

# Practices and Perceptions of School Integrated Pest Management by North Carolina Pest-Management Professionals<sup>1</sup>

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**ABSTRACT** The use of pesticides in schools is a matter of great concern to many school administrators, parents, students, staff, environmental groups, and legislators because children are more vulnerable than adults to the effects of pesticide exposure. To minimize pesticide use and exposure in schools, many states are promoting or requiring adoption of integrated pest management (IPM) programs in their schools. A focus group and telephone survey of pest-management professionals (PMPs) were conducted to aid development and promotion of a school IPM program in North Carolina. Only PMPs with current or anticipated contracts with public schools were surveyed. The objective of this effort was to determine current pest control practices, attitudes and knowledge of IPM, and IPM training needs. Ants, cockroaches, rats, mice, and termites were reported as the most important insect pests. Scheduled pesticide applications are predominantly used to control the pests, although 89% of respondents defined IPM as using action levels and a combination of management tactics. According to PMPs, education, better communication, organization, and administration can greatly enhance the implementation of IPM in schools.

**KEY WORDS** IPM, integrated pest management, schools, pest management professionals (PMPs), school IPM Survey

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Pesticide use in school buildings is an issue of great concern to parents, school administrators, teachers, and nongovernmental organizations. This has resulted from findings that children are more vulnerable than adults to the effects of pesticides and other chemicals (National Research Council 1993). Children's physiology, behaviors, and size increase their vulnerability to many environmental health hazards. Thus, children need special protection from exposure to pesticides used in schools. According to Alcorn et al. (2005), children and school employees in many school districts across the country experience acute illnesses produced by exposure to pesticides. There is broad support for promoting the use of integrated pest management (IPM) to reduce pesticide exposure to school oc-

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cupants. Currently, the School Environment Protection Act of 2003 (SEPA), a federal bill that will regulate pesticide use in schools and mandate implementation of IPM programs, is pending in the U.S. Congress (US House of Representatives 2005). In addition, 18 states already have legislation mandating or recommending implementation of IPM programs by schools (Harrington 2000; National Association of State Boards of Education 2005). In North Carolina, The School Children's Health Act (NC House of Representatives 2005) passed unanimously in the General Assembly. This legislation will require school districts to implement IPM programs.

Pest-control companies play an important role in school pest-management programs. Surveys show that pesticides are predominantly applied by pest-management professionals (PMPs; Minnesota Department of Agriculture 1999, Long 2001, Tootelian 2001, Vail 2001, Agriculture Resource Center and Pesticide Education project 2003, Gibb & Fournier 2006). In North Carolina, pest-control companies have contracts to perform some aspect of pest control in 96% of school districts (Lilley 1999); yet, their pest control practices are not known. The lack of information on their current pest-management practices and attitudes toward IPM hinders the assessment of their educational needs and ultimately the successful implementation of IPM. The goal of the study was to determine the current pest-control practices of companies that contract with public schools to improve implementation of IPM in North Carolina public schools.

The objectives of this study were to:

- (1) identify the pests considered most important to PMPs,
- (2) determine the current pest control practices of PMPs,
- (3) find out how PMPs define and understand IPM, and assess attitudes toward IPM,
- (4) discover the challenges that PMPs face in controlling pests in schools and the constraints of using IPM techniques,
- (5) investigate the extent to which PMPs use IPM in schools and what hinders adoption,
- (6) elicit PMPs' comments for improving adoption of IPM by schools.

### **Materials and Methods**

A focus group and telephone survey of PMPs with school contracts were conducted. The focus group convened during the Annual Pest Control Technicians School sponsored by The North Carolina Pest Control Association (NCPCA) in January 2002, in Raleigh, NC. The focus group consisted of nine PMPs that are members of NCPCA with current or anticipated contracts, a moderator and an assistant. A set of four questions (Table 1) was sequentially posed to the group by the moderator. Responses were recorded on a flip chart and by a microcassette recorder. Information from focus group notes and tape recording was analyzed and used to generate a report. The focus group participants were not included in the survey.

