	100

Table 9. Respondents' Use of Pesticide Label Component Field Re-entry Intervals.

	Frequency	Percent
I typically don't	7	3.5
Only when I have an emergency	2	1.0
When I am using a pesticide for the first time	47	23.7
At the beginning of the season	59	29.8
I usually read this part each time I use a pesticide	41	20.7
I always read this part each time I use a pesticide	42	21.2
Total	198	100

Table 10. Respondents' Use of Pesticide Label Component Pests Controlled (Weeds, Insects, Disease, etc).

	Frequency	Percent
I typically don't	2	1.0
Only when I have an emergency	0	0
When I am using a pesticide for the first time	34	17.3
At the beginning of the season	64	32.7
I usually read this part each time I use a pesticide	46	23.5
I always read this part each time I use a pesticide	50	25.5
Total	196	100

Table 11. Respondents' Use of Pesticide Label Component Signal Work to Ascertain General Toxicity.

	Frequency	Percent
I typically don't	6	3.1
Only when I have an emergency	6	3.1
When I am using a pesticide for the first time	49	25.1
At the beginning of the season	53	27.2
I usually read this part each time I use a pesticide	40	20.5
I always read this part each time I use a pesticide	41	21.0
Total	195	100

Table 12. Clothing Worn by Respondents' While Mixing and Loading Pesticides.

Clothing or Safety Equipment	Frequency	Percent of OCPPA	N
Chemical resistant gloves (nitrile or butyl)	176	76.9	229
Leather or canvas gloves	19	8.3	229
Long sleeved shirt	144	62.9	229
Chemically resistant apron	21	9.2	229
Jeans/work trousers	184	80.3	229
Disposable coveralls	31	13.5	229
Baseball-style cap	150	65.5	229
Goggles or face shield	93	40.6	229
Rubber boots	39	17.2	229
Respirator	35	15.3	229

Table 13. Primary Herbicides Used by Respondents.

Crop	Herbicide	Frequency	Percentage	N
Corn	Atrazine or Atrazine Mix	114	74	154
Soybeans	Glyphosate or Glyphosate Mix	149	83	179

Table 14. Mean and Standard Deviation by Label Component.

Label Component	Mean	STD	N
PPE	4.05	1.2	200
Environmental Hazards	4.08	1.1	198
Container Disposal	3.92	1.4	198
Application Use Rates	4.99	.93	199
Directions for tank Mix	4.78	1.1	201
Crop Rotation Restrictions	4.39	1.2	200
Emergency Medical Treatment	3.77	1.3	199
Pesticide Storage Instruction	3.80	1.2	198
Field Re-Entry Intervals	4.27	1.3	198
Pests Controlled	4.54	1.1	196
Signal Word	4.22	1.3	195
Grand Mean	4.27	0.9	202