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PEST MANAGEMENT IN MICHIGAN PUBLIC SCHOOLS

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PEST MANAGEMENT

IN MICHIGAN PUBLIC SCHOOLS

By

Deborah L. Miller

A THESIS

Submitted To Michigan State University In Partial Fulfillment of the Requirements For the Degree of

MASTER OF SCIENCE

Department Of Entomology and Urban Affairs Programs

ABSTRACT

0500-000,

PEST MANAGEMENT IN MICHIGAN PUBLIC SCHOOLS

By

Deborah L. Miller

Public school personnel face a variety of pest related problems ranging from health hazards and economic destruction to aesthetic damage. In order to develop model school pest management/pesticide policy guidelines, existing pest problems and control practices need to be identified. A questionnaire designed according to the principles of Dillman's Total Design Method was prepared in 1987 to assess perceived pest prevalence, pest management practices, personnel responsible for pest management, level of satisfaction with current pest management efforts, concern expressed over pesticide use in the school environment, types of pest management records maintained, and interest in new pest management program development. Responses were compared by school district size, location and community type. It was found that size is an important factor in pest presence and choice of personnel responsible for management. It was also found that pest control companies are employed by over 70% of the districts. New program development should take both district size and pest control company employment into consideration. This thesis is dedicated to the memory of my father.

ACKNOWLEDGEMENTS

I thank my major professors, Dr. George W. Bird and Dr. Dean L. Haynes, for their patience, support and encouragement throughout my graduate program.

I thank the members of my committee, Dr. Thomas Edens, Dr. Stuart Gage and Dr. Mark Whalon for their constructive criticism and support.

I am grateful to the many members of the 'Entomology and Nematology Family' at both the Natural Sciences Building and the Pesticide Research Center who have openly shared information and ideas.

I thank the Urban Affairs Programs for their support during my academic career and for the opportunity to interact with professionals and students from a diverse range of disciplines.

I thank my family for their love and encouragement to continue my education.

I also thank my friend, Bill Morgan, for his love, patience and understanding.

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INTRODUCTION

Managers of public buildings, health care facilities and schools face a variety of pest related problems ranging from health hazards and economic destruction to aesthetic damage. Common pests which cause such problems include insects (e.g. ants, cockroaches, flies, fleas, mosquitoes, termites and wasps), vertebrates (e.g. rats, mice, birds and bats), weeds and plant pathogens (National Academy of Science, 1980).

Various tactics and tools are available for control of these pests. Habitat modification includes sanitation, effective food storage, physical exclusion and removal of harborage. Direct suppression is possible by means of trapping, biological control agents and pesticides. These methods can be utilized as part of a comprehensive pest management program called Integrated Pest Management (IPM). IPM consists of the development, use and evaluation of pest control strategies that result in favorable socio-economic and environmental consequences (Olkowski, 1980; Bird et al., 1990). It is a systems approach to reduce pest damage to tolerable levels through the use of techniques selected as appropriate for the situation in which they are to be used. (See Figure 1.) However, despite the variety of available management methods, pesticides are often relied upon as the primary or sole pest control agents (Thorpe, 1988). When less toxic measures are ignored in favor of pesticides, unnecessary public exposure and increased health risks may result (Flint and van den Bosch, 1981).

In recent years, there has been a marked increase in public awareness of potential health hazards and environmental risks associated with pesticide use (Center for the Integration of Applied Sciences, 1981; National Academy of Science, 1980; Environmental Defense Fund and Boyle, 1979; von Rumker et al., 1975). In 1985, Michigan Governor James Blanchard



Figure 1. The IPM Process.

A series of decisions are made during the IPM process. After pest assessment, the intial decision concerns whether or not pest presence is within acceptable limits. If it is not, available control methods are evaluated to determine if any are appropriate for the situation. If none are appropriate, pest presence acceptability must be reassessed to decide if the risk of pest presence itself outweighs the risks of using control methods deemed inappropriate. If, however, pest management methods appropriate for the situation exist, they can be used. Following control implementation, effectiveness of the method(s) used must be evaluated. If effectiveness is found wanting, additional measures may need to be taken. If control is determined to be adequate, no further decision or action is necessary until the next time when pest presence is reassessed.

charged the State Cabinet Council on Environmental Quality with the task of assessing existing pesticide regulations and providing specific recommendations as part of an overall strategy for improving pesticide management and regulation. As a result, the report "A Strategy for Improved Pesticide Management in Michigan" was issued (Michigan Department of Agriculture Pesticide Subcommittee, 1985).

The report highlighted four areas of concern regarding public exposure. These included (1) the nature of state policies that govern the use of pesticides in public buildings, (2) whether existing policies adequately consider pesticide-related health risks to the general public, (3) whether individual chemical hypersensitivity is a significant concern and (4) whether widespread residential and agricultural use of pesticides represents a significant risk to human health or environmental integrity. The Subcommittee proposed ways to minimize human exposure. One recommendation was to "Develop model public building, school and health care facility pest management/pesticide policy guidelines for adoption by appropriate agencies."

In 1987, a preliminary report on "Integrated Pest Management for Michigan Schools" (Larsen et. al., 1987) was prepared by participants of Michigan State University's College of Natural Science Course 447. This report provided an overview of the public school system, reviewed pest data and discussed IPM and its implementation. It was found that little information existed on pest problems and control practices used within schools. Head lice were the only documented pest with over 350,000 cases reported annually to the Michigan Department of Public Health. Other pests said to be problems included cockroaches, rodents, ants and weeds. Management practices were also not documented, but were said to include sanitation and pesticide applications.

The first step in the development of any IPM program is the identification of existing pest problems and control practices. In order to acquire this information, a five part questionnaire was designed to assess (1) perceived pest prevalence, (2) management practices, (3) school personnel involved in making pest management decisions, (4) degree of satisfaction with

practices used and control achieved and (5) the need to implement or improve pest

management guidelines. During the fall of 1987, this questionnaire was distributed to 565

Michigan school district superintendents.

The purpose of this survey was to obtain new information on Michigan public school

districts. It was hypothesized that based on either district size, location or community type:

- * pests perceived as problems by K-12 public schools vary in intensity and variety,
- * control practices used to prevent and manage the pests vary and are also dependent on actual pest presence,
- * different personnel are responsible for pest management execution,
- the level of satisfaction with current pest management efforts and control achieved as well as the amount of concern over pesticide use in the school environment differs in expression,
- different types of pest management records are maintained and kept for different time periods, and
- * interest in new pest management technical assistance and program development varies.

LITERATURE REVIEW

A number of surveys have been conducted to assess general public attitudes, beliefs and behaviors toward pests, pesticides and pest management. These were first conducted at the same time expression of public concern over environmental problems started to show up in polls in the late 1960s (Council on Environmental Quality, 1980).

Surveys on General Public Pesticide Use

Initial surveys focused primarily on pesticide use. Finklea et al (1969) reported that 90% of 196 families surveyed in South Carolina used pesticides in the home and that most users ignored common-sense safety precautions; e.g. 88% did not keep pesticides in a locked area, 66% stored them within reach of small children, and 54% placed them near food or medicine.

In a survey of three urban communities (Philadelphia, PA, Dallas, TX and Lansing, MI), von Rumker et al. (1972) reported that the average deposit of pesticide active ingredients per urban residential acre was between 5.3 and 10.6 pounds. Of 525 respondents, 92.5% reported using pesticides. Eighty-four percent said they did so without reservations, whereas 8.5% indicated concern about possible side effects. Three and a half percent reported believing that birds, bees, etc. were diminishing and/or that pets became sick from the use of pesticides around the house and yard.

Prompted by local interest in public and environmental health aspects of pesticides, the Pennsylvania Allegheny County Health Department was asked to monitor local use and health effects of pesticides and to develop a public education and information program on pest control without pesticides and on safe use of pesticides (Lande, 1975). One hundred ten sites classified as single-family dwellings, commercial and recreational lawns, institutions, farms,

rights-of-way, and wilderness/wastelands were randomly selected for the survey. Of the 41 households and wilderness/wastelands were randomly selected for the survey. Of the 41 households interviewed, 84.6% said they used some pesticide in the previous 12 months. Many were not aware of all the pertinent information on pesticide labels. Only 12% claimed to read everything while 21% said they read nothing. Of the five institutions interviewed, four were schools. Three of these said they employed pest control operators but did not know what insecticides or rodenticides were used. No specific questions were asked regarding public concern over pesticide safety or environmental health risks. The author concluded that no observation in this or any other study supported the need for a new educational program in pesticides or indicated that a substantial segment of the public would use its services. This was in contrast to summaries of subsequent researchers who obtained similar survey results (e.g., Bennett et al, 1983).

Savage et al. (1979) found that among over 8,000 respondents across the nation, 90% reported using pesticides in their home or yard with three times as many using pesticides in their houses than in their yards. Many respondents were not aware of the pesticide they used, less than 50% read labels, and less than 6% went to knowledgeable sources for pest control information. One report conclusion was that "the use of pesticides in the home environment may be a major source of pesticide exposure in the general population. This is of special significance since certain members of the family spend the majority of their time in the home environment."

Surveys on Pests, Pesticides and Pest Control

Later, other researchers began to include questions on the pests themselves in addition to questions on pesticides and pest control. In 1982, the National Pest Control Association Consumer Affairs committee conducted a national opinion survey on pests and pest control by interviewing 1,005 men and women living in private households in the continental United States. The five most frequently named pests were flies, common ants, cockroaches, spiders

and mice (38%, 34%, 30%, 28% and 27% respectively). The pest for which PCOs were most often employed was cockroaches. Termites, spiders, common ants and mice followed. However, relative pest importance (in descending order) was assessed as termites, cockroaches, carpenter ants, ticks and spiders in terms of the percent of households with the pest that employed PCOs.

Three quarters of those interviewed agreed that chemical pesticides can be safely used to rid homes of unwanted pests. However, only 41% agreed that there are relatively few environmental problems related to pest control activies, compared to other industries. Twenty-seven percent disagreed and the remaining 32% had no opinion.

Bennett et al. (1983) surveyed 958 households in North Central Indiana to determine the pattern of pesticide use in homes. They found that 78% of the households used pesticides. Most relied on past experience when obtaining an insecticide, but when assistance was sought, it usually came from a friend or relative. Only 14% obtained pest problem diagnosis information and 77% of this came from retail salespersons. In contrast to the conclusions of Lande (1975) the dramatic lack of knowledge in proper selection and use of pesticides prompted the survey authors to conclude that greater control of the use of pesticides by householders be attained.

Interviewees were also asked about alternate (nonchemical) control measures, awareness of beneficial insects and the frequency of past and present pest problems. Alternate control measures had been tried by 87% with fly swatters and traps mentioned most frequently. Over 72% knew about beneficial insects with praying mantids and ladybugs being mentioned most frequently. Ants were named as the most common current problem by 41.9% of the respondents. Flies, fleas, mosquitoes, mice, hymenoptera, spiders, cockroaches, miscellaneous pests, rats, silverfish and centipedes followed. Termites were named in addition to the preceeding when frequency of past pests was reported.

Byrne et al. (1983) conducted a survey of households in Arizona in order to better understand the public's attitude toward arthropods. Over half of 1,117 households interviewed

said they either disliked or were afraid of outdoor arthropods and 88% were either afraid of or disliked indoor arthropods. Few, only 6%, said they took actual pleasure from arthropods encountered outside the home, whereas fewer still, less than 1%, enjoyed those found inside the home.

Other surveys have focused on specific insects or insect groups. The attitudes and knowledge of Roanoke and Norfolk, Virginia and Baltimore, Maryland public housing residents toward cockroaches was surveyed by Wood et al. (1981). Robinson and Atkins (1983) surveyed the attitudes and knowledge of Virginia Beach, VA homeowners toward mosquitoes. Barrows, et al. (1983) surveyed urban community gardener knowledge of arthropods in vegetable gardens in Washington, D.C.

Surveys to Obtain Information for Pest Management Program Development

G.W. Frankie, et al. (1981b) approached pest and pest management surveys as a means to gain information useful for pest management program development. They developed the concept of using the survey as a tool to allow for quantification of attitudes and practices towards pests and pest control which could be used for more intelligent and informed decision-making by pest managers.

From 1974 to 1976, Frankie and Levenson (1978) first surveyed rural and urban dwellers' attitudes and practices towards insects and insecticides in two Texas cities. Their survey approach was to format questions to allow for evaluation of the "A, B, C's" of attitudes - of how people feel (Affect), act (Behavior) and think (Cognition) about insect problems and insecticides (Kretch et al., 1962).

They found that 55 to 76% of the respondents in each community had at least one indoor or outdoor insect problem. Information on these problems was sought by 54-81% of all interviewees (551 total) with most people going primarily to exterminators (38-51%). Up to 78% said they used chemicals indoors and outdoors while up to 54% said they used nonchemical

control methods. Approximately 2/3rds of the interviewees in both cities said they were aware of beneficial insects.

Twenty-nine to 46% of the interviewees said they had had a change in attitude towards the use of chemicals most saying that they no longer use them or use them cautiously. Commonly cited reasons included personal experience with negative results, reading, broadcast media, and the ecology/environment movement. Examination of the general relationship between attitude and behavior led the researchers to say that the data suggest that affective components (feelings) of insecticide use and insect problems are most closely linked with cognitive factors (thoughts) or amount and type of information and not necessarily with any behavioral manifestations (actions). Their results were consistent with other psychological research on attitude change, which indicate that behavioral change appears to lag behind opinion and information change.

In 1981, Frankie et al. (1981a) surveyed the attitudes and practices of PCOs in Berkeley, CA, Dallas, TX and New Brunswick, NJ toward pests and pesticides. All interviewed PCOs (25 in each location) said they were an important information source for the homeowner. The top six pests in each state included ants, fleas, cockroaches, rodents, and termites. Outdoor pests varied greatly among the states and included ants, white grubs, and stinging insects. Pesticides were found to be the primary tool of the PCOs. Trapping, exclusion, habitat modification and improved sanitation were commonly cited as nonchemical controls. Overall, improved sanitation and habitat modification were the primary ways that PCOs and homeowners combined their efforts. But as homeowners hiring a professional expect the job to be completed as quickly, safely and inexpensively as possible, the PCOs usually relied on pesticides. The authors implied that PCOs were simply responding to market demand. Some PCOs felt that all insects were beneficial in their natural environments. Awareness of the harm that pesticides may cause was generally expressed by many PCOs. Dangers to animals and human health were citied by some, while a few mentioned disruptions to the environment.

Further work by Frankie et al. (1981b) and Levenson and Frankie (1981) detailed homeowner arthropod pest problems, attitudes toward the pests and measures used to control them in Berkeley, CA, Dallas, TX and New Brunswick, NJ. Survey findings suggested that it is possible to develop a profile on those urbanites who, because of their attitudes and behavior, would most likely use IPM technology or implement IPM programs. Characteristics of such a person might include (1) awareness of indoor and outdoor pest problems, (2) ability to tolerate low numbers of at least some pest species, (3) approaches pesticide use with caution, (4) awareness of potential hazards and limitations of pesticide usage, (5) uses some nonchemical means for controlling pests, (6) ability to name more than one beneficial organism in the urban environment, (7) likes some insects, (8) willingness to become involved with own pest control efforts, (9) seeks information on pests from more than one source, and (10) willingness to try new ideas.

Of 601 respondents, 90% said that they have either an indoor or outdoor pest problem with 61% having an indoor pest problem and 56% having an outdoor problem. An average of two pests was mentioned for each habitat. Ants, cockroaches, fleas and flies were among the top five selected in all three communities for indoor pests. Outdoor pests were often location specific such as snails and slugs in Berkeley and chinch bug in Dallas. Other pests such as ants, mosquitoes and wasps were not so restricted. The source of most pest control information came from pest control operators. Most people personally used chemicals both indoors (62%) and outdoors (52%), and a sizable number had professional help (36%) who commonly used chemicals indoors and outdoors. People felt generally satisfied with the information they received about pest problems. They believed that pesticides do good and rarely thought they did harm. While many respondents (47%) said they had changed their attitudes towards greater caution in pesticide use, few (10%) knew the type of chemical used by employed professionals. Half the people (51%) had tried some nonchemical methods to control pests but were

somewhat less satisfied with these methods than with chemical ones. About half the respondents also said that they liked some insects, mainly because of their utilitarian value.

Comparison of the 61% of homeowners having and the 39% not having indoor pest problems (Levenson and Frankie, 1983) showed that those who had indoor insect problems had a greater likelihood of having outdoor pest problems. They were also more likely to have obtained information about pest problems and were more likely personally to use chemicals indoors. In addition, those with an indoor problem used chemicals significantly more frequently indoors. However, they also personally tried more nonchemical means of control. Fifty-one percent of those with indoor problems said that their attitudes had changed versus 40% of those without problems. More people without than with insect problems feit too many chemicals were used in insect control (25% to 11%). It was thought that people who do not have insect problems and thus who are not dependent upon chemicals can "afford" the attitude that we should be more cautious, whereas those who do have insect problems might not have such a cautious attitude.

People who were aware of beneficial insects were also found to be more likely to have had indoor and outdoor pest problems. It was thought that people who have pest problems were more sensitive to the presence of insects and therefore more likely to be aware of and sensitive to beneficial insects. It was also hypothesized that persons with awareness of beneficial insects may go to sources that would be consistent with their own ideas and beliefs. Thus, those who were not aware of beneficial insects might be more likely to seek people who would not inform them about beneficial insects. That is, people who were comfortable reaching for a spray can would seek people for help who were also comfortable with sprays.

Assessing or determining the needs of intended pest management clientele allows for more relevant and effective program development. A pilot effort to transfer integrated pest management (IPM) information on outdoor pests to urban homeowners in Meridian Township, Michigan, was begun in 1979 (Lambur et al., 1981; Fear et al., 1983). The initial component of

Project PEST was a community needs assessment performed by means of a survey which identified types of pest problems experienced, how those problems were addressed, extent of reliance on pesticides and attitudes toward the use of alternatives to pesticides.