The telephone survey of PMPs with school accounts was conducted in April 2002. Eighty-four pest control companies or company branches that contract with schools were enlisted for this survey. The survey instrument (<http://schoolipm.ncsu.edu/reports.html>) was developed by the School IPM program of North Carolina State University and tested on a small group of PMPs before

**Table 1. Focus group questions.**

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1. (a). Working on pest control with any group of customers like school systems may have many advantages and disadvantages. Now, thinking just of school systems, what do you think are the most important advantages of working with this group?
    - (b). Any number of problems or issues may come up when working with school systems on pest control problems. Currently, what do you think are the most important problems and issues related to providing pest control services to school systems?
  
  2. (a). Some problems and issues you identified have to do with your company or school system policies. Others are technical issues and problems. Now considering just the technical issues and problems (those dealing with techniques and methods) what are the issues or problems you need training or other educational efforts to help solve?
    - (b). Training and other educational efforts to address these technical issues and problems could include self-study modules, day-long training sessions covering a variety of topics, tours and other in-school workshops, videotapes, etc. Each problem or issue could be addressed by one of more educational methods. Now, thinking about the technical issues we just discussed, what would be the best ways to learn about and help solve these problems and issues?
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conducting the interviews. The telephone interviews were made during regular work hours by the Center for Urban Studies at North Carolina State University.

## Results

**Demographics and the response rate.** The respondents were pest control company owners or managers with various levels of education: 40% had a high school or some college education, 52% had a 2-year and 4-year college education, whereas 8% held a masters level of education. Of the 84 pest-control companies that enlisted for the survey, 73 responded, representing 87% of the pest-control companies that contract schools in North Carolina. Survey responses were tallied and translated into percentages. For the purposes of this publication, only major findings are reported. The complete report (Nalyanya & Lilley 2002) can be obtained at <http://schoolipm.ncsu.edu/reports.html>. Because of multiple responses on some questions, the tally of percentages exceeds 100%. To provide a logical flow of information, the survey results are presented first, followed by the focus group results.

**Survey results.** *Important pests and pest-management practices.* A majority of respondents (73%) are contracted to control pests only in specific areas of the school buildings, mainly cafeterias (67%), bathrooms (40%), stores and mechanical rooms (16%) or as-needed (14%). In order of importance, ants, cockroaches, termites, rats and mice, flies, and spiders respectively, are considered to be a serious problem in North Carolina public schools (Table 2).

Pests are controlled predominantly using insecticides. Nearly all the respondents (94%) who consider ants to be a serious problem, and all those that consider

**Table 2. Pests considered by pest-management professionals as a serious problem in North Carolina schools ( $n = 73$ ).**

Pests considered a serious problem	Frequency	% of respondents
Ants	35	48.0
Cockroaches	16	21.0
Termites	11	15.1
Rats and mice	7	9.6
Bees and wasps	7	9.6
Flies	3	4.1
Spiders	1	1.4

cockroaches, wasps, and bees a serious problem use insecticides as the primary means of control. The most commonly used insecticide application methods included baiting (74%), crack and crevice treatments (43.8%), baseboard sprays (12.3%), dusts (4.1%), and space sprays (1.4%), respectively. All of the respondents using nonchemical methods control spiders and flies using traps, whereas 57.1% use trapping for rats and mice. In addition, >70% of the companies recommend nonchemical measures, such as structural repairs, screening, sanitation, and proper food storage to enhance the effectiveness of insecticide treatments and the control program overall.

*Decision-making for pesticide applications.* PMPs or technicians and the company's standard operating procedures determine whether to use pesticides in a school. The recommendations of facilities managers, contract requirements, and the level of pest infestation also play an important role in deciding whether to apply a pesticide (Table 3). But when a decision is made to apply pesticides, companies base their selection of pesticide products on a combination of safety to children (100%), product efficacy (86%), and formulation (81%). Contract requirements (68.5%), ease of application (51%), and chemical costs (16%) are less-important criteria in the pesticide selection process.

