

Survey of Pesticide Use by Ontario Greenhouse Chrysanthemum Producers

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The Ontario flower industry has a farm gate value in excess of \$220 million (OMAF, 1991). Chrysanthemums produced in greenhouses represent 22% of flower sales and are the largest sector of the industry (OMAF, 1991). Health regulatory agencies are faced with the task of assessing the pesticide exposure to individuals applying pesticides and those working in the greenhouse environment (Stamper *et al.*, 1989). Specific questions asked by the Canadian regulatory authority include: Which pesticides are used? Who applies them? What is the level of training of applicators? What is the level of applicator exposure? And, is there exposure risk for other people who work in the greenhouses? (Curry, 1989).

In order to develop pesticide exposure studies which accurately reflect the current use pattern of pesticides in greenhouse chrysanthemum production, a survey of commercial growers was conducted. The objectives of the survey were as follows: 1) to determine what pesticides were being applied and how often they were used; 2) to obtain a profile of the applicators; 3) to determine what precautions were being taken when applying pesticides in a greenhouse environment; 4) to determine the current level of training applicators have received; 5) to document the methods of application most frequently used; 6) to identify bystanders who might be exposed to pesticides in the greenhouses and; 7) to document the precautions being taken to reduce exposure to bystanders.

MATERIALS AND METHODS

A Greenhouse Chrysanthemum Producer Survey was developed with input from provincial and federal regulatory officials, provincial advisory field staff and selected growers. It was subdivided into six sections; general production, pest problems, pesticide use, application procedures, applicator and worker profile, and safety. After conducting a limited pretest to refine questions, the survey was mailed to all individuals who were registered as chrysanthemum producers with Flowers Canada over the past 5 years. A total of 112 surveys were mailed. A cover letter outlining the objectives of the survey as well as a letter of support from Flowers Canada was included in each survey package. The recipient was asked to complete the survey and return it in the postage prepaid and addressed envelope which was attached to the back of the survey form. Respondents were not required to identify themselves. All surveys were assigned a number for tabulation purposes when returned.

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A total of 38 surveys were returned. Of these, 31 had been properly completed and were used in compiling survey results. It is estimated that 30% of commercial growers responded to the survey. All data presented below is expressed as a % of those persons responding to the survey.

RESULTS AND DISCUSSIONS

The average size of the greenhouse operations was 11,168 m² (approximately 1.12 ha or 2.76 acres), with a range of 2,322 to 49,703 m². Of those responding, 68% indicated that at least 50% of the total greenhouse space was dedicated exclusively to cut or potted chrysanthemum production. With the exception of one grower who also grew tomatoes, all other crops grown in the greenhouses were flowers. The average production cycle for potted chrysanthemum production was 12 weeks. All respondents grew chrysanthemums on a continual basis and were involved in all stages of production (potting through to shipping) on a weekly basis. While production levels fluctuated to meet seasonal market demands, chrysanthemum production is continuous.

Aphids, thrips and mites were identified by the growers as the most common pests in chrysanthemum production (Figure 1). Not surprisingly therefore, is the fact that insecticides are the most frequently used pesticides. As shown in Table 1, a high percentage of these compounds are organophosphorus and N-methyl carbamate insecticides with acute oral lethal dose ratings less than 500 mg/kg body weight in rodent studies. The respondents reported an average of 39 separate pesticide applications annually, with a range of 22 to 70. Frequency of application increased by 40% in the spring and summer months compared with the fall and winter production periods.

Most growers indicated that, over the course of a year, they would make at least one pesticide application using a high volume hydraulic sprayer, fogs, smokes and ultra-low volume non-thermal applicators. All respondents used a hydraulic sprayer on a regular basis. This application method employs the use of either hand held spray guns equipped with flooding nozzles, or custom made booms on which a number of flat fan nozzles are mounted. Typically, the applicator applies the spray solution to the foliage up to the point of run-off (2000 - 2500 L/ha). Ninety percent of respondents made regular use of various ultra-low volume, non-thermal application equipment. These units atomize the pesticide solution into small droplets between 3 and 15 µm in diameter. Distribution of the spray solution is facilitated by use of a forced air fan system. All external fans in the greenhouse are turned off and shades drawn when the low-volume units are in operation. The greenhouse is sealed and no personnel are present while the unit is operating. The unit is turned on by means of an electronic timer or switch located outside of the greenhouse.

