

# Technology Transfer

## Greenhouse Pesticide Application Safety Training

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**Summary.** Between Dec. 1992 and July 1993, 13 greenhouse operations took part in on-site training programs concerning pesticide application safety. Each program involved a pre-quiz, post-quiz, presentation of two videotapes, discussion, session evaluation, and follow-up evaluation 1 month after each session. A total of 253 Colorado greenhouse employees participated in the programs, which fulfilled the employee training requirements for the Occupational Safety and Health Administration's Hazard Communication standard concerning hazardous materials in the workplace. Quiz scores increased from the pre- to the post-program quiz, from 17.3 to 22.1 points out of a possible 27. Post-program evaluations indicated that the vast majority of respondents either "agreed" or "strongly agreed" that (percentages in parentheses): "the training program will be helpful" (85%), "I understand hazardous materials better" (81%), "the training videos helped understanding" (84%), and "I would like the training done regularly" (79%). Follow-up evaluations showed that most "agreed" or "strongly agreed" that (percentages in parentheses): "I have used at least one new safe handling practice" since the program (55%), and "I plan to use more" safe handling practices (82%). This method of instructing employees about hazardous materials would be applicable to others interested in safety issues.

During the past several years, increased federal, state, and even local government regulations have changed the process of growing ornamental plants

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commercially. More attention must be paid to regulatory matters such as workman's compensation insurance, fringe benefits, and hiring foreign workers. Accessibility for disabled workers and customers (Carlson, 1992) and application of pesticides (Dysart, 1994; Justis, 1993) are two subjects influenced by major federal legislation recently. The latter issue is addressed here.

Growers in greenhouse operations are required to comply with Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) requirements for the use of hazardous materials, including pesticide applications on floricultural crops. Applicators are obligated to read and follow all label instructions and must be certified as pesticide applicators or must be working under the direct supervision of a certified applicator to use restricted-use pesticides in many states. Records must be kept on the amount and type of pesticide applied, the application date and time, and the host crop. Employers are required by OSHA (and, after 1 Jan. 1995, the EPA Worker Protection Standards) to provide a training program for all employees using or working around hazardous materials—in this case pesticides—in crop production.

In 1992, the U.S. Dept. of Labor, Bureau of Labor Statistics, reported 115,600 nonfatal injury and illness cases in agriculture, forestry, and fishing (farms with 11 or more employees). These translated into 54,000 total lost workday cases (Jackson, 1993). The number of injuries and illnesses attributable to hazardous materials in the workplace, including pesticides, is difficult to determine. However, OSHA's Hazard Communication standard is designed to make sure "employers and employees know about work hazards and how to protect themselves; this should help to reduce the incidence of chemical source illness and injuries" (Martin, 1992).

The OSHA Hazard Communication lists four responsibilities of employers: Identify and list hazardous materials in their workplaces; obtain Material Safety Data Sheets (MSDSs) and labels for each hazardous chemical; develop and implement a written hazard communication program, including labels, MSDSs, and employee training; and communicate hazard information to their employees through labels, MSDSs, and formal training (Martin, 1992).

To help greenhouse operators conduct training sessions required by OSHA, the Minnesota Flower Growers Assn. assembled a package called "Safe Handling of Pesticides Video Training Program" (SHP) (1985). This program has been accepted by OSHA and the American Society of Safety Engineers and complies with their regulations concerning worker safety and hazard communication.

It often is difficult for greenhouse operations to organize their own training programs, much less hire a safety consultant to do it for them. If the SHP package could be made available through Colorado State Univ. Cooperative Extension (CSUCE), the area Commercial Greenhouse Extension Agent could present the program to staffs at individual greenhouses at no cost to participants. Through procurement of grant monies from the Colorado County Model Safety Grant Program, materials were purchased and the program was offered at no cost to participants, other than the time involved for training.

There were five goals to be met in pursuing these safety programs:

- 1) To make the SHP program available to Denver-area

greenhouse operations at a low cost;

2) To assist greenhouse operations in meeting OSHA worker safety and hazard communication regulations;

3) To present the SHP program to the staffs at a minimum of 10 greenhouses in English and Spanish (where needed);

4) To determine any changes in attitudes toward pesticide handling after the training program; and

5) To determine if each trained employee adopted any new safe handling practices.