In the case of Project PEST, researchers felt they would have "missed the boat" in attempting to deliver IPM information if they had not first determined the homeowners' needs. Knowing these needs allowed the researchers to focus on the plant groups and related pests that the homeowners were most concerned about. It also allowed researchers to develop urban pest management educational materials more in line with the preferences of the respondents (80% of respondents interested in educational materials said they preferred manuals and demonstration yards to the traditional Extension education method of a workshop). In addition, the survey allowed the researchers to gauge respondents' receptivity to basic IPM principles and so determine if IPM could be promoted as a realistic pest management program Over 50% of the respondents indicated that they were willing to (1) accept low levels of pests on their plants, (2) spend more time on pest management and (3) seek out and pay more for resistant plant varieties.

Institutional Pest Management Program Implementation

No major surveys were found in the literature that addressed pest problems and pest management practices of private or governmental institutions. However, implementation of institutional pest management programs has been discussed. Olkowski, et al. (1982), identified nine factors which can serve as psychological barriers to new program adoption in institutional settings. These included (1) inertia over the increased attention and mental effort that change requires, (2) desire to avoid negative implications regarding past decisions and performance suggested by requests to change, (3) fear of loss of personal authority (individuals may fear that their experience in the field will become devalued), (4) fear of loss of supervisory authority if the new program makes the system more efficient and a supervisor loses subordinates, (5) fear of loss of territory should a consultant or an impersonal decision-making procedure be instituted,

(6) fear of job loss (although some pest managers contradicted themselves by claiming that a new pest management program, particularly an IPM program, is too labor-intensive while saying at the same time that it will cause job loss), (7) fear of ridicule should a program be supported that is assumed to be anti-pesticide (as IPM has been incorrectly assessed), (8) imagined difficulty in learning new technology and (9) fear of program failure should supervisory personnel believe that the program will not work even if it has been successful in similar situations.

In 1976, Olkowski, et al. (1978) had worked on development of a model IPM program for the Palo Alto, CA school district. The community had formed an ad hoc parent-teacher committee for the purpose of reducing pesticide use in the schools. This committee met with representatives of the district and the researchers to develop a collaborative pest management effort. Although this led to a number of successful changes in pest management practices which resulted in pesticide reduction, district officials interested in the program found it difficult to find a way to allocate the funds necessary to make full program implementation possible.

Three basic principles that apply in developing institutional urban IPM programs were summarized. These were: (1) One must have control over enough of the system to include the solutions to the problem being presented. For example, classroom cockroach management involves not just custodians but also requires the cooperation of teachers and student as the handling of lunch remains can be part of the problem. (2) It is essential to set up a communication system so that all the divisions or departments of the institution or system know what's going on. For example, a complaint on flies can be due to garbage stuck in the bottom of a school dumpster. A special request would need to be made of the sanitation company to have the material scaped loose and the dumpster washed with soap and water. (3) To be successful a strategy must be designed to provide something useful at every level in the institutional hierarchy. Principals, food service, maintenance and custodial personnel, teachers and students must all be involved and encouraged to cooperate.

Mail Surveys

Most of the preceding surveys were conducted as personal or telephone interviews. Surveys can also be conducted as mailed questionnaries. These have the advantage of taking less researcher time and of being less threatening to respondents. However, without high return and completion rates, the credibility of such survey results are questionable. Heberlein and Baumgartner (1978) reported that mailed survey return rates varied between an average of 46 percent for one mailing and an average of nearly 84 percent for four mailings (initial questionnaire mailing and three follow-ups). The return rates for 38 surveys reported by Dillman (1978), ranged from a low of 58 percent to a high of 94 percent.

The absence of an interviewer means there is no way to gloss over construction deficiencies and there is no way to respond to any respondent queries. Extreme care must be taken in mail survey preparation and implementation. Otherwise, there can be varying and sometimes incorrect interpretations of survey questions. The Total Design Method (TDM) of Dilman (1978) has been developed as a step-by-step procedure for mail (and also teleohone) surveys. It covers details of question writing, questionnaire design, cover and endorsement letters, mailing procedures and follow-up notices.

METHODOLOGY

Questionnaire Development and Distribution

Work on the questionnaire began January 1987 and continued until October 19th when the questionnaire packet was delivered for mail processing. Dillman's Total Design Method for mail and telephone surveys (Dillman, 1978) was used as a guide during preparation and survey implementation, although some procedures were modified or omitted.

Diliman's Total Design Method

The TDM is a step-by-step procedure for mail (and also for telephone) surveys. Generally, the most difficult detail is designing questions which can obtain the kind of information desired. Question writing can be divided into three parts. They are (1) the kind of information sought, (2) the question structure, and (3) the actual choice of words.

Information desired from survey respondents falls into four categories: attitude, belief, behavior and attributes. Attitudes concern how respondents feel about something. Questions are worded to indicate the direction of the respondent's feelings (e.g. favor vs oppose, prefer vs not prefer, good vs bad, right vs wrong, and desirable vs undesirable). Beliefs are what the respondents think to be true, that is, perception of past, present or future reality or actual knowledge of specific facts or opinion on issues for which there is no "correct" answer. Questions designed to acquire this type information are presented as choices (e.g. correct versus incorrect, accurate versus inaccurate, and what happened versus what did not happen). Behavior is what is actually done, or, more accurately, what the respondent perceives (believes) is done. Behavior questions ask respondents to describe actions taken. Attributes are

personal or demographic characteristics. Questions of this type ask respondents to categorize themselves according to specific measures.

Question structure depends upon the nature of the response behavior asked of the respondent. Open-ended questions have no answer choices. Instead respondents create their own answers and state them in their own words. Close-ended questions with order choices have answer choices provided as a gradation of a single dimension of some thought or behavior. Respondents are to select the most appropriate place on the continuum for their response. Close-ended questions with unordered response choices have answer choices provided as discrete, unordered categories from which the respondent must choose the one that best reflects his or her situation. Partially close-ended questions have both provided answer choices and the option for respondents to create their own response.

Question wording can be a challenge. Words must be selected that are uniformly understood. Care must be taken not to assume too much knowledge on the part of the respondent or to assume too much about the respondent's behavior. Questions cannot be too vague or too precise. They should not be objectionable or too demanding. They should not contain unconventional phrases or abbreviations nor should they contain double negatives. Additionally questions should not be double questions, containing more than one concept or request, and answer choices should be mutually exclusive.

The TDM questionnaire design is a 6-1/8" by 8-1/4" booklet. Questions are ordered by importance, similarity in content, continuity of flow from one topic to another and with more objectionable questions placed after less objectionable ones. Very specific recommendations are made for spacing, printing and cover designs. The questionnaire should be pretested on three groups of people. The first group may be described as colleagues, the second consists of potential users of the data and the third are those people drawn from the population to be surveyed.

The questionnaire is mailed with a cover letter that communicates an appeal to the respondent for survey completion. A postcard follow-up is sent to all recipients exactly one week later. A second follow-up is mailed to nonrespondents exactly three weeks after the original mailout and a third and final follow-up is mailed seven weeks after the original mailing.

School District Questionnaire Development.

Desired information (attitude, belief, behavior or attribute) was assessed so that questions could be structured and words selected that might best obtain that type information. Pest prevalence and acceptability included beliefs concerning what a pest is, the damage it does and the situation existing within school facilities. Pest management practices and application involved behavior. Questions about methods used, personnel who apply them, existence of guidelines, employment of pest control companies and maintenance of records all concerned behavior. Satisfaction with control achieved and practices used included both belief and attitude as did questions concerning sources of technical assistance and preparation and execution of new pest management programs. School district attributes to be solicited included the number of school buildings within the district, student enrollment, district community type (urban, suburban and rural) and location (by county).

Questions were ordered along a descending gradient of pest management procedures, with assessment of pest presence occurring before management practices which occurred before evaluation of effectiveness and satisfaction with methods used. The questionnaire was assembled as a 28-page booklet which was 6-1/4" x 8-1/2". No questions appeared on the front or back covers. These spaces were reserved for material that had the specific purpose of stimulating interest in the questionnaire.

Several persons reveiwed the questionnaire as it was being developed. These included MSU faculty and staff (Drs. George Bird, Gary Simmons, Fred Stehr, Donald Newson, Department of Entomology; Dr. Frank Fear, Department of Resource Development; Dr. Bonnie Morrison, Urban Affairs Program; Dr. Bradley Parks, Center for Remote Sensing; Bruce

Montgomery, Doctoral Candidate Department of Educational Administration, Joel Lichty, Specialist, Department of Resource Development; Dr. Michael Lambur, Extension Specialist, Cooperative Extension, Virgina Tech; and Kathleen Cowles, former Michigan education staff member of Center for the Integration of Applied Sciences of John Muir Institute, Berkeley, CA.

In addition, early drafts of the questionnaire were taken to DeWitt, Holt and Lansing School Districts for discussion with key personnel concerning content, format and target audience (individual schools versus entire districts). Mr. Stephan C. Garrett, Superintendent of DeWitt District, felt the questionnaire should be distributed to district superintendents who would after review, be able to direct it to the most appropriate individual within each district for completion. He thought the format was good but that the length might be intimidating.

Dr. Richard J. Halik, Superintendent of Lansing School District, approved of the survey objectives and granted permission to speak with Dr. Clyde Carnegie, principal of Sexton High School. Dr. Carnegie felt the questionnaire was inappropriate on an individual school basis and referred comment back to Dr. Halik. A meeting was then scheduled with Mr. Lee Mason, Assistant Superintendent of Support Services and Mr. Charles Parrish, Custodial Services Director. They both expressed concern about confidentiality stating that many Lansing residents would be upset if they found out that a specific Lansing school admitted to having a cockroach problem. They felt the survey needed to be conducted on a district basis and that they would not support a survey directed toward individual schools. They requested that a letter be sent to them describing the survey's purpose, the individuals/institutions conducting the survey, the use to be made of survey results and a guarantee of anonymity. Mr. Mason said he would forward the letter to Dr. Grace Iverson of Evaluation Services to clear Lansing's participation. A letter was prepared as requested.

Dr. Henry Sienkiewicz, Superintendent of Holt District, referred discussion of the survey to Mr. Ronald Van Ermen, Director of Business Services. Mr. Van Ermen thought the survey was a good idea and that there should be no problem with completion of the questionnaire. He

volunteered to place the survey on the May 13th, Michigan School Business Officials meeting agenda. Members of this organization are involved in school facility planning and management. Copies of the questionnaire along with cover letter were distributed to seven committee members. All indicated that the survey was a good idea and that the questionnaire looked reasonable. MSBO members Mr. James Sneathen (Grand Rapids Public Schools), Mr. Dennis Carpenter (Energy Consultant) and Mr. Van Ermen (Holt School District), were contacted again in September and sent a copy of the finished survey for final comment. All said that they thought there should be no problem with its completion.

To encourage questionnaire completion, a memorandum of endorsement was obtained from Mr. Gary Hawks, Interim Superintendent of Michigan's Department of Education. This was obtained though the assistance of Mr. J.D. Snyder, Environmental Specialist, Office of the Governor. The endorsement accompanied the questionnaire at distribution.

Per University regulations, no survey research can be conducted without approval of the University Committee on Research in Human Subjects (UCRIHS). Therefore, on June 24th, a draft of the questionnaire and cover letter addressed to the School District Superintendents was submitted to Dr. Henry Bredeck, Chairman. Since the data being collected concerned public institutions, request was made that the questionnaire be exempt from full committee review. Exemption was granted and approval given for conduct of the project on June 25, 1987. A copy of the final questionnaire and cover letter was taken to Dr. Bredeck prior to distribution and received verbal approval October 5th.

The questionnaires were mailed with cover letter, memorandum of endorsement and a stamped, preaddressed return envelop to school districts within the state of Michigan on October 19, 1987 (see Appendices A, B and C). Districts which had not responded by the requested November 15 return date, were sent a postcard reminder November 17.

School District Attributes

The State of Michigan is divided into 567 school districts (Figures 2A and 2B) which, according to the 1988 edition of the Michigan Education Directory and Buyers Guide, range in size from 1 to 280 buildings and from 2 to 185,000 students. (Population information was obtained from MSBE Bulletin 1011 for 11 districts and from MSBE Bulletin 1014 for 37 of the districts.)

For comparison purposes, districts were grouped into three classes based on number of buildings. These divisions correlated with degree of management hierarchy pertaining to pest management responsibility (personal communication, Dennis Carpenter, MSBO). In class 1 districts (1 to 3 buildings), the superintendent is in charge of management and supervises actual maintenance. In class 2 districts (4 to 10 buildings), the business manager has ultimate responsibility for pest management while a maintenance director is in charge of actual daily duties. In class 3 districts (11 plus buildings), a hierachy exits with either a separate maintenance supervisor, custodial supervisor, transportation supervisor, etc. under the direction of the business manager (11-20 buildings), or the different supervisors under the direction of a maintenance director who works in cooperation with the business manager (21-30 buildings), or a variety of categorizations based on several criteria including union and nonunion members, all under the coordination of the business manager (30 plus buildings).

The districts were also grouped into 5 classes based on student population: (1) 0-1000, (2) 1001-2500, (3) 2501-5000, (4) 5001-10,000, and (5) 10,000 plus. These divisions were selected to give a distribution for comparison purposes when analyzing questionnaire returns.

The districts were further grouped by location within the state. Southern lower peninsula (SLP) districts reside in counties south of Highway M-46 or in Kent and Muskegon counties. Northern lower peninsula (NLP) districts are those found within the remainder of the lower peninsula. Upper peninsula (UP) districts are those found within counties in the upper peninsula. These divisions were made based on observations expressed by Dennis Carpenter,



Figure 2.A. Michigan Lower Peninsula School Districts.

Districts above the dark line are located in the northern lower peninsula while those below the dark line are in the southern lower peninsula.

Source: Michigan Education Directory and Buyers Guide, 1988.



Figure 2.B. Michigan Upper Peninsula School Districts. Source: Michigan Education Directory and Buyers Guide, 1988.
MSBO. A variety of districts occur in the southern lower peninsula . Typical rural/suburban districts are eight to nine buildings in size while large districts can include 60 to 80 buildings. The Detroit school district alone has 280 buildings (Michigan Education Directory and Buyers Guide, 1988). Many northern lower peninsula districts are three to six buildings in size, although some urban/suburban districts have 15 to 20. The majority of upper peninsula districts are small with one to three buildings. Again, urban/suburban districts are larger with 15 to 20 buildings.

Data Analysis

Data analysis was performed using the SAS PC 6.03 statistical package and the Statview 512⁺ program for the Macintosh. The Chi-Square Goodness of Fit test was used when comparing the observed frequency distribution of a specific response with the expected frequency for classes of the attribute being examined (Conover, 1980). Expected frequencies were calculated by multiplying the number of answering districts within the specific attribute classes by the percent response of all districts. Most comparisons were made with this test. As some districts did not select a response to each question part and as others selected the do not know response, it was decided that the most accurate statistical comparison would be the distribution of those districts selecting positive responses to the expected distribution by attribute class.

Responses to specific questions which tested significantly different for districts grouped by size were examined in futher detail. The proportions of the three classes which selected the tested response were compared to determine which were significantly different from each other. Two proportions were compared at a time by calculating pooled 95% confidence intervals using the formula \hat{p}_1 - $\hat{p}_2 \pm 1.96$ s.e. $(\hat{p}_1-\hat{p}_2)$ with s.e. $(\hat{p}_1-\hat{p}_2)$ equal to the square root of $[\hat{p}_1(1-\hat{p}_1)]/n_1+[\hat{p}_2(1-\hat{p}_2)]/n_2$ (Berry and Lindgren, 1986). Those intervals which included zero supported the null hypothesis of no difference between the two classes.

Chi-Square was also used to test the measure of dependence of categories of data, such as always, often and sometimes or selection of different personnel types, against district classes of

a specific attribute. Pearson's correlation coefficient was used to assess the degree of correlation between types of district attributes or two different responses. ANOVA was used to test for significant differences in the total number of pest problems reported by districts classed by the different attributes and by actual number of school buildings. Student-Newman-Keuls means separation test was used to determine significant differences between levels of independent variables.

RESULTS AND DISCUSSION

Introduction

On October 19, 1987, questionnaires were mailed to all Michigan school districts except for 2 which were accidentally omitted. Of the 569 distributed, 329 or 58%, were returned between October 30th and March 22, 1988. One of these was returned as unusable since a duplicate mailing had been made, three were returned as unusable since the addressed districts had merged with adjacent districts, and 14 were returned incomplete and so could not be included in analysis.

More than half of the returns (70.7%, 220 of 311) were received prior to the November 17th postcard mailing. An additional 45 districts (14.5%) returned their questionnaire during the week immediately following postcard distribution and so could not have been influenced by postcard receipt. Of the 301 districts receiving a timely postcard reminder, an additional 60 (19.3%) returned their questionnaires.

Comparison of Returnee Attributes with All School Districts

Questionnaires were coded with identification numbers so that attributes of the returned questionaires could be compared to the master list of all districts. Comparison of 310 usable returns (54.7% of all districts) to the 567 state school districts showed that they did not differ significantly from the expected distribution of districts according to number of school buildings, student population and location (Table 1, Figure 3). (One district could not be included in this comparison as its identification number had been removed.) Therefore, results obtained from these returns were representative of the entire state school district system.

Attribute	Class	All Dist Numbe	ricts* ir (%)	District: Questic Numbe	s Completing onnaire** r (%)	P-Vatue for Class Distribution Comparison	Attribu Respoi Numbe	es Reported by ding Districts r (%)
Number Buildings								
1-3	-	259	(45.7)	126	(40.6)	0.577	108	(34.7)
4-10 11+	N M	258 50	(45.5) (8.8)	154 30	(49.7) (9.7)		163 40	(52.4) (12.9)
Student Population								
0-1000	-	177	(31.2)	78	(25.2)	0.702	84	(27.0)
1001 - 2500	0	217	(38.3)	124	(40.0)		114	(36.7)
2501 - 5000	ო	113	(19.9)	70	(22.6)		75	(24.1)
5001 -10000	4	39	(6.9)	22	(7.1)		23	(7.4)
10001+	S	21	(3.7)	16	(5.1)		15	(4.8)
Location								
Southern LP	-	337	(59.4)	192	(61.9)	0.874	193	(62.1)
Northern LP	0 0	164 66	(28.9) (11.1)	85 22	(27.4) (27.4)		85 22	(27.3)
	o	00	(/)	? ?	(10.7)		5 5	(0.01)
Community Type								
Urban	-						32	(10.3)
Suburban	0 C						94 10	(30.2)
HURA	n						185	(C.6C)
Total Number of Distr	icts	567		310			311	

Table 1. Attribute Distribution of All School Districts and of Those Returning Questionnaire.