All respondents indicated that only males applied pesticides in their operations. Seventy percent of the applicators were under the age of 35 and 80% of applicators were either the owners of the greenhouse operation or family members. Only full-time employees were involved in pesticide application. In all responses, the applicator was responsible for loading, spraying and cleanup operations.

All respondents indicated that coveralls, gloves and boots were worn when applying pesticides (Table 2). This result was unusually high compared to data collected from farmers attending pesticide certification courses (OMAF, 1992) and may reflect a greater

regard for the need to use caution when applying pesticides due to the greater frequency of use in greenhouse chrysanthemum production. Figures 1 and 2 provide information on the profile of those people employed by greenhouse chrysanthemum producers.

All respondents indicated that the pesticide applicators in their operations had successfully completed the Ontario Greenhouse Growers Pesticide Safety Course (OGGPSC). It should be noted, however, that as of April 1st, 1991, under Regulation 751 of the Ontario Pesticides Act at least one person on any farming operation applying agricultural class pesticides had to be certified. Certification could be achieved by attending a recognized course and obtaining a grade of 75% in a certification exam. The two day OGGPSC is one of the courses approved by the Ontario Ministry of the Environment for certification requirements. In addition, 22 % of respondents indicated they had received some other type of pesticide safety training. When asked what practices were used to reduce applicator and worker exposure, the three common responses were: 1) Apply pesticides with an ULV unit. (2) Apply pesticides on weekends when workers are usually not present or, if necessary, in the evening after regular work hours. (3) Ventilate the greenhouse thoroughly after each pesticide application and before reentry.

Table 1. The ten most frequently applied pesticides in greenhouse chrysanthemum production

Pesticide	Class	LD ₅₀ (mg/kg) ^A	Applications per year	
			Mean of 31 respondents	Range
pirimicarb	MCI	147	21	3-52
deltamethrin	SPI	535	17	2-34
bendiocarb	OCI	179	16	0-26
endosulfan	OCI	110	15	5-26
dienochlor	OCI	3160	15	0-22
oxydemeton-methyl	OPI	75	12	0-26
dicofol	OCI	684	12	0-12
benomyl	Ben.F	5000+	10	0-52
lindane	OCI	88	7	0-22
chlorpyrifos	OPI	135	7	0-22

MC = N-methyl carbamate, SP = synthetic pyrethroid, OC = organochlorine, OP = organophosphorus, Ben. = benzimidazole, I = insecticide, F = fungicide

^AAcute oral lethal dose, usually female rats (British Crop Protection Council, 1988)

Respondents were asked if they, or anyone in their operation, had experienced or thought they had experienced some type of pesticide poisoning no matter how mild the symptoms. Seventy five percent of those responding indicated that no one in their operation had ever experienced any adverse affects from pesticide use. For the 25% who indicated they or someone in their operation had been adversely affected by pesticides the symptoms

ranged from headaches to severe nausea.

The survey provided a number of useful insights into pesticide use in the greenhouse industry. Greenhouse chrysanthemum production is very intensive and specialized and there is a high emphasis on producing plants which are free from pest injury. The survey confirmed that pesticides were applied with regularity throughout the year. In one case 20 separate applications per year of a single insecticide were reported. There appeared to be two main methods of pesticide application, high volume hydraulic spraying and ultra-low volume applications. Many respondents felt that use of the ultra-low volume units provided greater levels of safety to the applicator and the workers. In most cases, pesticide applicators were responsible for all activities associated with the spraying operation. This emphasized the need to study all activities involved in pesticide application rather than isolating one function such as loading or spraying.