The frequency of pesticide application varies among companies. For example, 75% ( $n = 73$ ) of all the respondents apply pesticides on a regular schedule. Of the companies that apply pesticides regularly ( $n = 55$ ), 76% apply them at monthly

**Table 3. Decisionmaking for pesticide applications by pest-management professionals that contract North Carolina schools ( $n = 73$ ).**

Reason for applying pesticide	Frequency	% respondents
Technician's decision	39	53
Company standard procedure	18	25
Severity of problem	10	14
IPM program requirement	6	8
Facility manager recommendation	6	8
Contract requirements	2	3

IPM, integrated pest management.

**Table 4. Frequency of pesticide applications in schools by pest-management professionals in North Carolina ( $n = 55$ ).**

Frequency of pesticide application	Frequency	% of respondents
Monthly	42	76.4
Quarterly	8	14.6
Semi-annually	3	5.5
Annually	2	3.6

intervals, 15% apply them quarterly, and 9% apply them semiannually and annually (Table 4). We found that 85% ( $n = 55$ ), of the respondents apply pesticides on school days, 98% ( $n = 73$ ), treat after school hours when the school buildings are unoccupied, and 2% treat school buildings at anytime whether the buildings are occupied or not.

*Definition and attitudes toward IPM.* In the survey, 62% of the respondents defined IPM as the practice of controlling pests based on action levels and using a combination of pest control tactics, whereas 34% defined IPM as the combination of insecticides (including baits) and pest exclusion measures to solve pest problems. Of the remaining respondents, 3% defined IPM as mixing or rotating pesticide formulations and classes, and 1% thought IPM was pest management with absolutely no use of pesticides (Table 5).

Eighty-nine percent (89%,  $n = 73$ ) of all the respondents reported that they use IPM in the contracted schools. IPM was said to be very effective in solving pest problems by 69% ( $n = 65$ ) of the respondents that reportedly use IPM but only somewhat effective by 31% ( $n = 65$ ) of the respondents. According to 72% of the respondents that use IPM in schools, the main reason for adoption was child safety concerns, whereas 51% used IPM because it is very effective. Of the respondents (11%,  $n = 73$ ) that do not use IPM in schools, 50% claimed that their current methods are effective and 33.3% reported that IPM consumed too much time. The rest did not adopt IPM because of lack of demand, lack of information, and that IPM is not needed because baits are effective and readily available.

Most of the companies that defined IPM as the use of action thresholds and multiple pest management tactics (89%,  $n = 45$ ) also reported that they use IPM in the schools they service; however, they also apply pesticides routinely on a

**Table 5. How North Carolina pest-management professionals with school contracts define integrated pest management (IPM) ( $n = 73$ ).**

Definition of IPM	Frequency	% of respondents
Action levels + combination of tactics	45	61.6
Pesticides + pest exclusion	25	34.3
Rotation of pesticide formulations and classes	2	2.7
Absolutely no pesticides	1	1.4

schedule. Only 7% ( $n = 45$ ) of the respondents that reported using IPM defined IPM as the use of action thresholds and multiple pest-management tactics do not use pesticides on a calendar schedule (see Table 5). In addition, more than 70% ( $n = 73$ ) of the respondents recommend nonchemical measures, such as structural repairs, screening, sanitation, and proper food storage to improve the effectiveness of chemical pest-control efforts. Yet, 62% reported that schools were somewhat cooperative or not cooperative in making recommended changes.

Although the structural pest control laws and regulations of North Carolina (Wilson et al. 1996) do not require pesticide applicators to notify schools when pesticides are/will be applied, 81% of the respondents provide notice before or after applying pesticides. They notify the school administrators (47%), the maintenance supervisor (47%), or cafeteria manager (11%) before or after pesticide application. Sixty-four percent of the respondents provide notice to safeguard the health of children, 10% to reduce their liability and 9% to comply with county requirements. Five percent of the companies did not specify why they notify schools.