*Attribute class information obtained from the 1988 Edition of the Michigan Education Directory and Buyers Guide. **One district could not be identified and was omitted for comparison purposes.



Figure 3. Attributes of Michigan School Districts. (Size, Location, Student Population)

Information obtained from the Michigan Education Directory and Buyers Guide, 1988. Most (294) of the school districts returning usable questionnaires completed the attribute section concerning number of buildings, student population, location and community type. Those that did not were assigned building (4 districts) and student population (5 districts) values found in the "1988 Michigan Education Directory and Buyers Guide". Omitted locations were determined by district address. Eight districts said they represented more than one community type. These districts, along with 7 others which did not select any community type, were located on a state map. A community type was selected based on city location within the district and comparison with the community type selected by neighboring districts which returned questionnaires.

Attributes of the returnees as reported by the districts varied slightly compared to information in the school district master list. In general, respondents said they were larger when compared by number of buildings and about equally divided between being smaller or larger when compared by student population. For purposes of this study, it was assumed that nonreturnees would have also varied in reporting their school district attributes.

School district population and number of school buildings within a district were closely related. For the 310 usable returns which could be compared to the school district master list, a Pearson correlation coefficient of .9963 was obtained between these two attributes. As pest management practices relate primarily to school buildings, only the school district building attribute along with location and community type were used for comparison of questionnaire answers.

Distribution between building classes was reported as 34.7% (108 districts) for one to three buildings, 52.4% (163) for four to ten buildings, and 12.9% (40) for eleven and more buildings. Location of school districts returning questionnaires was distributed as 62.1% (193) in the southern lower peninsula, SLP, 27.3% (85) in the northern lower peninsula, NLP, and 10.6% (33) in the upper peninsula, UP. Community types were reported as 10.3% (32) urban, 30.2% (94) suburban and 59.5% (185) rural. Figure 4 shows the distribution of the districts by these



Distribution by Size, Location, and Community Type

Figure 4. Reported Michigan School District Attributes.

reported attributes as well as by the actual number of district buildings. Table 2 shows how these different attributes were related.

In general, districts with small building numbers were associated with rural communities while large districts were located in suburban and urban communities. Small districts were predominant in the upper peninsula while large districts occurred primarily in the southern lower peninsula. Mid-sized districts were distributed between community types and occurred in all three locations. A moderate correlation existed between the different attribute types when the actual number of buildings reported by each school district was compared to district location (-0.3469) and to community type (-0.4481). When the building attribute class number was used, these correlations decreased to -0.1559 (location) and to -0.3243 (community type). The correlation of location to community type was 0.2713.

Respondents of 259 of the questionnaires identified themselves by their positions within the districts (Table 3, Figure 5). Eighty-nine of these were administrative, (e.g. superintendent, assistant to the superintendent, principal, business manager, secretary to the board), 165 were support service personnel (e.g. maintenance, custodial, transportation and grounds directors), and five were a combination of two individuals, one administrative and the other support service. Fewer administrators completed questionnaires for the large districts (17.6%) and medium sized ones (27.7%) than did so for the small districts (51.1%). This was expected as the three class divisions were based on information received concerning pest management responsibility (see Methodology).

However, responses made by the two personnel groups may have varied. In particular, administrators may have perceived different pest problems than support service personnel. To test this hypothesis, the average number of pests reported as problems by the different groups for each district size that had at least two of each personnel type responding were compared. Questionnaires completed jointly by an administor and support service person were included with support service responses.

Attribute		Distric Numb	ts er (%)	Distri	cts ber (%)	Districts Numbe	s (%)
Number Building	S	1-3 B	uildings	4-10	Buildings	11+ Bu	ildings
Location	Southern LP						
Community	Urban Suburban Rural	1 7 35	(0.3) (3.2) (11.2)	15 51 51	(4.8) (15.8) (16.4)	10 23 2	(3.2) (7.4) (0.6)
Location	Northern LP						
Community	Urban Suburban Rural	040 040	(0.0) (1.3) (12.5)	1 7 30	(0.3) (2.2) (9.6)	O	(0.3) (0.3) (0.6)
Location	ЧР						
Community	Urban Suburban Rural		(0.6) (0.6) (5.8)	7-2	(0.6) (0.3) (2.2)	००न	(0.0) (0.0) (0.3)
Total Number of	Districts	108		163		40	

Table 2. Attribute Distribution Reported by Districts Completing Questionnaire.

	Num	ber of Districts Report	oorting M	ean ±SD	Differences	
District	Adm	inistrators	Supr	oort Service Staff	Used for	Calculated
Size	Num	Mean+SD	Num	Mean+SD	Testing+	T Values
					looking	
1	17	4.647±3.297	5	3.800±3.493	0.847	0.897
2	15	4.600±2.849	12	5.917±3.704	-1.317	1.865
3	12	4.500±2.067	25	6.840±3.132	-2.340	4.290*
4	19	5.526±2.611	13	8.615±2.663	-3.089	5.280*
5	8	6.625±2.560	21	7.333±3.411	-0.708	1.019
6	3	7.000±4.583	18	7.500±2.728	-0.500	0.386
7	3	7.000±2.646	16	7.000±3.521	0	
8	1	7.000	10	9.400±3.340		
9	1	4.000	12	7.167±2.480		
10	3	7.333±2.517	7	7.283±2.563	0.047	0.043
11	2	3.500±0.707	3	5.333±5.033	-1.833	1.286
12	2	10.500±2.121	1	4.000		
13	0	0.0	1	10.000		
14	0	0	3	10.000±3.000		
15	0	0	5	7.600±4.336		
17	0	0	2	11.000±2.828		
19	0	0	0	0		
20	0	0	0	0		
22	1	8.000	0	0		
24	1	9.000	0	0		
27	0	0	1	8.000		
28	0	0	1	7.000		
30	0	0	1	7.000		
32	0	0	3	7.000±6.083		
33	0	0	2	8.000±5.657		
38	0	0	1	5.000		
44	0	0	1	10.000		
65	0	0	1	10.000		
84	0	0	1	15.000		
280	0	0	1	15.000		
Total Number						
Districts	88		167			

Table 3. Comparison of Number of Pest Problems Reported by Administrator and Support Service Respondents (Mean \pm SD).

*Indicates a significant difference as does bold type. *A P-value of 0.039 was calculated using the Wilcoxon Signed Rank Test.



Figure 5. Distribution of Administrative and Support Services Staff as Questionnaire Respondents By Actual District Building Size.

T-test results showed significant response differences for three and four building districts with support service personnel reporting more pest problems than administrators. A significant difference (p=0.039) was also found when the Wilcoxon Signed Rank Test was used to compare responses of the nine testable district sizes as a group. This indicates that the mean number of reported pest problems for the small sized district group was most affected by the administrators reduced pest perception and that small districts may have actually had more pests and have been more similar to medium sized districts than was determined in the following survey analysis.

Pests Within School Districts

General Pest Occurrence

More than half of 300 responding districts (52.7%) said that pests were a current problem within their school buildings or on their school grounds (Q-1)*. Forty-five percent said that pests had previously been a problem but were not a current problem and 2.3% said pests have never been a problem (Table 4). A significant difference in response was found between districts classed by size and location. More large districts (77.0%) had a current problem than did medium and small ones (54.7% and 40.9%) while more districts in the lower peninsula (56.4% southern, 54.3% northern) had a current problem than did those in the upper peninsula (25.8%). There was no difference in district response when grouped by community. A comparison was made between the proportion of districts for each size class which indicated a current pest presence. A separate comparison was made between the proportion of districts which indicated a previous pest occurrence. The proportion of the size classes which indicated a current pest presence were all significantly different from one another (40.9%-S, 54.7%-M, 77.8%-L), while the proportion of small and medium size districts which indicated a

^{*}The notation (Q-number) refers to the survey question number.

Pest	Districts Selecti	s na	P-Value fo Based on	or Response District:	Selection
Occurrence	Numbe	r (% of 300)	Size	Location	Community
Current	158	(52.7)	0.001*	0.011*	0.441
Previous	135	(45.0)			
Never	7	(2.3)			
	District				

Table 4. Pest Occurrence within School Districts.

Pest	Distric Size	t Distribu	ution (as	Percent o	of Attribu	ite Class) Comn	nunity	
Occurrence	S	М	L	SLP	NLP	UP	U	S	R
Current	40.9	54.7	77.8	56.4	54.3	25.8	51.7	60.4	48.9
Previous	54.3	44.0	22.2	42.5	42.0	67.7	44.8	38.5	48.3
Never	4.8	1.3	0.0	1.1	3.7	6.5	3.5	1.1	2.8
Number of									
Districts	105	159	36	188	81	31	29	91	180

*indicates significant difference between classes of district attribute.

previous pest occurrence were not different from one another but were both different from the proportion of large class districts (54.3%-S, 44.0%-M, 22.2%-L).

Slightly more than 75% of 297 responding districts said that no pests are acceptable, 21.5% said a few are not of concern as long as they do not harm people and 1.3% said there is no concern over pest presence (Table 5). No difference was found in district response for any attribute comparison.

Important Pest Concerns

Head lice was selected as the most important school district concern by 37.4% of 302 responding districts (Q-3, Table 6). Cockroaches, rats, mice, ants and stinging insects followed (19.5%, 8.9%, 7.9%, 6.6% and 6.3%). All other listed pests were selected by fewer than 5% of the districts. Silverfish and communicable diseases were written as 'other' pests. Cockroaches were the only pest for which a significant difference was found in selection for any attribute comparison. It was most important to districts which were large, in the southern lower peninsula and in urban communities. A comparison was made between the proportion of districts for each size class which indicated that cockroaches were the most important school concern. Each proportion was significantly different from the other two (8.6%-S, 20.8%-M, 44.7%-L).

Head lice remained the most important school district concern when districts selecting the different pests as either 1st, 2nd or 3rd in importance were totaled, being selected by 64.6% of the districts (Table 7). Mice became second most important, cockroaches third, stinging insects fourth, ants fifth and rats sixth (46.4%, 42.7%, 36.4%, 31.1%, and 21.9%). Flies and termites (12.3% and 10.9%) followed. All other pests were selected as a 1st, 2nd or 3rd concern by less than 10% of the districts. Silverfish, millipedes, earwigs, hardshelled bugs, ground schools and communicable diseases were written in as 'other' pests. Again, a significant difference was found between district selection of cockroaches when grouped by any attribute. A significant difference also existed for rats, termites and bats when grouped by location and for flies when grouped by community type. Rats and bats were most important to districts in the upper

Number	Distric Selec	ts ting			P-Value Based o	for Res	ponse \$	Selecti	DN
Acceptable	Numb	er (% c	of 297)		Size	Loca	tion	Com	munity
Many	4	(1.3)			0.242	0.46	3	0.25	7
Few	64	(21.	5)						
None	229	(77.	1)						
Number Acceptable	Distric Size S	t Distribu M	ution (as	Percent Locati SLP	of Attribu on NLP	ite Class) Comn U	nunity S	
						·····	· · · · -	··· · ····	
Many	1.0	1.9	0.0	0.5	2.5	3.2	0.0	1.1	1.7
Few	28.2	19.0	13.9	19.9	25.0	22.6	6.9	20.9	24.3
None	70.9	79.1	83.1	79.6	72.5	74.2	93.1	78.0	74.0
Number of									
Districts	103	158	36	186	80	31	29	91	177

Table 5. Number of Pests Acceptable to School Administrators.

<u></u>	District	s Selecting Pest	P-Value for	Selection of Pest	Based on District:
Pest	Numbe	r (% of 302)	Size	Location	Community
Head Lice	113	(37.4)	0.226	0.127	0.359
Cockroaches	59	(19.5)	0.000*	0.004*	0.000*
Rats	27	(8.9)	0.664	0.120	0.857
Mice	24	(7.9)	0.174	0.590	0.102
Ants	20	(6.6)	0.864	0.811	0.126
Stinging Insects	19	(6.3)	0.229	0.730	0.670
Termites	13	(4.3)	.+	•	
Carpenter Ants	7	(2.3)		•	•
Flies	6	(2.0)			•
Bats	5	(1.7)			
Fleas	3	(1.0)		•	
Mosquitoes	2	(0.7)	•	•	
Birds	1	(0.3)	•	•	
Other	3	(1.0)			

Table	6.	Past	Selected	88	the	Most	Important	School	District	Concern.
IGNIG	ν.	L A91	Jelected	a a	1116	moat	mportant	3011001	Distinct	CUILCEIII.

	Distrib	ution of	Districts S	electing Pe	est (as P	ercent of	Attribute C	lass)	
	Size			Locatio	วก่		Comm	unity	
Pest	S	М	L	SLP	NLP	UP	<u> </u>	S	R
Head Lice	44 8	35.2	26.3	31.9	47 6	43.8	25.8	34 1	41 1
Cockroaches	8.6	20.8	44.7	26.1	9.8	6.3	45.2	27.5	11.1
Rats	8.6	10.1	5.3	8.5	6.1	18.8	6.5	9.9	8.9
Mice	3.8	10.1	10.5	8.5	8.5	3.1	0.0	12.1	7.2
Ants	7.6	6.3	5.3	6.4	6.1	9.4	0.0	4.4	8.9
Stinging Insects	9.5	5.0	2.6	6.9	6.1	3.1	3.2	5.5	7.2
Termites	4.8	4.4	2.6	6.4	0.0	3.1	6.5	3.3	4.4
Carpenter Ants	3.8	1.3	2.6	1.1	6.1	0.0	0.0	1.1	3.3
Flies	3.8	1.3	0.0	1.6	3.7	0.0	3.2	0.0	2.8
Bats	1.0	2.5	0.0	1.6	1.2	3.1	6.5	1.1	1.1
Fleas	1.0	1.3	0.0	0.5	2.4	0.0	0.0	0.0	1.7
Mosquitoes	1.0	0.6	0.0	0.0	2.4	0.0	0.0	1.1	0.6
Birds	1.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.6
Other	1.0	1.3	0.0	0.5	0.0	6.3	3.2	2.3	1.1
Number of									
Districts	105	159	38	188	82	32	31	91	180

*Indicates significant difference between classes of district attribute. *No comparison made as fewer than 5 selecting districts in 2 or more attribute classes.

	Districts	Selecting Pest	P-Value for S	Selection of Pest I	Based on District:
Pest	Number	(% of 302)	Size	Location	Community
Head Lice	195	(64.6)	0.252	0.449	0.304
Mice	140	(46.4)	0.267	0.369	0.312
Cockroaches	129	(42.7)	0.000*	0.002*	0.000*
Stinging Insects	110	(36.4)	0 503	0.666	0.545
Ants	94	(31.1)	0.314	0.212	0.164
Bats	66	(21.9)	0 487	0.047*	0 944
Flies	37	(12.3)	0.206	0 171	0.029*
Termites	33	(10.9)	0.224	0.001*	0.304
Camenter Ants	25	(8.3)	0 944	0.821	0.925
Bats	19	(6.3)	0.532	0.007*	0.936
Fleas	11	(3.6)	+	0.007	0.000
Rinds	7	(2.3)	•	•	•
Weeds	7	(2.3)	•	•	•
Mosquitoes	5	(2.5)	•	•	•
Skunke	Å	(1.3)	•	•	•
Outdoor Plant Pasts	2	(0.7)	•	•	•
Outdoor Plant Disease	2 2e 1	(0.7)	•	•	•
Other	7	(0.0)	•	•	•
	1	(2.3)	•	•	•

 Table 7. Pests Selected as One of the Three Most Important District Concerns.

	Distrib	ution of	Districts S	electing Pe	est (as P	ercent of A	Attribute C	lass)	
	Size			Locati	on`		Comm	unity	
Pest	S	М	L	SLP	NLP	UP	U	S	R
Head Lice	72.4	63.5	47.4	60.1	70.7	75.0	45.2	62.6	68.9
Mice	43.8	44.0	63.2	49.5	45.1	31.3	48.4	54.9	41.7
Cockroaches	24.8	47.8	71.1	53.2	26.8	21.9	71.0	58.2	30.0
Stinging Insects	41.9	34.0	31.6	38.3	35.4	28.1	29.0	33.0	39.4
Ants	28.6	35.2	21.1	28.2	40.2	25.0	25.8	23.1	36.1
Rats	25.7	20.8	15.8	20.7	17.1	40.6	22.6	23.1	21.1
Flies	17.1	9.4	10.5	9.6	18.3	12.5	6.5	5.5	16.7
Termites	6.7	13.8	10.5	16.5	1.2	3.1	19.4	11.0	9.4
Carpenter Ants	7.6	8.8	7.9	8.0	9.8	6.3	9.7	8.8	7.8
Bats	5.7	7.5	2.6	3.7	7.3	18.8	6.5	5.5	6.7
Fleas	3.8	3.1	5.3	3.7	4.9	0.0	6.5	1.1	4.4
Birds	1.9	1.9	5.3	1.6	2.4	6.3	3.2	3.3	1.7
Weeds	1.9	3.1	0.0	0.5	6.1	3.0	0.0	3.3	2.2
Mosquitoes	2.9	1.3	0.0	1.6	2.4	0.0	0.0	1.1	2.2
Skunks	1.0	1.3	2.6	0.5	3.7	0.0	0.0	1.1	1.7
Outdoor PP	0.0	1.3	0.0	0.5	0.0	3.1	0.0	0.0	1.1
Outdoor PD	1.0	0.0	0.0	0.0	0.0	3.1	3.2	0.0	0.0
Other	2.9	1.3	5.3	1.6	2.4	6.3	3.2	2.2	2.2
Number of									
Districts	105	159	38	188	82	32	31	91	180

*Indicates significant difference between classes of district attribute. *No comparison made as fewer than 5 selecting districts in 2 or more attribute classes.

peninsula while termites were most important to those in the southern lower peninsula. Flies were most important to rural communities.

Specific Pest Numbers Needing Management

The number of a specific pest that the majority of school districts considered a problem needing management depended on the specific pest (Q-4,Table 8). Although 307 districts responded to the question, several did not respond to each pest (6 to 31). Eighty-two point four percent of the districts answered that the presence of just one rat required action. Head lice, bats, cockroaches, termites and mice also required management with the presence of just one according to the majority of responding districts (70.4%, 60.3%, 56.4%, 52.4% and 49.2%). The percent of districts requiring management for just one of any other pest was below 35%.