The SHP program package used in the training sessions consisted of two videotapes (purchased in both English and Spanish versions): "Your Right to Know" and "Safe Handling of Pesticides." Also included was an instructor's training manual (including the quiz used here), employee handbooks (in English and Spanish), and employee registration cards (in English and Spanish). Employee handbooks included information on hazardous agents, protection, first aid, MSDSs, and chemical labeling.

The presentation at each greenhouse involved the following steps (the quizzes and evaluations were not conducted with the Spanish-speaking audiences due to translation and literacy problems):

1) An attendance sheet, which stayed on the premises, was signed by all participants, dated, and initialed by the facilitator.

2) A 10-question, 27-point pre-quiz was given to gauge initial knowledge level about hazardous materials in the workplace.

3) A discussion ensued on OSHA requirements concerning employees' questions about the Hazard Communication standard.

4) The video "Your Right to Know" was shown. The 23-min tape informed participants about general workplace hazards, including in-depth discussion of MSDSs.

5) The videotape then was discussed. The safety coordinator and the location of the MSDS file at each greenhouse were identified.

6) The second videotape then was shown. The 25-min "Safe Handling of Pesticides" tape included information on protective equipment, labeling, toxicity, exposure symptoms, and emergency procedures.

7) Time then was allowed for further discussion and answering questions.

8) The post-quiz then was given. No mention was made at any time that the pre- and post-quiz were identical.

9) Employee handbooks for all participants then were distributed. These were to be kept in an easily accessible location in case questions concerning hazardous materials arose during the work day.

10) An 11-question evaluation then was filled out by program participants. The survey was intended to determine the effectiveness of the program.

11) Individual registration cards were passed out, signed, and dated by all participants. The cards were left at each greenhouse with the safety coordinator to be placed in each employee's personnel file. The cards documented that the employee received "training as required by the Federal Hazard Communication law and respective state Right to Know Acts," (Safe Handling of Pesticides Video Training Program, 1985).

12) One month after each program, a follow-up evaluation was sent to each attendee via a packet sent to the safety coordinator at each greenhouse. The packet included a stamped, preaddressed envelope to return the forms. The

Table 1. Results of pre- and post-quizzes given before and after Pesticide Safety Programs in Colorado Greenhouses (27 points possible).

Variable	Pre-quiz scores	Post-quiz scores	Change <sup>z</sup>
Mean	17.3	22.1	4.9
SD	4.9	4.3	4.1
n	144	142	141 <sup>y</sup>

<sup>z</sup>Paired t test was statistically significant, with a value of 2.56 at  $\alpha = 0.01$ .

<sup>y</sup>Three program participants did not take one or the other of the quizzes, resulting in  $n = 141$  pairs of pre- and post-quiz scores.

six-question evaluation was intended to gauge material retention, post-program attitudes, and adoption of any new safe handling practices.

Twelve greenhouse operations participated in the training program, which were conducted from Dec. 1992 through July 1993. A total of 253 people participated, 154 English- and 99 Spanish-speaking individuals. A paired *t* test was performed on 141 sets of pre- and post-quiz scores (Table 1). Quiz scores increased (2.56,  $\alpha = 0.01$ ), from before the program to after the presentation. Once again, the program participants were not informed that the second quiz was the same as the first.

The results from the 11-question evaluation (Table 2) indicated a generally favorable view of the training programs. One month later, the follow-up evaluation was sent (Table 3). Sixty-four percent of the participants (English-speaking only) included in the program returned the six-question survey form via their safety coordinators. The sixth question on the form stated: "Please tell us one new safe handling practice that you started using since you attended the training program." Forty-six percent of the follow-up survey respondents wrote something down. However, several of the responses were not constructive or concrete in nature. Thirty-two percent of the respondents indicated that they had started doing something viable. Some of the written responses included: "Stay away from treated areas," "wear respirator," "wash hands more often," "don't chew fingernails," "read labels," "pay more attention to [respirator] cartridge changes," "dispose of Tyvek suits more quickly," "use gloves," and "submerge and wash spray mask."