Most companies maintain records of pest-control activities in schools. Ninety-nine percent of the respondents maintain pesticide application records to comply with the Structural Pest Control law of North Carolina (see Wilson et al. 1996), which requires applicators to maintain records for 2 years after contract termination. They also keep records of inspections (83%), monitoring (76%), pest sighting (72%), and recommendations for sanitation improvements and structural repairs (69%).

The employees/employers of pest-control companies receive pest control training monthly (45%), weekly (29%), or bimonthly, semiannually and annually, collectively (26%). Preferred methods of training are classroom teaching (53%) and hands-on demonstrations (29%; Table 6). The respondents regarded the following areas of training as most important: pest identification (97%), inspection and monitoring (96%), chemical control (95%), tools and equipment (95%), regulations and liability (97%), IPM (90%) record keeping (89%), nonchemical control (75%), and sales and marketing (60%).

The three most important sources of pest control information to PMPs are pesticide product labels (96%), books and manuals (82%), and seminars/workshops (79%). The three least important sources of information are extension literature (37%), extension agents (34%) and the Internet (28%) whereas in-house

**Table 6. The training methods preferred by pest-management professionals with school contracts in North Carolina ( $n = 73$ ).**

Training method	Frequency	% of respondents
Classroom	39	53.4
Hands-on demonstrations	21	28.8
Presentations	6	8.2
Books/manuals	4	5.5
Videos/DVDs	2	2.7
CDs/audio tapes	1	1.4

technicians (66%), product representatives and literature (51%), and trade journals (46%) are of moderate importance (Table 7).

**Focus group results.** *Challenges of controlling pests in schools and constraints of adopting IPM techniques.* Focus group respondents listed several pest control challenges in schools. These constraints can be barriers to the adoption of IPM by PMPs. According to the PMPs, the major impediments to IPM adoption include:

- (1) **School administrators:** School administrators do not understand that successful IPM programs require partnership and good communication between school communities and PMPs. School systems are familiar with the notion that pest control is the work of the “exterminator.” As such, school systems do not understand the role that administrators play in enhancing the effectiveness of pest management efforts through improved sanitation, prompt maintenance and repair of buildings.
- (2) **Low tolerance of school occupants to pests:** In many cases, almost every pest sighting is considered an emergency. As a result, school administrators respond with demands for immediate action and often insist on an insecticide treatment even when schools or classrooms are occupied. False pest alarms are also common in schools, causing the pest control technicians to go to the school for no reason.
- (3) **School pest-control policies and procedures:**
  - i. Lack of formal pest-management policies leads to a confusing situation as to who is responsible for pest control. Even school districts with policies often do not adhere to them. Some school districts combine in-house personnel and contractors to control pests. Sometimes school employees misapply “low-toxicity pesticides” such as boric acid; large piles of boric acid are haphazardly distributed in buildings. PMP may be held responsible for problems arising from the schools’ pest control efforts that disrupted the IPM program.
  - ii. Multiple contracts and selection of pest control contractors on the “lowest-bidder” basis. Most school districts contract portions of their pest-control operations to various companies on a “low-bid” basis. It is very common to

**Table 7. The sources of pest control information that are considered very important by North Carolina pest-management professionals with school contracts ( $n = 73$ ).**

Source of information	Frequency	% of respondents
Product labels	70	95.9
Books and manuals	60	82.0
Seminars and workshops	58	79.5
In-house technicians	48	65.8
Pesticide product representatives and literature	37	50.7
Trade magazines	34	46.6
Extension literature	27	37.0
Extension agents	25	34.0
Internet	21	28.8

have separate contracts for cafeterias, school buildings, grounds, and termites (Geiger & Tootelian 2002; Nalyanya unpublished data 2004). Each individual contract may often be granted to the lowest-bidding companies that rely solely on scheduled pesticide sprays, which results in a pest control program that is the antithesis of IPM.