Table 2. Protective clothing worn by greenhouse pesticide applicators

Item	% Response	Type	# of Responses
coveralls	100	disposable	13
		rubber	8
		tyvek	4
		neoprene	6
gloves	100	rubber	28
		neoprene	3
boots	100	rubber	31
hats	16	helmet	5
goggles	32	face shield	5
		safety goggles	5
respirator	84	cartridge	12
		canister	8
		SCBA ^A	6

^ASelf contained breathing apparatus

The survey indicated that most of the applicators were young males and members of the families who owned the business. Thus there was a high probability that they would be applying pesticides in the greenhouses for a large proportion of their working lives. If one assumes an average active working career of 25 years in the greenhouse, and if the average of 39 separate pesticide applications per year remained constant, the average applicator could potentially handle and apply pesticides 975 times. These facts emphasize the need to examine the effectiveness of methods to minimize exposure to pesticides as well as the need to educate the applicators about the most important precautions for avoiding exposure.

While the high number of female employees working in the greenhouse operations was

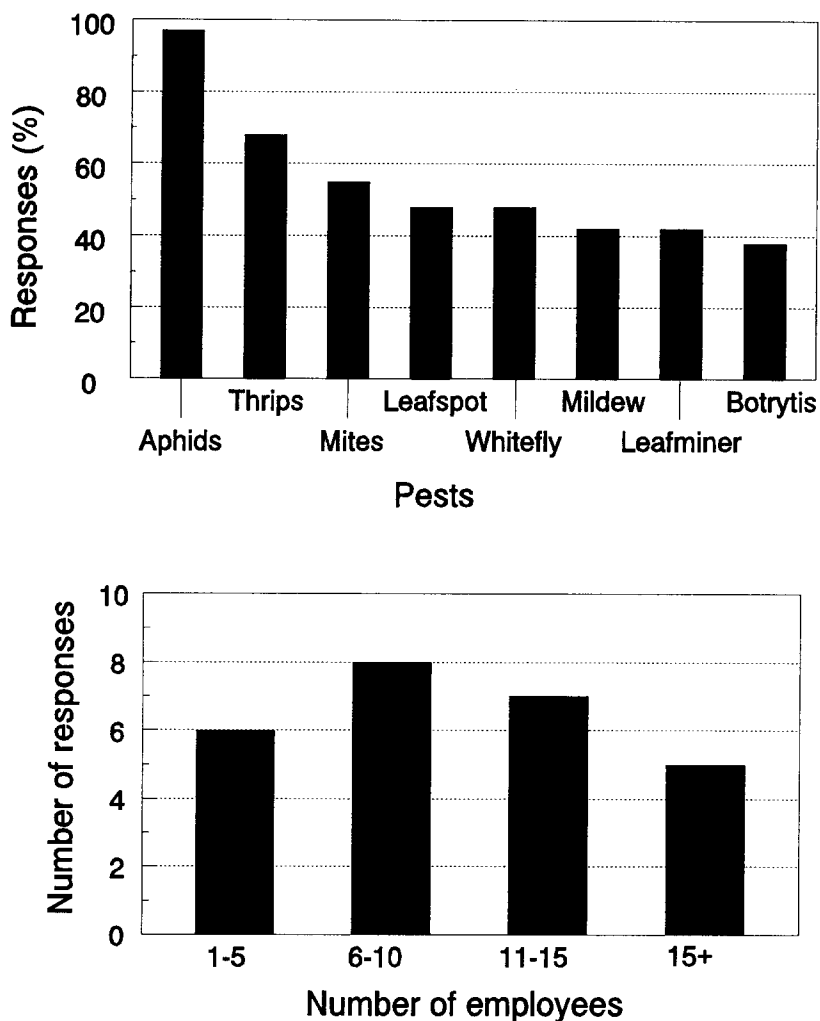


Figure 1. Most frequently report pests and average number of employees in Ontario greenhouse chrysanthemum operations

not surprising, the average length of employment was. For much of the year, the working environment in the greenhouse is pleasant and the tasks varied, resulting in high job satisfaction.