Almost 60% of the districts answered that the presence of a few carpenter ants would require action. The majority of districts also selected the presence of a few for other ants, stinging insects, fleas, outdoor plant pests, flies, outdoor plant diseases and birds (58.0%, 54.1%, 53.7%, 47.9%, 45.3%, 41.4% and 34.9%).

About 50% of the districts answered that many mosquitoes and weeds would need to be present before management became necessary (55.0% and 49.2%).

Few significant differences were found in response selection between districts compared by attribute classes. Non-responses were not included in district comparisons. No differences were found in response selection of any pest when compared by district size. Only bat, termite and mice responses were significantly different when compared by district location. More upper peninsula districts selected the presence of a few of these pests than did lower peninsula districts. Stinging insect and mosquito response selections differed significantly between districts grouped by community type. Rural and suburban districts tended to select the presence of a few in the case of stinging insects and many in the case of mosquitoes more often than did urban districts.

	Percent	of 307 Di	stricts Sek	ecting	P-Value Fo	r Selection Of On	e, Few or
Pest		Consider Few	ed a Proble Many	em NR+	Many base Size	d on Uksting.	Community
Rats	82.4	11.4	0.3	5.9	0.129	0.254	0.511
Head Lice	70.4	25.7	1.0	5.0	0.555	0.774	0.951
Bats	60.3	24.1	9.8	5.9	0.476	0.021	0.531
Cockroaches	56.4	38.1	2.3	3.3	0.477	0.773	0.483
Termites	52.4	35.5	5.9	6.2	0.932	0.000	0.377
Mice	49.2	45.6	3.3	2.0	0.356	0.019*	0.239
Carpenter Ants	17.3	59.9	16.6	6.2	0.871	0.450	0.360
Ants	6.2	58.0	32.6	3.3	0.615	0.743	0.469
Stinging Insects	33.9	54.1	8.8	3.3	0.778	0.463	0.011*
Fleas	28.0	53.7	12.1	6.2	0.153	0.972	0.629
Outdoor Plant Pests	9.1	47.9	32.6	10.4	0.548	0.683	0.311
Flies	5.2	45.3	44.3	5.2	0.630	0.908	0.064
Outdoor Plant Diseases	18.9	41.4	29.6	10.1	0.220	0.550	0.363
Birds	24.4	34.9	34.2	6.5	0.998	0.259	0.311
Mosquitoes	3.6	35.2	55.0	6.2	0.316	0.597	0.031*
Weeds	5.9	37.1	49.2	7.8	0.848	0.932	0.802

Table 8. Number of Each Specific Pest Considered a Problem that Must be Managed.

Pest	Number Requiring Management	Percent For Sign SLP	District Di lificant Dif NLP	istribution ferences UP	Pest	Requiring Management	Percent For Sign U	District Di ificant Dif S	stribution ferences R
Bat	One Few Many	69.2 50.3 10.4	56.6 30.3 13.2	51.6 45.2 3.2	Stinging Insects	One Few Many	62.1 34.5 3.5	25.6 63.3 11.1	35.4 55.6 9.0
	Number of Districts	182	76	31		Number of Districts	29	06	178
Termite	One Few Many	60.1 37.2 2.7	45.9 36.5 17.6	54.8 45.2 0	Mosquitoes	One Few Many	0.0 57.1 42.9	7.0 27.9 65.1	2.9 39.1 58.1
	Number of Districts	183	74	31		Number of Districts	28	86	174
Mice	One Few Many	51.3 47.6 1.06	50.6 40.5 8.9	42.4 54.6 3.0					
	Number of Districts	189	79	33					

Table 8 (cont'd).

*+Comparison was made only between districts selecting a response for the specific pest. *Indicates significant difference between classes of district attribute.

Number of Actual Pest Problems

The number of different pests that school districts reported as current or previous problems ranged from 0 to 15 with a total of 1966 for the 306 responding districts and an average of 6.4 per district (Q-5, Table 9). ANOVA of the number of pest problems reported by the districts showed significant differences for districts classed by size, by location and by community type. An average of 5.1 pest problems occurred in one to three building districts, 6.9 pest problems in four to ten building districts and 8.1 pest problems in eleven+ building districts. Southern lower peninsula districts had an average of 7.0 pest problems, northern lower peninsula districts and an average of 5.8 and upper peninsula districts an average of 4.6. Urban districts reported an average of 7.3 pest problems, suburban districts an average of 6.9 and rural districts an average of 6.0.

An ANOVA was also run on the number of pest problems reported by the different districts grouped according to their actual reported district building sizes (Table 10). A significant difference was found but the Student-Newman-Keuls means separation test showed that only the two largest districts (84 and 280 buildings) differed from districts with 19 buildings in their reported number of pest problems. This indicates that the significant difference found for the size class comparisons may have been an artifact of the district grouping.

Seven pests (mice, head lice, ants, stinging insects, flies, weeds and mosquitoes) were indicated as having occurred in all the buildings of 18.6% to 39.9% of the responding districts while other pests were said to have occurred in all the buildings of fewer than 5% of the districts (Table 11). Mice, head lice, ants and stinging insects were said to have occurred in either 1/2 or 3/4ths of the buildings of an additional 10.1% to 19.6% of the districts. Fewer than 10% of the districts said that any of the other listed pests occurred in as many buildings. All the pests were said to occur in at least 1/4 of the buildings of 8.8 to 28.8% of the remaining districts.

Many districts said that none of their buildings had ever experienced certain pest problems. Rats led this category with 72.5% of the districts while head lice was last with only 16.3%. A number of districts did not know whether specific pests were problems. This ranged from a low

Number of Pest Proble	ems N	Districts Number	(% of 306)		Numbe Pest P	r of roblems	Districts Number	(% of 30)6)
0 1 2 3 4 5 6 7		11 12 13 26 23 32 (* 46 (*	(3.6) (3.9) (4.3) (8.5) 12.4) (7.5) 10.5) 15.0)		8 9 10 11 12 13 14 15		23 22 27 8 10 4 8 3	(7.5) (7.2) (8.8) (2.6) (3.3) (1.3) (2.6) (1.0)	
Number of	Distrit (as Po	oution of ercent of	Districts w Attribute C	ith Speci Class)	fied Nun	nber of P	est Proble	ms munity	
Pest Problems	S	М	L	SLP	NLP	UP	U	S	R
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	7.6 7.6 8.5 7.6 13.2 9.4 15.1 12.3 6.6 3.8 2.8 1.9 2.8 0.0 0.9 0.0	1.3 2.5 9.4 10.6 7.5 8.8 18.1 8.8 8.1 11.3 3.8 2.5 1.3 3.1 0.6	2.5 0.0 7.5 17.5 2.5 5.0 10.0 5.0 12.5 15.0 0.0 7.5 5.0 5.0 5.0	2.1 2.1 5.2 5.7 10.4 6.8 10.4 17.2 8.9 8.9 8.9 3.1 3.7 1.0 4.2 1.6	3.7 6.2 2.5 9.9 16.1 12.4 9.9 13.6 4.9 4.9 8.6 2.5 2.5 0.0 0.0	12.1 9.1 3.0 21.2 15.2 0.0 12.1 6.1 6.1 6.1 3.0 9.1 0.0 3.0 0.0 0.0	6.3 6.3 0.0 12.5 3.1 9.4 0.0 15.6 6.3 6.3 12.5 3.1 6.3 0.0 6.3 6.3	3.3 1.1 4.4 8.7 14.1 4.4 8.7 14.1 6.5 10.9 12.0 2.2 3.3 2.2 4.4 0.0	3.3 5.0 5.0 7.7 13.2 8.8 13.2 15.4 8.2 5.5 6.6 2.8 2.8 1.1 1.1 0.6
Number of Districts	106	160	40	192	81	33	32	92	182
Total Number of Pest Problems+	537	1106	323	1345	470	151	235	632	1099
Mean Number of Pest Problems++	5.1a	6.9b	8.1c	7.0a	5.8b	4.6c	7.3a	6.9a	b 6.0b

 Table 9. Number of Different Pest Problems Experienced by School Districts Grouped by Attribute Class.

*There was a total of 1966 pest problems experienced by all 306 districts and an average of 6.4 pest problems for each.

++ANOVA of the number of pest problems reported by the districts showed a **significant difference** for districts classed by size (p = 0.000), by location (p = 0.000) and by community type (p = 0.036). Means followed by the same letter did not test significantly different using Student-Newman-Keuls means separation test.

District Size	Number of Districts	NL 0	umbo 1	er of 2	Dis 3	trict: 4	s Re 5	por 6	ting I 7	Num 8	iber 9	of F 10	Pest	Prol	blerr 13	ns+ 14	15	Mean Number Problems
						4		-		_								0.0.0.
1	28	2	4	3	2	1	2	5	3	1	1	4		1				3.9ab
2	35	3	2	3	2	(2	٥ ۲	3	3	1	1	1	1				5.0ab
3	43		2	3	4	b	b	S		3	2	2		1		1		5.9ab
4	34		T]	5	2	4	1	5	4	3	6	1	٦		~		6./ab
5	34		•]	4	4	2	5	10	1	1	2]	~		3		6.8aD
6	28	1	2	1	1	2	2	6	2	2	4	1	1	2		1		6.6ab
/	23	1			3	5	2		3	3	1	3	_	1	1			6.4ab
8	13				1	1		1	1	2	2	1	2			1	1	8.8ab
9	14				1	2	1	1	5		1	2	1					6.9ab
10	14		1	1		1	1		3	2	1	3			1			7.2ab
11	6	1			1	2		1				1						4.5ab
12	3					1					1			1				8.3ab
13	2											1		1				11.0ab
14	3								1			1			1			10.0ab
15	6					2		1			1	1				1		7.8ab
17	2										1				1			11.0ab
19	1				1													3.0a
20	2								1		1							8.0ab
22	1									1								8.0ab
24	1										1							9.0ab
27	1									1								8.0ab
28	1								1									7.0ab
30	1								1									7.0ab
32	3				1	1										1		8.0ab
33	2					1								1				5.0ab
38	1					•	1							-				5.0ab
44	1						-					1						10.0ab
65	1											1						10.0ab
84	1											•					1	15.0b
280	i																1	15.0b

 Table 10. Comparison of Number of Pest Problems Reported by Districts Grouped by Actual District Building Size.

*ANOVA of number of pest problems reported based on district size showed a significant difference with a P-value = 0.000. Student-Newman-Keuls means separation test showed that districts with 84 and 280 buildings were significantly different in their reporting of number of pest problems from districts of 19 buildings in size. All other district sizes were not significantly different from one another. (Means followed by the same letter were not significantly different from one another.)

	Percent o as Previo	of 306 Distr Jusly or Cur	icts Indicat rently Exp	ing Portior eriencing t	n of Schoo he Specifi	l Buildings ed Pest	5
Pest	None	1/4	1/2	3/4	All	DNK	NR+
Mice	18.3	28.8	15.4	4.9	27.5	3.3	2.0
Head Lice	16.3	25.5	19.6	10.1	18.6	7.2	2.6
Ants	19.0	26.1	15.4	6.2	24.5	6.2	3.3
Stinging Insects	18.3	25.8	15.4	2.6	27.5	7.5	2.9
Flies	23.9	15.0	6.5	3.3	39.9	6.5	4.9
Weeds	28.1	8.8	7.8	2.3	38.2	8.8	5.9
Mosquitoes	43.1	11.8	5.6	1.0	23.2	9.5	5.9
Cockroaches	50.0	20.3	9.5	3.9	4.9	8.2	3.3
Birds	59.5	17.3	3.6	1.0	4.6	8.8	5.2
Bats	63.4	15.4	2.6	0.3	2.0	11.4	4.9
Outdoor Plant Pests	48.7	9.2	3.7	0.7	3.9	23.5	10.8
outdoor Plant Disease	52.0	11.4	1.3	0.3	3.6	21.9	9.5
Carpenter Ants	62.4	10.1	3.3	1.0	2.3	14.7	6.2
Termites	66.3	10.8	4.2	1.3	0.3	12.1	4.9
Fleas	63.7	9.2	2.6	0.3	2.0	17.0	5.2
Rats	72.5	9.8	1.6	0.0	1.6	9.5	4.9

Table 11. Portion of District School Buildings with Pest Problems.

	District	s Indicating	P. Valua fa	Positivo Post	Bracanaa
	Proson		in School B	FUSILIVE FESI	t on District
Pest	Numbe	r (% of 306)	Size	Location	Community
Mice	234	(76.5)	0.304	0.358	0.959
Head Lice	226	(73.9)	0.721	0.551	0.258
Ants	221	(72.2)	0.120	0.260	0.561
Stinging Insects	218	(71.2)	0.102	0.001*	0.790
Flies	198	(64.7)	0.568	0.594	0.322
Weeds	175	(57.2)	0.067	0.337	0.300
Mosquitoes	127	(41.5)	0.987	0.476	0.720
Cockroaches	118	(38.6)	0.000*	0.000*	0.000*
Birds	81	(26.5)	0.020*	0.620	0.040*
Bats	62	(20.3)	0.454	0.309	0.889
Outdoor Plant Pests	52	(17.0)	0.004*	0.012*	0.137
Outdoor Plant Disease	51	(16.7)	0.063	0.068	0.255
Carpenter Ants	51	(16.7)	0.001*	0.037*	0.172
Termites	51	(16.7)	0.133	0.000*	0.002*
Fleas	43	(14.1)	0.006*	0.139	0.022*
Rats	40	(13.1)	0.391	0.981	0.143

Table 11 (cont'd).

	Distribution of Districts Indicating Positive Pest Presence (as Percent of Attribute Class)									
	Size		•	Locat	ion		Comr	nunity		
Pest	S	M	L	SLP	NLP	UP	U	S	<u>R</u>	
Mice	67.0	79.4	90.0	80.7	74.1	57.6	78.1	78.3	75.3	
Head Lice	68.9	77.5	72.5	70.3	82.7	72.7	59.4	69. 6	81.9	
Ants	58.5	79.4	80.0	77.1	69.1	51.5	62.5	79.3	70.3	
Stinging Insects	57.5	76.9	85.0	84.4	56.8	30.3	71.9	76.1	68.7	
Flies	59.4	69.4	60.0	65.6	67.9	51.5	53.1	57.6	70.3	
Weeds	43.4	64.4	65.0	62.0	50.6	45.5	65.6	65.2	51.6	
Mosquitoes	41.5	41.9	40.0	40.1	48.1	33.3	43.8	37.0	43.4	
Roaches	12.3	46.9	75.0	49.5	23.5	12.1	68.8	53.3	25.8	
Birds	21.7	24.4	47.5	28.6	22.2	24.2	37.5	34.8	20.3	
Bats	16.0	23.1	20.0	20.3	16.0	30.3	21.9	21.7	19.2	
Outdoor PP	9.4	17.5	35.0	22.4	7.4	9.1	25.0	19.6	13.7	
Outdoor PD	10.4	18.1	27.5	20.8	9.9	9.1	25.0	21.7	13.2	
Carpenter Ants	6.6	19.4	32.5	20.8	12.3	3.0	25.0	20.7	13.2	
Termites	10.4	19.4	22.5	24.5	4.9	0.0	40.6	15.2	13.2	
Fleas	7.5	14.4	30.0	16.7	12.3	3.0	31.3	13.0	11.5	
Rats	9.4	15.6	12.5	13.0	13.6	12.1	25.0	12.0	11.5	
Number of										
Districts	106	160	40	192	81	33	32	92	182	

*DNK = do not know, NR = no response. **Includes districts selecting 1/4, 1/2, 3/4 and All as estimated portion of school buildings previously or currently experiencing pest problems. *Indicates significant difference between classes of district attribute.

of 3.3% for mice to 17.0% for fleas. Although 306 districts answered the question, several (7 to 33) did not respond to all pests.

Responses to this question were summarized by totaling the number of districts indicating that they currently or previously had problems with the specific pests regardless of the number of buildings involved. Mice were found to be the greatest pest problem with 76.5% of the districts citing its occurrence. Head lice, ants, stinging insects, flies, weeds, mosquitoes, cockroaches, bird and bats followed (73.9%, 72.2%, 71.2%, 64.7%, 57.2%, 41.5%, 38.6%, 26.5% and 20.3%). All other listed pest problems occurred in fewer than 20% of the responding districts. Nineteen districts indicated additional problems with five 'other' arthropods (millipedes, silverfish, earwigs, carpet beetles and spiders), one plant (sand burr) and seven vertebrates (woodchucks, chipmunks, racoons, weasels, gophers, moles and skunks).

A significant difference was found in the presence of stinging insects between districts grouped by location, in the presence of cockroaches between districts grouped by classes of any attribute, and in the presence of bats between districts grouped by size. In general, large sized districts, districts located in the southern lower peninsula and districts in urban communities responded more frequently as having these specific pest problems. As noted in Table 11, additional significant differences existed for pests which occurred in fewer than 20% of the districts.

To examine the prevalence of pest problems in more detail, the actual number of school buildings experiencing each particular pest was calculated by multipling the portion indicated as having problems by the number of buildings reported within each district. Flies were found to be most prevalent with half (50.8%) of 2389 buildings affected (Table 12). Mice, weeds, ants, stinging insects, head lice, roaches and mosquitoes followed (47.1%, 45.1%, 42.2%, 39.1%, 35.2%, 31.5% and 28.5%). All other listed pests occurred in fewer than 15% of all school buildings.

	School Bu with Speci	uildings ified Pest+	P-Value for Pest Based	Number of Bu	ildings with
Pest	Number	(%)	Size	Location	Community
Flips	1214	(50.8)	0 492	0 194	0.000*
Mice	1125	(47.1)	0.520	0.046*	0.281
Weeds	1076	(45.1)	0.000*	0.166	0.000*
Ants	1008	(42.2)	0.048*	0.077	0.000*
Stinging Insects	934	(39.1)	0.000*	0.001*	0.000*
Head Lice	841	(35.2)	0.000*	0.000*	0.000*
Cockroaches	753	(31.5)	0.000*	0.000*	0.000*
Mosquitoes	681	(28.5)	0.301	0.156	0.020*
Birds	349	(14.6)	0.000*	0.187	0.000*
Outdoor Plant Pests	314	(13.1)	0.000*	0.000*	0.000*
Outdoor Plant Disease	280	(11.7)	0.000*	0.001*	0.000*
Carpenter Ants	256	(10.7)	0.000*	0.006*	0.000*
Fleas	236	(9.9)	0.000*	0.013*	0.000*
Termites	214	(9.0)	0.000*	0.000*	0.000*
Bats	210	(8.8)	0.074	0.003*	0.000*
Rats	123	(5.1)	0.665	0.873	0.000*

Table 12. Pest Occurrence within District School Buildings.