- iii. *Poor contract management in schools*: Contracts determine the timing and quality of service provided by PMPs. Although some school districts want the IPM approach to be used, it is not reflected in the language of their pest-control contracts. In addition, if they have a policy, schools do not have expertise to evaluate the work of pest-control companies for adherence to the school's policies. In some cases, pest-control companies sign contracts with schools, promising to use IPM methods to control pests, but actually use conventional methods. In either case, school administrators often are not able to evaluate the appropriateness or effectiveness of service they receive.
- (4) General complexity of school structures and environment and accessibility of schools for pest control: School buildings are very complex with many microenvironments that need special attention to properly control pests. For example, classrooms may have live animals, vegetable gardens outside the classrooms, stored food, etc. Scheduling to gain access into the school buildings and certain rooms can be challenging. Schools with year-round calendars make scheduling of service time especially difficult. Lockers, cubbyholes, and desk drawers are subject to privacy and are not easily accessible to PMPs yet can be focal points for infestations. The difficulty of timing entry to school buildings also makes it hard to pick up traps during monitoring or to remove dead pests. Special arrangements are often necessary to get access to the buildings.
- (5) Liability: The PMPs were concerned about the liability associated with pest control in schools because of the sensitive nature of school occupants. The financial liability and media exposure can be astronomical if a student or staff was injured by a pest or exposed to a pesticide.

According to the PMPs, the constraints of adopting IPM techniques in schools include:

- (1) PMPs are not motivated to use alternative methods and IPM because there is no clear evidence of pesticide-related problems in schools. Some PMPs claim that current methods are effective and so there is no need to change. In addition, there is no demand for IPM and IPM is very time consuming. PMPs commented that animal rights groups oppose the use of certain alternative pest control methods (e.g. glue board traps).
- (2) The definition and objectives of IPM are not clear to school administrators, government agencies, and pest control companies. Therefore, the expected IPM service varies depending on the perceived definition. The nine focus group participants could not agree on a single definition of IPM. They defined IPM as decreased chemical management whereby the quantity of pesticide applied is reduced relative to conventional pest control. Others defined IPM as responsible use of least toxic chemicals to control pests where responsible use meant using chemicals as needed. Another view was that IPM was a multitactic approach of controlling pests.

- (3) Lack of clear criteria and guidelines for pest control decisions. To facilitate the implementation of effective IPM strategies clear action or threshold levels are needed to base pest control decisions.
- (4) Decision-making in IPM is challenging because there are many strategies for approaching any given pest problem. These include chemical and nonchemical approaches (eg, biological, physical, mechanical and cultural methods, including engineering and construction elements for pest proofing and control, and landscaping alternatives).
- (5) There are different standards for pest control among institutions such as public schools, day care facilities, private schools, and colleges. In addition there are many stakeholders to satisfy including parents, school administrators, government regulatory (city, county or state government) officials and nonprofit groups.
- (6) Most schools do not readily enforce their building sanitation and maintenance policies yet improved sanitation and maintenance are critical ingredients for the success of any IPM program. This leads to the tendency to revert to the use of broad-spectrum pesticides that have a longer residual life and can, to some extent, attempt to overcome poor sanitation and maintenance and older application methods.

The PMPs recognized the significance of education and training in adoption of IPM. To facilitate the adoption of IPM techniques, they recommended targeting education, awareness, and training on IPM to school administrators and to the pest control industry, at the state level. They recommended that:

- (1) School administrators at the state level should be made aware of the important role they play in the implementation of school IPM programs. The North Carolina State Board of Education (NCSBE) makes recommendations for the school districts. Pest management policy decisions are made by the NCSBE then passed to school districts. Information on IPM should be presented in seminars and workshops to the NCSBE to influence policy making, and at annual professional meetings of school maintenance personnel (supervisors) and child nutrition administrators. These school personnel should be trained to understand IPM and their role in the implementation of IPM programs. In addition, resources such as manuals, brochures, pamphlets, should be made available to the school staff to clarify their role in the implementation of IPM. Model IPM contracts should be made available for school districts to adapt to each district's specific needs.
- (2) The pest-control industry at the state level (in collaboration with NCPA) should be given training on IPM in workshops held in a typical school setting. These workshops should last approximately a day and be composed of two components: a morning classroom session to teach pest-management techniques and an afternoon field session to demonstrate IPM practices and to provide hands-on training. In addition, a seminar or workshop on IPM can be designed, developed, and presented at the annual Pest Control Technicians School of the NCPA that is held in Raleigh, NC. The content or curriculum for the training sessions should be as outlined specifically for North Carolina situations. Overall, the PMPs recommended that the training program needs to be well thought out and presented effectively to foster learning if its content is to be adopted.

For schools to adopt IPM, the PMPs in the focus group recommended that:

- (1) Education and public relations should be targeted at the school community and PMPs. IPM should be well defined, and the roles and responsibilities of the stakeholders clarified.
- (2) Pest management in schools should be performed by the best-trained and most-experienced technicians because of the sensitive nature of children and the complexity of the school environment. They outlined that the IPM technician should be trained and knowledgeable in the following areas:
  - i. Pest identification, biology, behavior, and structural inspection (eg, microhabitats, harborage etc).
  - ii. Pest control products, tools, equipment, and evaluation of treatments.
  - iii. Knowledge of buildings and construction to competently inspect school buildings and recommend appropriate actions and treatments based on knowledge of children's behavior and pest biology and behavior.
  - iv. Understanding of contracts/policies and rules/regulations governing pest control in schools.
  - v. Documentation and record keeping: compiling and administering log-books, completing and keeping pesticide application reports.
  - vi. Behavior of children.
  - vii. Public relations and communication.

Data from the survey concurred with the focus group findings. Many pest-control companies regularly train their employees in various aspects of pest control. Therefore, to promote IPM training, there is a need for a supplemental program consisting of workshops/seminars and hands-on demonstrations to train PMPs in the principles and practices of IPM. The program should present specific information on important pests and problem areas. There is also a need to provide pest-control companies with information on IPM in the form of manuals, books/booklets, fact sheets, and other printed material with ideas that can be readily implemented to reduce the frequency of pesticide applications in school buildings.

### **Discussion**

Pest-control companies play a vital role in pest-management programs of schools across the country. Survey information shows that the bulk of pest control work in schools is contracted to pest control companies in many states, including Massachusetts (Hollingsworth 1996), Connecticut (Addiss et al.1999), California (Tootelian 2001), Minnesota (CJ Olson Market Research Inc. 1999), Maine (Maine Dept. of Ag., Food and Rural Resources 2000), Pennsylvania (Long 2001), Tennessee (Vail 2001), Ohio (Geissler et al. 2001), New Hampshire (Martin 2002), Virginia (Miller 2004), North Carolina (Agriculture Resources Center and Pesticide Education Project 2003, Williams et al. 2005), and Indiana (Gibb & Fournier 2006). Pest-control companies and their technicians determine which pest-management tactics are appropriate for the situation, whether to apply pesticides, and how often. Importantly, they also define, by their actions and statements, pest management within schools.

In this study, we found that although PMPs reportedly use IPM in schools, they also apply pesticides on a predetermined schedule, contrary to the principles of IPM. Pest-control companies rely on their standard operating procedures and

technician's evaluations of the pest situation to determine whether to use pesticides in schools. We also found that contract requirements and stipulations have little effect on the frequency of pesticide applications in schools. This may be attributable to the fact that most school districts do not have formal pest-management policies and they do not evaluate pest control practices of their contractors because of a lack of expertise or personnel.