The number of reported cases of actual or suspected pesticide poisonings among applicators and workers was low. However, the frequency of use was high, thus there is a need to assess exposure as a first step toward developing a plan to minimize long term chronic effects as well as to reduce the occurrence of accidental poisonings.

These results indicate that future exposure studies in greenhouse settings should examine

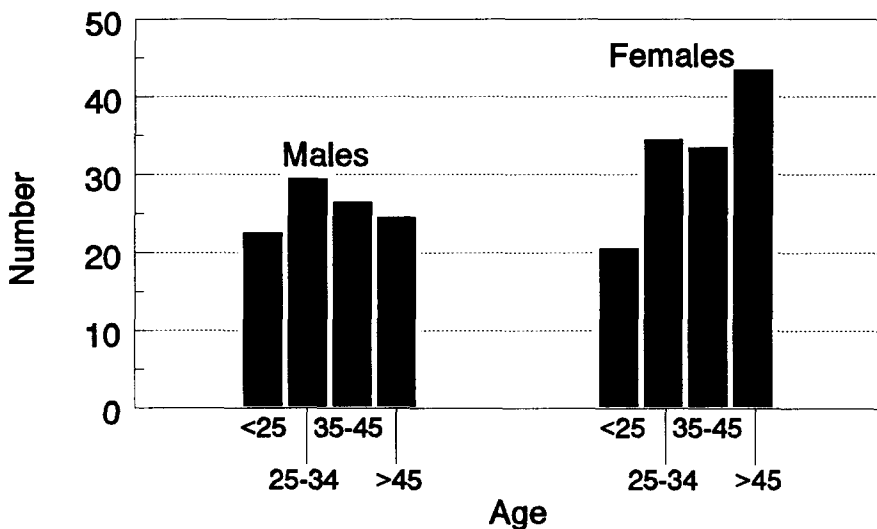
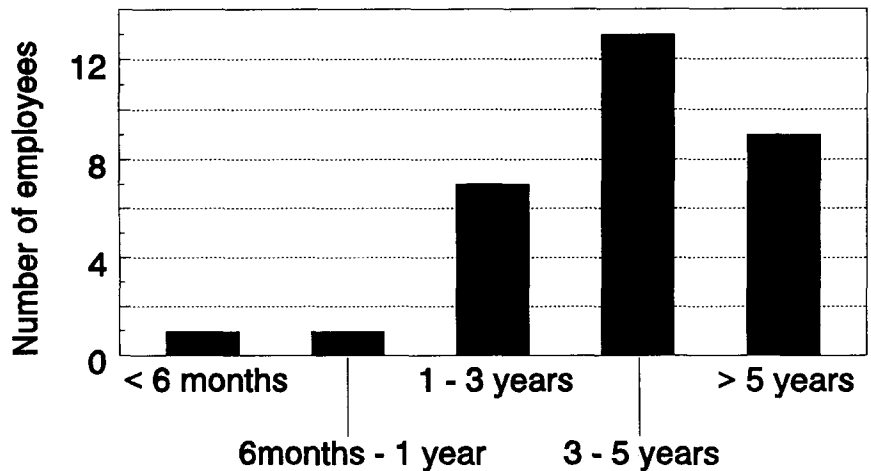


Figure 2. Average length of employment and distribution of greenhouse employees by age and sex

exposure resulting from the use of various application techniques, the effectiveness of various types of protective clothing for reducing the exposure, the potential of workers to be exposed to pesticides from contact with treated foliage, and the importance of ventilation. The high frequency of pesticide application and the finding that workers are not transient but rather long-term full-time employees in the greenhouse operations

underlines the need to ensure that chronic exposure levels remain low for both applicators and workers.

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