	Distrib	ution of	Buildings	Experienci	ng Pest	(as Perce	nt of Attrib	ute Clas	s)
	Size		•	Locati	on	•	Comm	unity	•
Pest	S	М	L	SLP	NLP	UP	U	S	R
Flipe	46.8	52 5	50 1	50 G	54 7	40 5	53 3	41 7	59 1
Mice	42.2	47.3	47.8	48 0	46 5	30.8	50.3	45.2	45 9
Woode	25 1	52 5	207	40.0	50.9	40.0	36.0	51 A	A7 0
Ante	20 5	JJ.J 16 0	39.1	44.2	JU.0 46 4	30.1	27.5	525	47.0
Stinging Incode	A 9 9	40.0	31.0	42.0	20.4	16 2	27.5	40.2	40.5
	42.0	47.1	31.4	40.5	30.0	10.3	29.0	40.2	4/./
Head Lice	40.5	43.1	27.3	32.7	42.5	50.1	27.1	31.0	47.9
Cockroaches	8.0	20.1	46.1	35.6	17.4	6.1	57.8	22.2	15.3
Mosquitoes	30.0	30.2	26.8	27.6	31.1	36.4	30.5	24.5	31.1
Birds	11.0	10.2	19.1	15.2	11.2	15.3	19.4	15.3	8.8
Outdoor PP	6.5	7.7	19.1	14.9	6.1	5.1	20.5	10.5	8.6
Outdoor PD	6.7	7.6	16.3	13.1	6.6	5.1	19.6	8.6	7.2
Carpenter Ants	4.3	8.0	14.3	11.7	7.9	2.9	17.0	8.5	6.8
Fleas	4.5	5.4	14.8	10.6	8.7	1.5	18.5	5.5	6.2
Termites	5.4	6.9	11.5	10.9	1.6	0.0	16.1	5.1	6.2
Rate	7 4	75	10.2	9 1	5 4	16.3	13 1	6 1	7 6
Data	2.4	7.J E 0	5.2	J .1	3.4	10.0	0 5	2 4	2 0
nais	3.9	5.3	5.3	5.2	4.9	4.1	0.3	3.4	3.0
Number of									
Buildings	227	1005	1157	1917	369	103	768	880	741

*Number of infested buildings determined by multipling the portion (0, 0.25, 0.50, 0.75 or 1.00) of buildings said to be infested by the total number of buildings for each district and summing the products. Percent of buildings infested calculated by dividing the number of infested buildings by the total number of buildings (2389) reported by the 306 responding districts. *Indicates significant difference between classes of district attribute. Many comparisons of number of buildings with positive pest presence were significantly different for districts classed by any attribute. Exceptions were flies, mice, ants, mosquitoes, bats and rats for districts grouped by size; flies, weeds, ants, mosquitoes, birds and rats for districts grouped by location; and mice for districts grouped by community.

When pest presence was compared to actual district building size, the reporting of pest presence became an all or nothing response for most districts above 17 buildings (Figure 6). In order to assess the influence of actual district building size on each specific pest's presence, regression analyses were performed on the percent of all buildings reported as infested for each district building size against the actual district size transformed to the log scale (Figure 7). Data outliers were not eliminated as each response was unique and characteristic of the district involved. The presence of cockroaches, fleas, head lice and stinging insects were the only pests for which a significant correlation to actual district building size was found to exist (Table 13). The number of buildings with cockroaches and fleas increased as actual district building size increased while the number of buildings with head lice and stinging insects decreased. Mean \pm sd for percent of buildings with pest presence for non-significant regression analyses ranged from 6.96 \pm 8.56% for bats to 46.16 \pm 29.59% for weeds.

Results of this analysis of pest presence showed fewer significant differences between district responses than did the analysis using the three district size classes of small, medium and large. This means that the increase or decrease of a specific pest's presence over actual district building size was not reported uniformly implying that certain districts had pest problems regardless of size. Interpretation of the results of the analysis of pest presence by small, medium and large district sizes must be tempered with the awareness that significance may be due to this district grouping as there was a trend for more of the buildings in the districts within at least one of the three sizes to be infested with the pest under consideration.

Overall (Q-1) and specific pest presence (Q-5) were compared to verify that districts saying they currently or previously had pest problems did actually list specific pests as problems and



Figure 6. Distribution of Districts Reporting Specific Pest Presence as Proportion of All Responding Districts by Actual Building Size.



Figure 6. (cont'd).



Figure 6. (cont'd).



Figure 7. Regression Analysis for Percent Pest Presence Against Log of Actual District Building Size.



Figure 7. (cont'd).



Figure 7. (cont'd).

	Rearessio	n Coefficient	s		
Pest	Intercept	P-Value	Slope	P-Value	
Carpenter Ants	2.593	0.723	7.274	0.210	
Other Ants	47.475	0.000*	-3.026	0.743	
Cockroaches	-0.901	0.914	24.291	0.001*	
Fleas	-0.949	0.822	8.423	0.016*	
Flies	50.072	0.001*	-6.957	0.499	
Head Lice	50.497	0.000*	-16.118	0.004*	
Mosquitoes	35.058	0.000*	-10.347	0.141	
Stinging Insects	50.163	0.000*	-11.560	0.020*	
Termites	1.713	0.810	5.692	0.312	
Bats	4.060	0.333	2.488	0.447	
Birds	9.999	0.178	5.114	0.374	
Mice	44.051	0.000*	-0.583	0.941	
Rats	2.171	0.506	1.859	0.466	
Weeds	54.044	0.001*	-6.678	0.555	
Outdoor Plant Disease	0.433	0.965	9.382	0.235	
Outdoor Plant Pests	2.710	0.795	10.413	0.209	

Table 13. Regression Analyses Results for Percent of District School Buildings
with Pest Presence Against Log of Actual District Building Size and
Mean ± SD of the Percent of District School Buildings with Pest
Presence for Non-Significant Results.

Pe	est	Mean ± SD	
Ca	irpenter Ants	11.18 ±15.33	
Ot	her Ants	43.90 ±24.08	
Fli	es	41.85 ±26.96	
Ma	osquitoes	22.84 ±18.68	
Te	rmites	8.44 ± 14.82	
Ba	ts	6.96 ± 8.56	
Bir	rds	16.04 ±15.11	
Mi	Ce	43.36 ±20.79	
Ra	ts	4.37 ± 6.69	
W	eeds	16.16 ±29.59	
Οι	Itdoor Plant Diseases	11.51 ±20.86	
Ou	Itdoor Insect Pests	14.34 ±21.91	

*indicates significant difference as does bold type.

that those which said they'd never had a pest problem did not list any specific ones. It was found that 155 of the 158 districts which answered that they currently had a pest problem did indeed select specific pests as infesting a percentage of their school buildings. The three that did not select any specific pests did not respond to the question. Of the 135 districts which answered that they previously had pest problems, 124 selected specific pests as infesting or having infested buildings within their district. Four districts did not know if any of the pests were or had been a problem, five districts said that no buildings had ever been infested with any of the pests and two districts did not respond to the question. Of the seven districts which responded that they had never had a pest problem, only one said that they had none of the specific pest problems. The other six all selected at least one pest problem as currently or previously occurring within some or all of their school buildings. This inconsistency may indicate that some districts think they have a general problem but deny specific pest presence while others may not wish to acknowledge a general pest presence but do respond when questioned about specific pests.

Correlation between the importance of a specific pest (Q-3) and its presence within a district (Q-5) was low. A Pearson correlation coefficient less than ± 0.29805 was obtained for all pests. Correlation between a pest's rated importance and the actual number of district buildings said to be infested with the particular pest was just as low.

The correlation between pest number needing management (Q-4) and specific pest presence (Q-5) was also low, less than ± 0.21466 for all pests. Correlations were just as low for pest number considered to be a problem and actual number of buildings said to be infested with the particular pest.

Pest Problem Locations

Few districts (less than 4% of 308) indicated that pests were always found within each of the different building locations (Q-6, Table 14). The number of districts indicating that pests were often found within each location was also low, 0.3 to 21.1%. Pests were most frequently
	Percent Pest Oc	of 308 Di currence	stricts Selectin	g Frequer ed Locatio	ncy of on		
Location	Always	Often	Sometimes	Never	DNK	NA	NR+
School Kitchen	4.2	19.8	61.4	75	1.6	1.9	36
Cafeteria	2.9	21.1	60.7	7.8	1.0	2.3	4.2
Classrooms	2.3	8.4	73.1	8.4	3.2	1.0	3.6
Home Ec Room	1.0	12.3	59.4	12.3	4.9	5.2	4.9
Aministration Offices	0.6	2.3	58.4	27.3	2.6	2.9	5.8
Gym Locker Room	1.0	9.4	50.3	21.1	6.8	4.9	6.5
Téacher's Lounge	0.6	4.2	52.6	25.0	7.1	3.2	7.1
Boiler Room	0.3	5.5	51.3	27.6	5.5	2.6	7.1
Custodial Closets	0.3	4.9	48.1	26.9	8.8	3.9	7.1
Restrooms	0.3	4.2	46.1	33.4	5.8	3.9	6.2
Gymnasium	0.3	2.6	44.2	35.1	7.5	3.2	7.1
Book Lockers	0.3	5.2	36.7	30.2	13.3	7.5	6.8
Shop Room	0.3	1.0	36.4	35.1	13.3	6.5	7.5
Library	0.3	0.3	36.7	40.6	10.7	4.2	7.1
Art Room	0.6	0.6	33.4	38.0	12.3	6.5	8.4
Pool Area	0.0	1.9	9.4	22.1	2.9	56.5	7.1

Table 14. Indoor School Building Locations with Pest Problems.

	Distri Pest	cts with Positive Presence within	P-Value fo	or Selection of F	Positive Pest
	Spec	ified Location++	Presence	Based on Distri	ct:
	Num	per (% of)	Size	Location	Community
School Kitchen	263	(87.1 of 302)	0.923	0.246	0.931
Cafeteria	261	(86.7 of 301)	0.944	0.517	0.887
Classrooms	258	(84.6 of 305)	0.984	0.782	0.852
Home Ec Room	224	(76.7 of 292)	0.673	0.002*	0.851
Administration Offices	189	(63.2 of 299)	0.243	0.271	0.690
Gym Locker Room	187	(63.8 of 293)	0.261	0.718	0.259
Teacher's Lounge	177	(59.4 of 298)	0.200	0.216	0.490
Boiler Room	176	(58.7 of 300)	0.732	0.400	0.902
Custodial Closets	164	(55.4 of 296)	0.978	0.548	0.461
Restrooms	156	(52.7 of 296)	0.601	0.937	0.245
Gymnasium	145	(48.7 of 298)	0.932	0.738	0.565
Book Lockers	130	(45.6 of 285)	0.819	0.140	0.553
Shop Room	116	(40.3 of 288)	0.672	0.889	0.804
Library	115	(39.0 of 295)	0.838	0.816	0.901
Art Room	107	(37.2 of 299)	0.950	0.420	0.787
Pool Area	35	(26.1 of 134)	0.707	0.842	0.192

Table 14 (cont'd).

	Distrib (as Pe	ution of rcent of	Districts Attribute	Experiencin Class)	g Pests	Within Spe	cified Loc	cation	
	Śize			Locatio	on		Comm	unity	
Location	S	M	L	SLP	NLP	UP	U	S	<u>R</u>
School Kitchen	84.2	88.2	90.0	90.1	90.1	60.0	87.1	90.1	85.6
Cafeteria	84.2	88.1	87.5	90.1	85.2	69.0	93.5	87.8	85.0
Classrooms	85.6	84.5	82.5	81.8	89.0	90.3	83.9	80.2	86.9
Home Ec Room	72.8	76.3	87.5	96.2	80.2	46.4*	80.6	80.0	74.3
Admin. Offices	53.0	66.7	75.0	66.8	63.0	41.9	74.2	60.0	62.9
Gym Locker Room	58.3	62.4	82.5	66.7	59.5	57.1	77.4	71.1	57.6
Teacher'sLounge	53.9	58.0	79.5	64.9	53.2	41.9	67.7	65.2	55.1
Boiler Room	56.7	57.7	67.5	62.8	53.8	45.2	64.5	58.4	57.8
Custodial Closets	54.5	55.4	57.5	57.7	55.1	41.9	67.7	58.9	51.4
Restrooms	57.8	51.3	45.0	53.5	52.6	48.4	64.5	42.5	55.6
Gymnasium	48.0	48.1	52.5	51.1	44.3	45.2	61.3	47.8	46.9
Book Lockers	43.2	45.7	51.3	50.3	42.7	24.1	58.1	44.3	44.0
Shop Room	44.7	39.0	35.0	41.8	36.4	40.7	35.5	38.2	42.3
Library	42.0	37.4	37.5	38.8	41.0	34.5	41.9	37.1	39.4
Art Room	36.8	36.6	40.0	38.5	39.5	23.3	43.3	34.5	37.4
Pool Area	18.8	26.1	27.5	27.7	24.0	20.0	43.5	24.1	21.1
Maximum Number									
of Districts	107	161	40	192	84	32	31	92	185

+DNK = do not know, NA = location not applicable, NR = no response.

++Includes districts selecting Always, Often or Sometimes as frequency of pest occurrence.
 Percent calculated based on total number of districts responding to the question less those indicating location not applicable to their district.
 *Indicates significant difference between classes of district attribute.

reported as being sometimes present in all locations (33.4% to 61.4%) except pool areas which were not applicable for 56.5% of the districts.

Except for home economics rooms, classrooms, cafeterias and kitchens, pests were said to have never occurred in the different areas for 20% to 38% of the districts. Only 12.3%, 8.4%, 7.8% and 7.5% of the districts indicated respectively that home economics rooms, classrooms, cafeterias and kitchens have never had a pest problem. Do not know and not applicable responses varied between 1.0 and 13.3%. Three districts responded with not applicable to classroom locations. Two of these districts have two school buildings each while the third has only one. It is not clear why their response was not applicable unless they misunderstood question instructions and meant that the location was 'not applicable' as pests have never occurred in their classrooms. Not applicable responses for all other locations were credible.

Positive responses to pest presence were totaled for each location. These frequencies were compared to the total number of districts responding to at least one part of the question less those districts which indicated that the specific location was not applicable for their district. Just over 87% of these districts listed school kitchens making it the most commontly pest inhabited area. This location was followed by cafeterias, classrooms, home economics rooms, administration offices, gym locker rooms, teacher's lounges, boiler rooms, custodial closets and restrooms (86.7,84.6, 76.7, 63.2, 63.8, 59.4, 58.7, 55.4 and 52.7%). Only six locations were indicated as having pest problems in fewer than 50% of the responding districts. These were gymnasiums, book locker areas, shop rooms, libraries, art rooms and pool areas.

A significant difference was found between attribute classes for positive pest presence in home economics rooms when districts were grouped by location. Ninety-six point two percent of southern lower peninsula districts indicated pest presence compared to 46.4% of upper peninsula districts.

Pests were reported as occurring in the different outdoor areas by 64.7 to 78.0% of the total number of districts responding to at least one part of the question less those districts which

indicated that the specific location was not applicable for their district (Q-7, Table 15). Few of the 301 responding districts indicated that pests were always found in such locations (1.7% to 3.3%). Up to 13.6% said that pests were found often and 41.9% to 53.5% said they were found sometimes. No significant differences were found between districts indicating positive pest present for any location by any attribute grouping.

Specific Outdoor Plant Disease and Pest Problems

Many outdoor plant disease and insect pest problems were listed (Q-8, Q-9). Forty-four districts wrote in responses to outdoor plant disease though only sixteen listed actual diseases. These included anthracnose, brown leaf, dutch elm disease, fusarium (grass), leaf spot, a maple tree disease, mold, oak blight, pine tree disease (white pine blight, diplodia), round spot, spruce galls, and tree fungus.

One hundred forty-three disticts listed pests in response to outdoor insect problems. Only 20 districts actually named pests of outdoor plants. These pests included aphids, bagworms, black clicker bugs, boring insects, box elder bugs, bugs on honey locust, caterpillars, centipedes, earwigs, grubs, gypsy moth, mealybugs, scale on ornamental plums, spider mites (in general and on pine), and tent caterpillars.

Summary

Eighty-seven tests for differences between responses to pest presence questions were performed for each district attribute. The trend in response selection was usually an increase in frequency of positive response (importance or presence) and a decrease in the tolerable number of pests from small to medium to large districts, from southern lower peninsula to northern lower peninsula to upper peninsula districts, and from rural to suburban to urban districts. Twenty-one significant differences were found for responses grouped by district size, 26 significant differences were found for responses grouped by district location and 25

	Percent Pest Oc	of 301 Di	stricts Selectii in each Speci	ng Frequer	ncy of		
Location	Always	Often	Sometimes	s Never	DNK	NA	NR+
Playgrounds Athletic Fields Landscaped Areas	3.0 3.3 2.7	13.0 13.6 9.6	53.5 50.2 52.2	17.9 16.9 16.6	8.6 9.6 8.6	1.0 3.7 5.0	3.0 2.7 5.3
Turf Areas	1.7	7.6	41.9	19.6	11.3	11.0	7.0
	Distric Pest F Outdo Numb	ts with Po Presence or Locatio er (% of)	sitive within on++	P-Value fe Pest Pres Size	or Selecti ence Bas Locati	on of Po ed on D ion (sitive istrict: Community
Playgrounds Athlethic Fields Landscaped Areas Turf Areas	209 (202 (194 (154 (78.0 of 20 69.7 of 20 67.8 of 20 64.7 of 20	68) 90) 86) 38)	0.281 0.858 0.414 0.143	0.258 0.857 0.460 0.185	B 7 6 5	0.266 0.626 0.941 0.321
<u></u>							

Table 15. Outdoor School Building Locations with Pest Problems.