Many pest-control companies regularly train their technicians to keep them up-to-date with the current pest-control information. Pest-control practices used by technicians are determined by the company policies, the training they receive, and their sources of information. According to the survey, pesticide product labels, books and manuals, and seminars and workshops are the most important sources of information for the pest-control companies, followed by in-house technicians, product representatives, and trade magazines. These preferred sources of information may perpetuate outdated pest-management practices and encourage the purchase and frequent use of certain pesticide products. To adopt IPM techniques, the training and sources of information should be diversified to include material from other sources such as North Carolina Cooperative Extension Service. Our survey data show that extension agents and literature are not important sources of information for pest management in schools. At the time of the survey, the School IPM program of North Carolina State University was at inception stage and unknown to the PMPs but the situation may currently be different.

PMPs do not practice a full IPM program. They have incorporated some IPM procedures in their operations (eg, pest identification, inspection and monitoring, record-keeping, notification, regular training) but do not fully implement IPM as shown by the routine application of pesticides. The important question to answer is why PMPs who are familiar with IPM and have implemented some IPM aspects continue to apply pesticides on a routine basis. There are several probable reasons for this practice:

- (1) PMPs are skeptical about the effectiveness of IPM because they do not understand the IPM concept and how it works. Fear of pest-control failure and subsequent time-consuming and expensive service call backs causes them to spray to prevent infestations between service visits.
- (2) The school staff considers a pesticide application as evidence of service and therefore demands that pesticides be applied whether needed or not.
- (3) Most PMPs are certified pesticide applicators and therefore believe that pest control is equivalent to applying pesticides, and feel that they have delivered a service when they spray or apply a pesticide.
- (4) IPM requires increased education and communication with the customer. Most technicians are instructed to respect customer opinion. Therefore, when school staff request spraying in certain areas they comply regardless of need. Additionally, PMPs do not feel they will be compensated for the extra time required to educate occupants.
- (5) It is legal to spray or apply pesticides on a routine or calendar basis, and some school contracts specifically require scheduled pesticide applications.
- (6) There is no direct evidence of health effects of scheduled pesticide use. If there are any symptoms of ill health, they often cannot be associated or connected with pesticides.

- (7) IPM requires a partnership between PMPs and schools, yet PMPs cannot count on schools to do their part. Therefore they spray or apply pesticides to prevent infestations.

It is evident from this study that PMPs are willing to adopt IPM techniques, but unless the schools demand the use of IPM and play their role in IPM programs, it is very difficult to change pest-management practices. IPM requires partnership and good communication, which are clearly lacking between PMPs and most school districts. PMPs reported that the greatest impediments to implementation of IPM techniques in schools are organizational and administrative. School administrators and staff are familiar with a pest control system in which they do not play an active role and are not familiar with IPM, which requires their participation; therefore, they have been slow to change. The PMPs recommended awareness, education and training on IPM to both PMPs and school administrators and staff to increase cooperation and participation in IPM programs, and to accelerate adoption of IPM. In addition, there is need for an unambiguous definition and understanding of IPM so that training of PMPs can be effective, and implementation of IPM programs successful. Finally, good pest-management policies and contracts from schools, a statement of goals and expectations that schools have for pest control, and communication between schools and pest-control companies will create an environment that encourages implementation of IPM programs in schools.

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Integrated pest management (IPM), also known as integrated pest control (IPC) is a broad-based approach that integrates practices for economic control of pests. IPM aims to suppress pest populations below the economic injury level (EIL). The UN's Food and Agriculture Organization defines IPM as "the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other Integrated Pest Management (IPM) is the implementation of diverse methods of pest controls, paired with monitoring to reduce unnecessary pesticide applications. In IPM, pesticides are used in combination with other crop management approaches to minimize the effects of pests while supporting a profitable system that has negligible negative effects. NIFA administers and provides leadership for a broad portfolio of IPM programs. The concept of IPM was hatched in the 1970 through the environmental movement that resulted in part from the purported pesticide use abuses that were described in Rachel