Several interesting points emerged from the program results. First, the training program itself was successful in increasing knowledge about safe pesticide handling and hazardous materials, as evidenced by the significant paired *t* test. Second, the percentage of respondents who "strongly agreed" that they knew where to locate written materials in the greenhouse (MSDS, etc.) dropped from 69 to 64 one month later. This drop may have occurred because the participants had no need to use the written materials, and possibly forgot where they were located. It is also possible that discussion on this point during the training was not sufficient and, consequently, its importance was not stressed enough. More likely, lack of feedback from management was a problem. Komaki et al. (1980) found that employee performance after safety training declined until feedback and reminders were given. Performance then improved, but was sustained only when feedback was given to employees at least three times a week. The authors suggest that employers' compliance measures generally only include safety training plus posting of rules and reminders.

Third, the percentage of respondents who "strongly agreed" that the employee handbook would be helpful dropped from 57 to 26 one month later. Either the program participants put the handbook away and didn't have a need

Table 2. *Results of evaluations given at the conclusion of the Pesticide Safety Training programs in Colorado greenhouses (n = 144).*

Statement	Respondents (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Know where written materials are	69	16	6	2	7
Understand MSDS	66	22	10	1	1
Know who safety coordinator is	62	16	7	2	13
Employee handbook will be useful	57	27	13	2	1
Would like training done regularly	57	22	14	2	5
Presentation clear and understandable	55	33	10	1	1
This training program will be helpful	55	30	13	1	1
Training videos helped	51	33	14	1	1
Understand Hazard Communication standard	44	29	19	3	5
Understand hazardous materials	43	38	15	4	0
Feel more comfortable applying pesticides	34	29	25	5	7

Table 3. *Results of evaluations sent out 1 month after the Pesticide Safety Training programs in Colorado greenhouses (n = 92).*

Statement	Respondents (%)				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Know where written materials are	64	22	12	1	1
Plan to use more safe handling practices	41	41	11	1	6
Employee handbook has been helpful	26	35	31	6	2
Have used at least one new safe handling practice	26	29	33	0	12
Have become more comfortable	19	31	26	9	15

to look at it again before the follow-up evaluation was filled out, or the participants read the handbook and decided that it would not be as helpful as they originally had thought. Goldstein (1989) suggested that, even though training programs may be of high quality, employees may not be able to use their training knowledge because of constraints in their job structures and environments. It is possible that the working and time structures in participating greenhouses were not conducive to allowing individual participants easy access and use of MSDSs and handbooks.

Last, the percentage of respondents who "strongly agreed" that they had become more comfortable about applying pesticides dropped from 34 to 19 one month later. Apparently, the information from the training program served to increase participants' discomfort about pesticide application. Again, lack of feedback and possible problems with access to needed materials may have contributed to this decrease.

Goals 1 and 3 were met in that the SHP program was presented (in English and Spanish) to the staffs of 12 greenhouse operations at no cost to them other than time. Goal 2, assisting greenhouse operations in meeting OSHA worker safety and hazard communication regulations also was met, as 253 employees signed cards that stated that they met requirements for their Right to Know. Goal 4 also was met; attitudes changed in that fewer respondents were more comfortable with pesticide application 1 month after the training than at the time of training. Last, goal 5 was not met as completely as was hoped; that of each trained employee adopting one new safe handling practice. Only 32% indicated that they were using a new safe handling practice.

It seems that educating greenhouse employees about hazardous materials and pesticide application does not make them more comfortable. In fact, it makes them more

uncomfortable. This may work to the benefit of all. These programs were beneficial because they were done on location. They also were tailored to each greenhouse operation by inclusion of site-specific information, such as acknowledgement of each greenhouse's safety coordinator, location of MSDSs, and other safety information unique to that operation. Had the program only been done once or twice at a central location, participation probably would have been decreased greatly.

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