	Distrib (as Pe	oution of arcent of	Districts E Attribute C	xperiencin Class)	g Pests	in Specifi	ed Locatio	n	
	Śize			Locati	on		Comm	unity	
	S	М	L	SLP	NLP	UP	U	S	R
Playgrounds	67.6	70.7	74.4	71.3	70.9	61.3	69.0	66.3	72.3
Athletic Fields Landscaped	66.0	72.0	69.2	71.2	68.8	62.1	72.4	62.6	72.9
Areas	61.1	73.9	60.5	72.4	60.8	58.1	65.5	65.9	69.3
Turf Areas	48.3	62.5	59.5	61.3	52.1	45.8	53.6	59.1	57.2
Maximum Numbe	ər								
of Districts	103	159	39	189	81	31	30	92	179

+DNK = do not know, NA = location not applicable, NR = no response.
 ++Includes districts selecting Always, Often or Sometimes as frequency of pest occurrence.
 Percent calculated based on total number of districts responding to the question less those indicating location not applicable to their district.

significant differences were also found for responses grouped by district community type. The same responses were often significantly different for each of the three comparisons.

Districts grouped by size differed significantly in their reporting of general pest occurrence. They also differed in their selection of cockroaches as being an important as well as a major school district concern (selected as the single most important concern as well as one of the top three concerns). Reporting of the positive occurrence of five pests within the districts in general and of eleven pests within specific numbers of school buildings were significantly different. Three exceptions to the usual frequency trend were for the number of buildings reported as having weeds, head lice and stinging insects. Medium sized districts reported greater occurrence of these pests than did large ones.

Districts grouped by location also differed significantly in their reporting of general pest occurrence and in their selection of cockroaches as the most important school district concern. In addition, they differed significantly in their selection of cockroaches, rats, bats and termites as major school district concerns. Reporting of positive occurrence of five pests within the districts in general and of ten pests within specific numbers of school buildings was significantly different. Four exceptions to the usual trend in frequency of positive response selection occurred. Upper peninsula districts selected bats and rats more frequently as major district concerns and reported head lice and bats as occurring in more school buildings.

The selection of cockroaches as the most important district concern was significantly different for districts grouped by community type. This grouping also differed in their selection of cockroaches and flies as a major district concern. The concern over flies was expressed most often by rural districts. The frequencies of positive selection for four district pest occurrences and for 15 building pest occurrences were significantly different. Exceptions to the usual frequency trend occurred for mosquitoes, flies, stinging insects, head lice and weeds. More rural districts reported the first four pests while more suburban districts reported weeds.

All district groupings showed a significant difference in the number of reported pest problems. Only one significant difference in the selection of pest problem locations was found. This was for home economics rooms for districts grouped by location.

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Pest Management Methods

Methods Used for Pest Prevention and Pest Management

District Response Selections. The methods districts selected as preferred for prevention and management depended upon the pest under consideration (Q-10, Q-11). Method selections included change in sanitation practices, facility repair or modification, change in turf/ landscape care, use of traps, use of pesticides and education to encourage students, teachers and school personnel to reduce pest presence by changing habits. Some districts identified 'other' methods or indicated do not know or no method used.

Three hundred two districts selected prevention methods while 294 selected ones for management (Table 16). Some districts did not select methods for each pest. Up to 29.8% did not select prevention methods and up to 33.3% did not select management methods. Districts which did not select prevention methods often did not select management methods (ranging from 74.1% for head lice and 95.8% for ants other than carpenter ants). Many of these districts indicated earlier in the questionnaire (Q-5) that the specific pest under consideration had never been a problem within their district (30.0% for head lice to 66.7% for cockroaches).

A few districts selected prevention methods but did not select management methods (2.2% for stinging insects to 9.0% for outdoor insect pests) while a few others selected management methods but none for prevention (from 0.4% for ants to 3.3% for birds and rats). These districts may not differentiate between prevention and management. Or, they may utilize the methods as selected, not needing to manage the pest where a problem does not exist or to prevent a problem from developing where one already exists.

Other districts selected a primary prevention or management method but not a secondary one (up to 42.1% for prevention and 42.2% for management). These districts added to those that made no response revealed that more than 50% of the districts did not select secondary prevention and management methods for ten of the pests and more than 75% did not select secondary methods for the other six. Because of this low response, only the most preferred methods were examined further.

Table 16. Preferred Pest Prevention and Pest Management Methods.

		Percen	t of 302 D Manag	istricts Solution	electing f	^o reventio	n Method	s and of	294 Distri	icts		
Pest	Importance	San	Fac	Fnd	Тр тр	Cid	Ed	đ	Dnk	W	RN	NS
Carp. Ants												
Prevent Manage	Primary	15.2 10.5	8.9 6.8	0.0 0.0	2.0 1.0	29.5 38.8	1.3 0.3	2.0 2.0	14.6 13.6	2.6 2.4	23.5 24.5	
Prevent Manage	Secondary	7.3 9.5	8.6 10.5	1.0	3.6 2.0	16.9 12.6	4.6 3.4	0.3	2.0 0.7	3.3 2.4	23.5 24.5	28.8 32.0
Other Ants												
Prevent Manage	Primary	25.5 18.3	3.3 3.1	1.0 0.0	5.0 5.1	41.1 53.7	6.3 1.0	2.0 4.0	6.3 5.4	1.7	7.9 10.2	
Prevent Manage	Secondary	10.9 18.4	7.0 7.8	1.3 1.7	7.3 5.4	23.5 17.0	11.3 10.2	0.3 0.7	1.7 0.7	2.0 2.0	7.9 10.2	26.8 25.9
Cockroache	Sé											
Prevent Manage	Primary	32.8 21.1	5.0 5.0	0.0	1 .0 2 .0	34.1 43.2	2.0 1.0	2.0 3.1	7.3 6.5	1.3 0.7	17.2 20.4	
Prevent Manage	Secondary	13.2 17.0	3.0 4.8	0.0 0.7	4 .0 3.1	23.2 17.7	10.6 10.2	0.7 0.3	1.7 0.3	2.3 1.7	17.2 20.4	24.2 23.8
Fleas												
Prevent Manage	Primary	20.5 13.6	1.7 1.4	0.3 0.0	0.0 0.0	18.2 26.9	9.6 7.8	1.3 2.4	17.2 15.6	5.0 4.1	25.5 28.2	
Prevent Manage	Secondary	9.0 9.0	2.6 3.7	0.3 0.7	0.3 0.7	14.9 11.2	8.9 7.1	1.0 1.0	3.0 1.4	2.0 4.0	25.5 28.2	31.5 34.0

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Pest	Importance	San	Fac	Lnd	đ	Cid	Ed	ер О	Dnk	MN	R	NS
Flies												
Prevent Manage	Primary	31.5 22.1	8.6 5.8	0.0	1.3	27.8 40.8	5.6 4.1	0.7 1.4	7.6 5.8	0.7 0.7	16.2 18.4	
Prevent Manage	Secondary	10.9 4.3	6.0 8.2	0.0 0.3	3.0 3.1	21.9 18.4	12.6 8.2	1.0 0.7	1.3 1.0	2.0 1.4	16.2 18.4	25.2 26.2
Headlice												
Prevent Manage	Primary	29.8 24.2	1.0	0.0 0.3	0.0	8.9 14.3	42.4 40.1	4.0 4.8	3.0 3.1	2.0 2.0	8.9 10.2	
Prevent Manage	Secondary	19.2 22.1	1.3 1.7	0.0	1.0 0.7	11.3 10.5	21.9 21.4	2.3	1.0 0.0	2.0 1.7	8.9 10.2	31.1 28.9
Mosquitoe	6											
Prevent Manage	Primary	16.6 10.5	10.0 7.8	2.6 4.4	0.0 0.0	28.1 33.0	2.0 1.0	1.0	18.2 17.7	1.7	19.9 22.1	
Prevent Manage	Secondary	4 .0 5.8	6.3 7.8	3.6 3.1	1.3 1.4	15.2 11.9	6.0 5.1	1.0	2.6 1.4	2.6 1.7	19.9 22.1	37. 4 38.8
Stinging In	sects											
Prevent Manage	Primary	9.6 6.5	18.2 13.6	2.0 1.4	0.3 0.3	41.4 51.7	2.3 2.0	2.6 3.1	7.3 6.5	1.0 0.7	15.2 14.3	
Prevent Manage	Secondary	5.3 6.1	8.9 15.3	2.0 2.4	0.7 2.0	19.2 14.3	6.3 5.1	1.3	1.7 0.7	3.3 1.7	15.2 14.3	36.1 37.1
Termites												
Prevent Manage	Primary	5.3 5.1	12.6 9.5	0.7 0.0	0.0 0.0	30.1 34.0	0.0 0.0	3.1 3.1	17.9 16.3	3.6 4.4	26.5 27.6	

Table 16 (cont'd).

Pest	Importance	San	Fac	Lnd	đ	Cid	Ed	Å	Dnk	M	RN	NS
Termites												
Prevent Manage	Secondary	2.3 4.5	12.6 13.6	1.3 1.4	0.7 0.7	12.6 10.9	0.4 4.	0.0	2.6 1.7	2.3	26.5 27.6	38.1 37.8
Bats												
Prevent Manage	Primary	4.0 3.4	26.5 22.8	0.3 0.0	5.6 7.8	5.0 5.8	0.7 0.7	2.3 2.4	25.5 23.1	4.3 5.8	25.8 28.2	
Prevent Manage	Secondary	1.7	6.0 7.5	0.0 0.0	8.9 8.5	5.0 3.4	2.0 2.0	0.7 0.7	3.0 3.4	5.3 3.1	25.8 28.2	40.7 41.5
Birds												
Prevent Manage	Primary	4.0 2.7	28.1 25.9	0.7 0.0	5.3 7.5	2.6 3.7	0.3	1.0 4.1	26.5 24.5	4.0 4.4	27.5 29.3	
Prevent Manage	Secondary	2.0	7.0 6.5	0.0 0.3	7.9 7.8	4.0 3.1	3.0 2.7	0.3 0.3	3.0 2.4	3.0 3.1	27.5 29.3	42.4 41.8
Mice Prevent Manage	Primary	19.9 12.9	16.6 14.3	0.0 0.3	37.7 41.8	10.9 15.3	3.3 0.7	1.7 2.4	2.3 1.0	0.3 0.3	7.3 10.9	
Prevent Manage	Secondary	10.6 12.6	9.9 10.9	1.0	25.2 20.7	12.9 11.6	9.9 8.5	0. F 0. F	1.0 0.7	2.0	7.3 10.9	19.2 21.1
Rats												
Prevent Manage	Primary	15.6 9.5	14.6 11.6	0.0 0.3	22.2 25.9	7.6 11.9	1.7 0.3	1.7 2.4	10.9 10.2	7.1 7.1	24.2 26.2	
Prevent Manage	Secondary	7.0 8.2	6.6 8.5	1.0 4.1	19.9 16.0	7.9 7.8	5.6 4.8	1.0 0.7	0.7 0.3	2.3 0.7	24.2 26.2	23.8 25.5

Table 16 (cont'd).

Pest	Importance	San	Fac	Lnd	đ	Cid	Ed	đ	Dnk	¥	£	SN
Weed												
Prevent Manage	Primary	3.0 2.4	1.7 0.7	34.8 31.6	0.7 0.3	29.8 32.0	0.0	1.0 4.	8.S 8.5	0.7 0.7	20.2 22.4	
Prevent Manage	Secondary	1.7 0.7	2.3 3.4	10.9 10.2	0.7 0.3	16.6 12.6	1.3 1.4	0.7 0.7	2.6 2.4	3.6 3.1	20.2 22.4	39.4 42.9
Outdoor F Disease	lant											
Prevent Manage	Primary	3.0 2.4	1.0 0.3	21.9 18.7	0.3 0.3	15.2 17.7	0.0 0.0	1.0 2.0	21.9 21.1	6.0 5.8	29.8 31.6	
Prevent Manage	Secondary	0.7 0.7	1.7	5.6 6.8	0.7 0.3	11.6 8.5	1.7 4.1	0.3 0.7	3.0 1.7	3.0 4.4	29.8 31.6	42.1 42.2
Outdoor F Pests	olant											
Prevent Manage	Primary	3.6 3.1	1.7 0.7	17.6 14.3	0.0	19.2 21.1	0.7 0.0	1.3 1.7	21.5 20.4	5.6 5.4	28.8 33.3	
Prevent Manage	Secondary	0.3 0.7	2.0 1.4	6.0 7.8	0.7 0.3	14.6 9.5	0.7 1.4	0.3 1.0	3.0 1.0	2.6 3.1	28.8 33.3	41.1 40.5

+San = sanitation, Fac = facility repair/or modification, Lnd = modification of turf/landscape care practices, Trp = traps, Cid = pesticides, Ed = encouragement of school members to change habits so as to discourage pests, Oth = other, DNK = Do Not Know, NM = No Method, NR = no response to the specific pest, NS = no second preferred method.

Pesticides were selected most frequently as the preferred method for prevention and management of carpenter ants, other ants, cockroaches, mosquitoes, stinging insects, termites, and outdoor plant pests. Pesticides were also selected most frequently for management of fleas, flies, and weeds with sanitation selected most frequently as the preferred prevention method for fleas and flies and modification of landscape care practices selected for weed prevention. Education was selected most frequently for head lice prevention and management; facility modification was most often selected for bats and birds; traps were favored for mice and rats and change in landscape care practice was preferred for outdoor plant disease.

Methods written in as 'other' referred most often to the use of private pest control companies or contractors (79.1% of the 86 prevention and 71.8% of the 110 management write-ins). Inspections for and parental and public health department involvement with head lice accounted for an additional 11.6% prevention and 11.0% management write-ins. The remaining 'other' methods included destruction of nests for stinging insects (3 prevention and 2 management), brooms for bats (1 prevention) and electronic pest controllers for bats (1 prevention and 1 management). Inspections were listed as being used to help prevent carpenter ants (1 district) and termites (2 districts) and to help manage carpenter ants, other ants, roaches, termites, bats, plant diseases, and plant insects (1 district each except termites with 2). Two districts wrote that they use a variety of methods for the control of roaches, fleas, flies, mosquitoes, stinging insects, bats, and birds (1 response each) and 1 district wrote that it uses whatever method local farmers advise for the management of outdoor plant diseases.

Only those districts selecting actual methods were compared by attribute to determine if significant differences existed in method preference for the specific pests (Table 17). Any method chosen by fewer than 15 districts was included as part of the 'other' category. This created data sets with different method categories depending on the pest. For example, only sanitation, pesticides and 'other' methods were compared for cockroaches whereas sanitation, facility modification, traps, pesticides and 'other' methods were compared for mice.

	Primary Pr	evention Me	thod	Primary Ma	nagement M	ethod
Pest	Size	Location	Community	Size	Location	Community
Carp. Ant	0.388	0.669	0.965	0.546	0.367	0.519
Other Ants	0.082	0.511	0.241	0.221	0.107	0.739
Cockroaches	0.393	0.026*	0.422	0.060	0.381	0.369
Fleas	0.300	0.660	0.997	0.023*	0.638	0.518
Flies	0.842	0.809	0.509	0.316	0.964	0.730
Headlice	0.037*	0.815	0.883	0.633	0.409	0.683
Mosquitoes	0.133	0.317	0.201	0.162	0.427	0.209
Sting Insects	0.894	0.186	0.993	0.446	0.349	0.901
Termites	0.085	0.195	0.910	0.230	0.679++	0.992
Bats	0.940	0.692	0.183	0.823	0.578	0.718
Birds	0.824	0.611	0.137	0.805	0.251	0.802
Mice	0.404	0.843	0.044*	0.266	0.677	0.107
Rats	0.030*	0.413	0.005*	0.287	0.561	0.485
Weeds	0.134	0.883	0.909	0.012*	0.952	0.626
Outdoor Plant						
Diseases	0.461	0.585	0.329	0.496	0.828	0.854
Outdoor Plant						
Pests	0.446	0.140	0.108	0.826	0.945	0.245

Table 17. P-Values for Selection of Preferred Pest Prevention and Management Methods Based on District Attribute Class.+

Pest	District	Distribu Method	tion of [s (as Pe	Districts vercent of	with Sigr Attribute	nificantly Class)+	Differer ++	nt Preferre	be
Prevention	Туре	San	Fac	Lnd	Trp	Cid	Ed	Oth	Tot
Headlice	Small	33.0				33	56 0	77	91
	Medium	37.8	•	•	•	15.6	43.0	3.7	135
	Large	26.5	•	•	•	8.8	55.9	8.8	34
Rats	Small	18.6	33.9		32.2	6.8	•	8.5	59
	Medium	29.8	15.4		39.4	11.5		3.8	104
	Large	17.9	28.6	•	25.0	25.0	•	3.6	28
Roaches	SLP	38.4				51.7		7.9	151
	NLP	58.2				36.4	•	5.5	55
	UP	50.0	•			27.8	•	22.2	18
Mice	Urban	16.7	20.0		26.7	23.3		13.3	30
	Suburban	26.5	16.9		34.9	15.7		6.0	83
	Rural	20.8	18.9	•	48.4	8.2	•	3.8	159
Rats	Urban	12.0	24.0		20.0	28.0		16.0	25
	Suburban	33.3	17.6	•	29.4	15.7	•	3.9	51
	Rural	23.5	25.2	•	40.9	7.0	•	3.5	115

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Pest Management	District Type	San	Fac	Lnd	Тгр	Cid	Ed	Oth	Tot
Fleas	Small	23.1		•	•	46.2	17.3	13.5	52
	Medium	24.0			•	62.7	9.3	4.0	75
	Large	38.5	•	•	•	30.8	26.9	3.8	26
Weeds	Small			32.8		56.3		7.8	64
	Medium			48.6		47.6		3.8	105
	Large	•	•	65.6	•	25.0	•	0.0	32

⁺The categories DNK (Do Not Know), NM (No Method) and NR (No Response) of Table 16 were not part of the comparison. Any method chosen by fewer than 15 districts (5% in Table 16) was included with the Other (Oth) category.

++Comparison was made between SLP and NLP districts as fewer than 5 UP districts selected methods.

+++San = sanitation, Fac = facility repair/or modification, Lnd = modification of turf/landscape care practices, Trp = traps, Cid = pesticides, Ed = encouragement of school members to change habits so as to discourage pests, Oth = other, Tot = number of districts within each district type. *Indicates significant difference between classes of district attribute. When districts were compared by size, methods used to prevent both head lice and rats were found to be significantly different with medium sized districts selecting pesticides more and education less for head lice and large sized districts selecting pesticides more and traps less for rats. Cockroach prevention methods were significantly different for districts compared by location. Southern lower peninsula districts selected sanitation less and pesticides more frequently than either northern lower peninsula or upper peninsula districts. Methods preferred to prevent mice and rats were significantly different between districts compared by community type. Traps were preferred more and pesticides less in rural districts while suburban districts selected sanitation more often than did either rural or urban.

Selected management methods were significantly different for two pests and only when the districts were compared by size. Pesticides were preferred more and education less in medium-sized districts for flea management while pesticides were preferred less and landscape practice modification more in large districts for weed management.

For all pests, pesticides were more preferred for management than for prevention. Similarly, use of traps for bats, birds, mice and rats was listed more often for management than for prevention. 'Other' methods were also more preferred for management than for prevention but some of the responses were questionable. Although eleven additional districts that did not employ pest control companies for prevention wrote that they did so for management, twelve additional districts wrote that they either inspected for the pest (not actually management at all) or used a variety of methods (basically a do not know response).

<u>Comparison of Prevention and Management Methods</u>. In order to examine the relationship between prevention and management methods, the responses of only those districts answering both questions were analyzed (Table 18, Figure 8). Since districts experiencing problems with a particular pest may prefer methods other than the ones said to be preferred by districts which have never experienced the pest, responses were further separated into two groups, those with and those without the specific pests as determined by answers to Q-5.

Pest	Distric San	t Selecti Fac	on of Pre Lnd	eferred Trp	Method Cid	(as Perce Ed	ent of To Oth	otal)++ Dnk	NM	Tot
Carp. Ants										
Prevent	20.5	11.9	0.5	2.7	37.4	1.8	2.7	19.2	3.2	219
With	19.6	4.3	0.0	4.3	60.9	4.3	0.0	6.5	0.0	46
Without	20.3	16.7	0.7	2.2	28.3	1.4	3.6	23.9	2.9	138
Manage	14.2	9.1	0.0	1.4	52.1	0.5	2.7	17.4	2.7	219
With	21.7	6.5	0.0	4.3	63.0	0.0	2.2	2.2	0.0	46
Without	12.3	12.3	0.0	0.7	47.8	0.7	2.9	21.0	2.2	138
Other Ants										
Prevent	28.2	3.8	1.1	5.0	43.9	7.3	2.3	6.9	1.5	262
With	28.8	3.5	0.5	6.1	46.5	9.1	1.0	3.5	1.0	198
Without	28.6	7.1	4.8	2.4	28.6	0.0	4.8	19.0	4.8	42
Manage	19.8	3.4	0.0	5.7	59.9	1.1	2.7	6.1	1.1	262
With	21.2	2.5	0.0	6.6	64.1	1.5	1.5	2.0	0.5	198
Without	16.7	9.5	0.0	4.7	40.5	0.0	4.8	19.0	4.8	42
Cockroaches										
Prevent	40.3	2.6	0.4	1.3	40.8	2.1	2.1	8.6	1.7	233
With	33.6	0.9	0.0	0.9	58.2	4.5	0.0	1.8	0.0	110
Without	44.7	4.9	1.0	1.9	24.3	0.0	3.9	15.5	3.9	103
Manage	26.2	2.6	0.0	2.6	54.5	1.3	3.9	8.2	0.9	233
With	29.1	0.9	0.0	2.7	61.8	1.8	2.7	0.9	0.0	110
Without	21.4	4.9	0.0	1.9	49.5	1.0	4.9	14.6	1.9	103
Fleas										
Prevent	28.2	2.4	0.5	0.5	23.9	12.4	1.9	23.4	6.7	209
With	27.3	3.0	0.0	0.0	45.5	18.2	0.0	6.1	0.0	33
Without	30.4	3.0	0.7	0.7	20.0	11.1	2.2	25.2	6.7	135
Manage	19.1	1.9	0.0	0.0	37.3	11.0	3.3	22.0	5.3	209
With	27.3	0.0	0.0	0.0	51.5	15.2	3.0	3.0	0.0	33
Without	18.5	3.0	0.0	0.0	35.6	11.1	3.0	24.4	4.4	135
Flies										
Prevent	37.8	10.1	0.0	1.7	34.0	6.7	0.8	8.0	0.8	238
With	33.7	12.4	0.0	1.2	39.1	5.9	0.0	6.5	1.2	169
Without	52.1	4.2	0.0	2.1	16.7	10.4	2.1	12.5	0.0	48
Manage	26.5	7.1	0.0	1.3	50.4	5.0	1.7	7.1	0.8	238
With	23.7	8.3	0.0	0.6	55.6	5.9	0.6	4.1	1.2	169
Without	37.5	4.2	0.0	2.1	33.3	2.1	4.2	16.7	0.0	48

Table 18.Methods Preferred by Districts Selecting Responses for Both Pest
Prevention and Management with Districts Grouped as All Districts,
Those Reporting Presence of the Specific Pest and Those Reporting
No Presence of the Specific Pest.*

Table 18 (c	ont'd).
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Pest	San	Fac	Lnd	Тгр	Cid	Ed	Oth	Dnk	NM	Tot
Headlice										
Prevent	33.1	1.2	0.0	0.0	10.0	46.2	4.6	3.1	1.9	260
With	35.5	1.0	0.0	0.0	10.0	46.0	4.0	2.0	1.5	200
Without	31.6	2.6	0.0	0.0	7.9	42.1	7.9	5.3	2.6	38
Manage	26.9	1.2	0.4	0.0	15.8	45.0	5.4	3.1	2.3	260
With	29.0	1.0	0.5	0.0	15.5	45.0	5.5	1.5	2.0	200
Without	26.3	2.6	0.0	0.0	7.9	44.7	5.3	10.5	2.6	38
Mosquitoes										
Prevent	20.7	11.0	3.5	0.0	35.7	2.6	1.3	22.9	2.2	227
With	16.8	11.5	1.8	0.0	47.8	1.8	0.0	18.6	1.8	113
Without	26.4	11.5	4.6	0.0	25.3	3.4	1.1	25.3	2.3	87
Manage	13.7	10.1	5.7	0.0	41.9	1.3	2.2	22.9	2.2	227
With	13.3	10.6	5.3	0.0	47.8	1.8	0.9	16.8	3.5	113
Without	16.1	11.5	5.7	0.0	35.6	1.1	2.3	26.4	1.1	87
Stinging Ins	ects									
Prevent	11.7	21.9	2.4	0.4	48.6	2.4	2.8	8.5	1.2	247
With	10.4	22.9	2.1	0.0	52.1	2.6	2.1	7.3	0.5	192
Without	22.9	20.0	2.9	0.0	31.4	0.0	2.9	14.3	5.7	35
Manage	7.7	15.8	1.6	0.4	59.9	2.4	3.6	7.7	0.8	247
With	8.3	14.1	2.1	0.0	64.6	2.6	3.1	4.7	0.5	192
Without	8.6	28.6	0.0	0.0	34.3	0.0	2.9	22.9	2.9	35
Termites										
Prevent	7.6	17.6	1.0	0.0	40.0	0.5	3.8	24.3	5.2	210
With	2.2	19.6	2.2	0.0	63.0	0.0	6.5	6.5	0.0	46
Without	10.0	19.3	0.7	0.0	32.1	0.7	2.9	27.9	6.4	140
Manage	7.1	12.4	0.0	0.0	47.1	0.0	4.3	22.9	6.2	210
With	8.7	17.4	0.0	0.0	63.0	0.0	6.5	4.3	0.0	46
Without	7.9	12.9	0.0	0.0	42.1	0.0	3.6	26.4	7.1	140
Bats										
Prevent	5.7	35.4	0.5	6.7	7.2	1.0	2.9	34.5	6.2	209
With	5.7	43.4	1.9	15.1	3.8	0.0	7.5	22.6	0.0	53
Without	6.9	32.3	0.0	3.8	6.2	1.5	0.8	39.2	9.2	130
Manage	4.8	31.6	0.0	11.0	8.1	1.0	3.3	32.1	8.1	209
With	9.4	35.8	0.0	18.9	7.5	0.0	7.5	15.1	5.7	53
Without	3.8	30.0	0.0	9.2	4.6	1.5	1.5	40.0	9.2	130

Table 18 (cont'd).

Pest	San	Fac	Lnd	Тгр	Cid	Ed	Oth	Dnk	NM	Tot
Birds										
Prevent	5.5	38.5	1.0	7.5	4.0	0.5	1.0	36.5	5.5	200
With	1.7	55.0	1.7	8.3	6.7	0.0	0.0	21.7	5.0	60
Without	8.2	32.8	0.8	6.6	2.5	0.0	0.8	42.6	5.7	122
Manage	4.0	37.5	0.0	11.0	4.5	1.0	1.5	35.0	5.5	200
With	3.3	53.3	0.0	11.7	6.7	0.0	0.0	23.3	1.7	60
Without	4.9	30.3	0.0	11.5	2.5	0.8	1.6	41.0	7.4	122
Mice										
Prevent	21.6	18.5	0.0	40.5	11.6	3.1	1.9	2.3	0.4	259
With	22.0	17.1	0.0	41.0	13.7	3.4	1.5	1.5	0.0	205
Without	23.7	28.9	0.0	26.3	5.3	2.6	2.6	7.9	2.6	38
Manage	14.3	15.8	0.4	47.1	17.4	0.8	2.7	1.2	0.4	259
With	14.6	14.1	0.0	47.8	20.0	1.0	2.4	0.0	0.0	205
Without	15.8	28.9	0.0	34.2	7.9	0.0	2.6	7.9	2.6	38
Rats										
Prevent	20.9	19.0	0.0	28.9	10.0	2.4	2.4	14.2	2.4	211
With	13.5	8.1	0.0	45.9	13.5	2.7	2.7	10.8	2.7	37
Without	22.5	21.9	0.0	23.8	9.9	2.0	2.0	15.9	2.0	151
Manage	12.8	14.7	0.0	35.5	16.6	0.4	3.3	14.2	2.4	211
With	8.1	13.5	0.0	43.2	21.6	0.0	5.4	5.4	2.7	37
Without	13.9	14.6	0.0	33.8	15.2	0.7	2.6	17.9	1.3	151
Weeds										
Prevent	4.0	1.8	43.1	0.4	38.2	0.0	1.3	10.2	0.9	225
With	0.7	2.1	46.8	0.0	44.0	0.0	0.7	5.7	0.0	141
Without	11.9	1.7	40.7	0.0	20.3	0.0	1.7	20.3	3.4	59
Manage	3.1	0.9	40.0	0.4	41.8	0.0	1.8	11.1	0.9	225
With	1.4	0.7	42.6	0.0	48.2	0.0	1.4	5.7	0.0	141
Without	8.5	1.7	39.0	0.0	22.0	0.0	1.7	23.7	3.4	59
Outdoor Pla Disease	nt									
Prevent	4.0	1.5	30.8	0.5	21.7	0.0	1.5	31.8	8.1	198
With	2.3	2.3	41.9	0.0	25.6	0.0	2.3	20.9	4.7	43
Without	7.0	1.0	33.0	0.0	13.0	0.0	1.0	37.0	8.0	100
Manage	3.5	0.5	27.3	0.5	25.8	0.0	3.0	30.8	8.6	198
With	4.7	0.0	34.9	0.0	34.9	0.0	4.7	20.9	0.0	43
Without	5.0	1.0	31.0	0.0	15.0	0.0	2.0	37.0	9.0	100

Tabl	e 1	B (C	ont'	d).
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Pest	San	Fac	Lnd	Тгр	Cid	Ed	Oth	Dnk	NM	Tot
Outdoor Plai Pests	nt									
Prevent	5.2	2.6	24.2	0.0	26.8	0.5	1.5	32.0	7.2	194
With	2.3	4.7	32.6	0.0	39.5	2.3	0.0	14.0	4.7	43
Without	9.0	2.2	28.1	0.0	16.9	0.0	1.1	37.1	5.6	89
Manage	4.6	1.0	21.6	0.0	31.4	0.0	2.6	30.4	8.2	194
With	4.7	0.0	30.2	0.0	48.8	0.0	2.3	9.3	4.7	43
Without	6.7	2.2	27.0	0.0	16.9	0.0	1.1	38.2	7.9	89

*Only districts selecting both prevention and management methods were included. Districts were grouped as all districts (Prevent and Manage categories), those who said they have or have previously experienced the specific pest problem (With) and those who said they have never experienced the specific pest problem (Without).

+++San = sanitation, Fac = facility repair/or modification, Lnd = modification of turf/landscape care practices, Trp = traps, Cid = pesticides, Ed = encouragement of school members to change habits so as to discourage pests, Oth = other, DNK = Do Not Know, NM = No Method, Tot = number of districts providing responses for each grouping.







Do Not Know

Other

Landscape No Method Pesticides Sanitation



Except for head lice, pesticide treatment was the most preferred method of prevention and management for districts having the specific insect pests. For districts without these pests, pesticide treatment was also the most preferred method for prevention and management of carpenter ants, other ants, stinging insects and termites and for management of cockroaches, fleas and mosquitoes. The majority of districts without cockroaches, fleas, flies and mosquitoes preferred sanitation for their prevention and for the management of flies. Education was most preferred by all districts for prevention and management of head lice.

The majority of districts with bats and birds preferred facility modification for prevention and management while the majority of those without these pests did not know what method was preferred. Traps were most preferred for prevention and management in districts with mice and rat problems, whereas facility modification, sanitation and traps were almost equally preferred for prevention in districts without the rodents, with traps and facility modification most preferred for management of mice and traps most preferred for management of mass most preferred for management of mass most preferred for management of mass.

The use of pesticides and modification of landscape practices were most preferred for prevention and management by districts with weeds. Those without preferred modification of landscape practices twice as often as pesticide use. The majority of districts with outdoor plant disease problems preferred modification of landscape practices for prevention and the use of pesticides as well as modification of landscape practices for management. Most districts experiencing outdoor insect plant pest problems preferred the use of pesticides or modification of landscape practice for both prevention and management. The majority of districts without these disease or insect problems either did not know what method was used or preferred landscape practice change.

For almost every pest, pesticides were selected as appropriate for management and prevention more frequently by districts actually having problems with that pest than by districts without them. Pesticides were also selected more frequently by all districts as a management than as a prevention method. Except for bats, birds, mosquitoes, outdoor plant diseases and

outdoor insect pests, all pests of low importance, few districts which actually have specific pest problems said that they did not know what method was used for prevention or management.

Statistical comparisons were made only between districts which actually selected methods, with those methods chosen by fewer than 10 districts being included as part of the 'other' category (Table 19). Methods preferred by districts with a specific pest were compared to those preferred by districts without the pest. Significant differences were found between methods used by districts for the prevention of carpenter ants, other ants, cockroaches, flies, mosquitoes and weed prevention and for the management of flies, stinging insects and weeds. Districts experiencing certain pest problems did use different methods than did those without the pest, particularly for prevention.

Comparisons were also made between preferred prevention methods and preferred management methods. When no distinction was made between districts concerning pest presence, methods preferred for carpenter ants, other ants, cockroaches, fleas, flies, mice and rats tested significantly different. However, when methods selected only by districts with the specific pests were compared, methods preferred to prevent and manage other ants were the only comparison found to be significantly different. The use of similar methods to both prevent and manage existing pests could mean that once a problem develops, prevention is no longer a separate issue. Methods said to be preferred by districts without the pests were significantly different for carpenter ants, cockroaches, fleas and rats.

Pest Management Guidelines

Of 307 respondees, 19.2% said that written guidelines exist that specify what should be done when pest problems occur, 75.9% said they had no guidelines and 4.9% did not know. Four districts chose not to answer the question. A significant difference was found between district's responding yes when compared by size (Table 20). More than twice as many large districts said they have written guidelines compared to small and medium sized districts (42.5% compared to 13.2% and 17.4%). These proportions were compared to each other to determine

	Methods & with Pest & Methods &	Selected by Districts Compared to Selected by Districts	Prevention Methods Compared to Management Methods Selected by: Districts Districts					
	Without P	est for:	All	With	Without			
Pest	Preventio	n Management	Districts	Pest	Pest			
Carpenter Ants	0.012*	0.416	0.016*	0.988	0.008*			
Other Ants	0.005*	0.076	0.000*	0.002*	0.337			
Cockroaches	0.000*	0.312	0.007*	0.695	0.001*			
Fleas	0.158	0.799	0.020*	0.978	0.021*			
Flies	0.006*	0.012*	0.007*	0.056	0.113			
Headlice	0.562	0.758	0.151	0.224	0.891			
Mosquitoes	0.011*	0.768	0.220	0.487	0.294			
Stinging Insects	0.086	0.023*	0.155	0.124	0.375			
Termites	0.063	0.948	0.337	0.827	0.248			
Bats	0.111	0.689	0.566	0.612	0.336			
Birds	0.137	0.418	0.764	0.845	0.416			
Mice	0.092	0.074	0.024*	0.108	0.803			
Rats	0.052	0.729	0.035*	0.718	0.047*			
Weeds	0.001*	0.004*	0.820	0.755	0.951			
Outdoor Plant								
Diseases	0.520	0.289	0.744	0.615	0.866			
Outdoor Plant								
Pests	0.162	0.051	0.730	0.761	0.975			

Table 19. P-Values for Selection of Prevention and Management Methods Based on Pest Presence⁺

	Pest	Distribut Methods	Distribution of Districts with Significantly Different Preferred Methods (as Percent of Total)+++								
Pest	Presence	San	Fac	Lnd	Тгр	Cid	Ed	Oth	Tot		
Prevention:											
Carp. Ants	With Without	20.9 27.7	4.7 22.8	•	•	65.1 38.6	•	9.3 10.9	43 101		
Other Ants	With Without	30.2 37.85	3.7 9.4	•	6.3 3.1	48.7 37.5	9.5 0.0	1.6 12.5	189 32		
Roaches	With Without	34.3 55.4	•	•	•	59.3 30.1	•	6.5 14.5	108 83		
Flies	With Without	36.5 59.5	13.5 4.8	•	•	42.3 19.0	6.4 11.9	1.3 4.8	156 42		
Mosquitoes	With Without	21.1 36.5	14.4 15.9	•		60.0 34.9	•	4.4 12.7	90 63		
Manage:											
Flies	With Without	25.0 45.0	8.8 5.0	•	•	58.8 40.0	6.3 2.5	1.3 7.5	160 40		
Sting. Ins.	With Without	8.8 11 <i>.</i> 5	14.8 38.5	•	•	68.1 46.2	•	8.2 3.8	182 26		

Table 19 (cont'd).

Pest	Presence	San	Fac	Lnd	Тгр	Cid	Ed	Oth	Tot
Weeds	With Without	•	•	45.1 53.5	•	51.1 30.2	•	3.8 16.3	133 43
All Districts									
Carp. Ants	Prevent Manage	26.5 17.7	15.3 11.4	•	•	48.2 65.1	•	10.0 5.7	170 175
Other Ants	Prevent Manage	30.8 21.4	4.2 3.7	•	5.4 6.2	47.9 64.6	7.9 1.2	3.8 2.9	240 243
Roaches	Prevent Manage	45.0 28.8	2.9 2.8	•	•	45.5 59.9	•	6.7 8.5	209 212
Fleas	Prevent Manage	40.4 26.3		•	•	34.2 51.3	17.8 15.1	7.5 7.2	146 152
Flies	Prevent Manage	41.5 28.8	11.1 7.8	•	•	37.3 54.8	7.4 5.5	2.8 3.2	217 219
Mices	Prevent Manage	22.2 14.5	19.0 16.1	•	41.7 47.8	11.9 17.6	3.2 0.8	2.0 3.4	252 255
Rats	Prevent Manage	25.0 15.3	22.7 17.6	•	34.7 42.6	11.9 19.9	•	5.7 4.5	176 176
With Pests									
Other Ants	Prevent Manage	30.2 21.8	3.7 2.6	•	6.3 6.7	48.7 65.8	9.5 1.6	1.6 1.5	189 193
Without Pest	S								
Carp. Ants	Prevent Manage	27.7 16.0	22.8 16.0	•		38.6 62.3	•	10.9 5.7	101 106
Roaches	Prevent Manage	55.4 25.6	6.0 5.8	•	•	30.1 59.3	•	8.4 9.3	83 86
Fleas	Prevent Manage	44.6 26.0				29.2 50.0	16.2 15.6	9.8 8.3	92 96
Rats	Prevent Manage	27.4 17.2	26.6 18.0	•	29.0 41.8	12.1 18.9	•	4.8 4.1	124 122

*The categories DNK (do not know) and NM (no method) were not part of the comparison. Any method chosen by fewer than 10 districts was included with the Other (Oth) category. *Indicates significant difference between classes of district attribute.

Guidelines	Districts	Selecting	P. B	P-Value for Selection of Yes Response Based on District:					
Available	Number (% of 30		7) Size		LC	ocation	Con	nmunity	
Yes No Do Not Know	59 233 15	(19.2) (75.9) (4.9)	0	.001*	0	.837	0.2	82	
		()							
Guidelines Available	Distr (as p Size	ibution of a	Districts S Attribute C	electing Class) Locati	Yes Re	sponse	Comr	unity	
	S	М	L	SLP	NLP	UP	U	S R	R
Yes	13.2	2 17.4	42.5	20.3	17.9	16.1	25.0	23.7	15.9
Number of Districts	106	161	40	192	84	31	32	93	182
Guidelines Prepared By	Districts Respons Number	Selecting se (% of 58)	P-\ Siz	/alues fo e	or Respo	nse Sele ocation	ction Bas Corr	ed on D nmunity	istrict:
School District Other	29 19 10	(50.5) (32.8) (17.2)	0.0	058	0	.577	0.5	68	

Table 20. Availability of Pest Management Guidelines.

*Indicates significant difference between classes of district attribute.

which of the class sizes were the source of the difference. It was found that the proportions of small and medium classes were not different from each other but were both different from the proportion of the large class.

Fifty-eight of the districts with guidelines indicated who prepared them. Twenty-nine said they were prepared by staff in the individual schools, 19 by district personnel and 10 by others. These 'other' responses included four combinations of local and district school personnel, three combinations of school personnel and public health departments, one public health department by itself and two pest control companies. No significant difference existed between district responses for any comparison made.

The guidelines covered a number of different pests. Fifty-four districts gave 14 different responses. These were for head lice, mice, other ants, cockroaches, stinging insects, flies, rats, termites, birds, weeds, carpenter ants, fleas, bats and miscellaneous pests such as skunks, spiders, snakes and pests in general.

Pesticide Use

Safety and Effectiveness. The question about pesticide safety and effectiveness combined two issues making it a poor question as districts could mean different things by the same answer (Q-13). Most appeared to respond to the issue of pesticide safety, but a few addressed the effectiveness question, as indicated by written comments. Three hundred three districts responded with 90.4% saying pesticides were safe and effective and 9.6% that they were not (Table 21). A significant difference existed for districts selecting a yes response when grouped by location. Over 92% of the northern and southern lower peninsula districts said pesticides were safe and effective while seventy-five percent of the upper peninsula districts agreed.

Almost all districts provided a comment on their response. Yes comments fit 4 general categories. One group spoke of application procedure and pesticide registration saying pesticides are "safe when applied properly", that they are used "following MSDS requirements ",

Safe and	Districts Respons	Selecting	P-Values for Selection of Yes Response Based on District:				
Safe and Effective Yes No	Number	(% of 303)	Size	Location	Community		
Yes No	274 29	(90.4) (9.6)	0.905	0.007*	0.786		
	Distr (as F	ibution of Distr	icts Selecting '	Yes Response			
• • •	(as r	ercent of Attric			• •		

 Table 21. Pesticide Safety and Effectiveness as a Pest Management Method.

	Distribution of Districts Selecting Yes Response (as Percent of Attribute Class)										
Safe and	Śize			Locati	Location			Community			
Effective	S	М	L	SLP	NLP	UP	U	S	R		
Yes	87.3	92.6	98.7	92.1	92.7	75.0	87.1	90.3	91.1		
Number of Districts	102	162	39	189	82	32	31	93	179		

*indicates significant difference between classes of district attribute.

or that they use "only approved pesticides" including "(pesticides used are approved) around students and food." Another group specified that pesticides are safe as long as people are not present saying that they do not use pesticides "around people or food or anywhere that could cause harm", they are used "when students are not in immediate area", they are used "during off hours of school building use", or they are used as a "last resort and only during designated breaks without children present." A third group didn't concern themselves with safe application or presence of people. Instead they left everything up to a pest control company saying "we use licensed pest control companies", "we have exterminators out once a month", or "we have an outside firm do the work--we trust them to use safe methods." The last group said pesticides work well or are the only available method giving responses such as "seem to work well", "not used extensively", it's "been done for years", "until pesticides won't do the job", or "pesticides are the only method available to the staff at this time." Two responses reflected community pressure. One district said "We keep use down because of public concern." But another district said "Parents demand quick-effective action- it's a P.R. problem- We haven't found an answer to head lice, it gets ugly at times."

Most districts which said pesticides were not safe and effective were concerned about health risks, "I prefer not to use pesticides where children or food may become contaminated", "dangerous to students", and "due to health hazards, pesticides are not considered a safe method." One district gave legal reasons "in some cases yes, but with "Right-to-Know" and other monitoring laws, one must be careful." Another district felt it was not proper for its staff to apply pesticides but that it was acceptable for a hired company, "we are now using a pest control service and trying to get away from spraying our own insecticide."

<u>Frequency of Use</u>. Pesticides were said to be used by 69.9% of the 306 responding districts for prevention and by 96.1% for management (Q-14). Twenty-three percent of the districts said they never use pesticides for prevention and only 1.3% said they never use pesticides for management (Table 22). The frequency of pesticide use for prevention as always,

Pesticide	Percent of 306 Districts Selecting Use Frequency Response									
Use for:	Always	Often	Sometimes	Never	DNK	N R+				
Prevention Management	16.3 22.9	18.3 42.2	35.3 31.0	22.9 1.3	2.0 0.7	5.2 2.0				
 Pesticide	Districts Ir Pesticide	ndicating Use++		P-Value for Selection of Positive Response Based on District:						
Use for:	Number	(% of 306	5)	Size	Location	Community				
Prevention Management	214 194	(69.9) (96.1)		0.314 0.939	0.306 0.863	0.339 0.995				
Pesticide	Number of Dist Pesticide Use	ricts Selecti Frequency	ng	P	-Values for Re election Based	sponse on District:				
Use for:	Always (%) C	ften (%) Sc	ometimes (%)	Total S	ize Locatio	n Community				
Prevention Managment	50 (23.4) 5 70 (23.8) 12	6 (26.2) 9 (43.9)	108 (50.5) 95 (32.3)	214 0 294 0	.014* 0.136 .041* 0.003	0.103 2* 0.369				
		Percent of	Districts Selec	tina Pesticida	a Lise Frequen	CV				

Table 22. Pesticide Use Frequency.

		Percent of Districts Selecting Pesticide Use Frequency									
Pesticide		By Size			By Location			By Community			
Use for:	Frequency	S	М	L	SLP	NLP	UP	U	S	R	
Prevention	Always	16.9	24.4	32.4	23.8	20.3	26.7	40.7	25.7	18.0	
	Often	15.4	30.4	32.4	32.2	18.6	13.3	25.9	27.1	25.6	
	Sometimes	67.7	45.2	35.3	44.1	61.0	60.0	33.3	47.1	56.4	
Number of Districts		65	115	34	140	59	15	27	70	117	
Management	Always	20.4	25.5	25.6	26.9	21.0	11.1	26.7	25.6	22.4	
Ū	Often	35.7	46.5	53.9	45.7	46.9	22.2	56.7	52.2	42.5	
	Sometimes	43.9	28.0	20.5	27.4	32.1	66.7	16.7	32.2	35.1	
Number of Districts		98	157	39	186	81	27	30	90	174	

+DNK = do not know, NR = no response.
 ++Districts with pesticide frequency use of always, often or sometimes.
 *Indicates significant difference between classes of district attribute.

often and sometimes was 16.3%, 18.3% and 35.3% of the districts. Frequency of use for management as always, often and sometimes was 22.9%, 42.2% and 31.0%.

Selection of a positive pesticide use response was not significantly different for either prevention or management for districts grouped by any atttibute. Significant differences were found, however, in their frequency of pesticide use. For pest prevention, a significant difference occurred between districts grouped by size. Large districts were evently split between always, often or sometimes using pesticides for prevention. Among small districts, 67.7% said they sometimes used pesticides, 15.4% responded often and 16.9% always.

Comparison of the proportion of each district size class indicating that they always use pesticides for prevention found no significant differences (16.9%-S, 24.3%-M, 32.4%-L). Comparison of the proportion indicating that they often use pesticides found that small districts were significantly different from medium sized districts but that the proportion of large districts was not different from either small or medium ones (15.4%-S, 30.4%-M, 32.4%-L). The lack of a significant difference from small districts was probably due to the low number of large districts selecting the often response. Comparison of the proportion of each district size class indicating that they sometimes use pesticides for prevention found a significant difference between small districts and the other two size classes (67.7%-S, 45.2%-M, 35.2%-L).

The frequency of pesticide use for pest management was significantly different between districts grouped by size or location. Large and medium sized districts responded similarly, with approximately 50% often using pesticides and the remainder divided between sometimes and always compared to 36% of the small districts responding often, 20% always and 44% sometimes. Almost 50% of districts in the lower peninsula districts said they used pesticides often while over 66% of upper peninsula districts said they used them sometimes.

Comparisons of the proportions selecting the different frequency responses for districts grouped by size found that no differences existed between the proportions selecting the response always (20.4%-S, 25.5%-M, 25.6%-L), no differences existed between the

proportions selecting the response often (35.7%-S, 46.5%-M, 53.8%-L), but that the proportion of small districts selecting the response sometimes differed significantly from both medium and large sized districts (43.9%-S, 28.0%-M, 20.5%-L).

Two hundred eighty-five districts selected pesticide use responses for both prevention and management. Response comparison showed that of the districts using pesticides for prevention, most selected equal or greater use frequencies for management. Those districts (10%) that selected lower frequencies may be using pesticides on a preventative basis, resorting to different or multiple pest management methods such as traps or facility modification when specific pests are actually present.

Frequency of pesticide use was also compared to district pesticide safety and effectiveness response (Q-13). A use frequency of always was not selected for prevention or management by any district which said pesticides were not safe and effective (29 total).

Pesticide Use and Presence of People. The question concerning appropriateness of pesticide use in school districts when people are present was not well presented, especially part three which contained a double negative (Q-15). Several districts commented that they felt the question was misleading. Review of responses showed that an equal number of districts answered each question part but that most districts answered only two parts. Those districts which did answer all three parts often gave responses to part three which were in conflict with their answers to parts one and two. The question was dropped from analysis.

Notification of Use. More districts indicated that they sometimes, often or always announce intended pesticide use than post notices once pesticides have been applied (78% compared to 45.1% of 304 responses). Amost 15% said they never announce intended use while 40.8% said they never post notices after use (Q-16, Table 23). The remaining districts either did not know or did not respond to part of the question.

No significant difference in total posting response was found between districts grouped by any attribute. However, a significant difference was found in frequency of posting intended use

Notification	Percer Always	nt of 304	Distric Often	ts Selecting Sometime	y Notification es Never	n Frequen DNI	cy Respo < N	nse R+	
Intended Use Following Use	31.9 14.5	1;	3.5 6.6	32.6 24.0	14.5 40.8	4.6 9.9	3 4	.0 .3	
Notification	District Pestici Numbe	s Selecti de Use N er (%	ng Pos Notifica 6 of 30	sitive ation++ 4)	P-Valu Select Size	ies of Pos ion Based Loc	itive Res I on Distri ation	oonse ct: Comm	unity
Intended Use Following Use	237 137	(7 (4	8.0) 5.1)		0.887 0.702	0.80 0.92	60 20	0.887 0.897	
Notification	Number of D Pesticide Us Always (%)	istricts S e Notifica Often (%	electir ation 6) Soi	ng Frequenc metimes (%	cy of) Total	P-Values Based or Size	for Select District: Location	tion Com	munity
Intended Use Following Use	97 (40.9) 44 (32.1)	41 (17 20 (14	.3) .6)	99 (41.8) 73 (53.5)	237 137	0.021* 0.178	0.739 0.184	0.20 0.33)9 32
Notification	Frequency	Perce By Siz S	nt of D e M	Districts Sele	ecting Frequ By Location SLP NLP	ency of No	otification By Co U	ommun S	iity R
Intended Use	Always Often Sometimes	39.8 13.3 47.0	39.0 16.3 44.7	51.6 32.3 16.1	39.7 38. [°] 17.9 17. [°] 42.4 43.0	7 54.2 7 12.5 6 33.3	40.7 25.9 33.3	42.3 22.5 35.2	40.3 13.0 46.7
Number of	Districts	83	123	31	151 62	24	27	71	139
Following Use	Always Often Sometimes	36.7 16.3 46.9	24.7 13.7 61.6	53.3 13.3 33.3	25.3 41. 14.9 16. 59.8 41.	7 50.0 7 7.1 7 42.9	25.0 0.0 75.0	31.7 17.1 51.2	33.8 16.3 50.0
Number of D	Districts	49	73	15	87 36	14	16	41	80

Table 23. Pesticide Use Notification.

+DNK = do not know, NR = no response.

++Districts with pesticide frequency use of always, often or sometimes. *Indicates significant difference between classes of district attribute.

announcements for districts grouped by size. More large districts said they always or often announce intended pesticide use (51.6% and 32.3%) compared to almost 50% of small or medium sized districts which said they sometimes announce intended use.

Pesticide use notification was compared with responses to pesticide safety and effectiveness (Q-13) to determine if the 29 districts which said pesticides are not safe and effective notify school occupants more frequently about pesticide use than do other districts. Twenty-seven answered the question on intended use notification. Of these ten said they always announce, six often, six sometimes, four never and one do not know. Two hundred sixty-one of the districts which said pesticides are safe and effective answered the same question. Of these, 86 said they always announce, 32 often, 92 sometimes, 40 never and 11 do not know. No significant difference was found between the two groups (p=0.524). Similar responses were found for posting notices after pesticide application. No significant difference was found (p=0.656).

Days Applied. Pesticides were applied on all days of the week (Q-17). Approximately 30% of the 303 responding districts applied them on Mondays, Tuesdays, Wednesdays, and Thursdays. Friday, Saturday and Sunday applications were made by 56.1%, 37.3% and 13.9% of the districts (Table 24). Approximately 30% of the districts did not know whether or not they use pesticides on any one of the specific days. Significant differences in positive response were found between districts grouped by size for Monday, Tuesday, Wednesday and Thursday applications. More than half of the large size districts used pesticides on these days compared to approximately 25% of small and medium size districts.

Summary

Forty-nine tests for differences between response selection to pest prevention and management questions were performed for each district attribute. Twelve significant differences were found for responses grouped by district size while only two significant differences were found for responses grouped by either location or community type.

	Perce								
Day Applied	Yes		No	DNK	•	NR+			
Monday	30.7		18.8	31.7		18.8			
Tuesday	28.4	2	20.1	32.0		19.5			
Wednesday	29.7	•	19.1	31.7		19.5			
Thursday	28.7	2	20.1	32.0		19.1			
Friday	56.1		7.3	25.7		10.9			
Saturday	37.3	•	19.8	24.4		18.5			
Sunday	13.9		28.7	27.1	· · · · ·	30.4	<u>.</u>	<u>.</u> .	<u> </u>
	Distric	ts Apply	ing	P	-Values	for Select	ion of Y	es	
Day Applied	Numb	er (% (of 303)	S	lize	Loca	tion	Comn	nunity
Monday	93	(30	7)	0	.028*	0.17	3	0.675	
Tuesday	86	(28)	4)	ŏ	.009*	0.13	2	0.570	
Wednesday	90	(29)	7)	ō	.007*	0.09	5	0.383	
Thursday	87	(28)	7)	ō	.011*	0.25	3	0.494	•
Friday	170	(56.	1)	Õ	.062	0.14	2	0.262	
Saturday	113	(37.	3)	Ō	.114	0.58	2	0.262	
Sunday	42	(13.	9)	0	.385	0.18	3	0.167	,
	Distrib Size	ution of	Districts /	Applying P	esticide: on	s (as Perco	ent of Af	ttribute nunitv	Class)
Day Applied	S	М	L	SLP	NLP	UP	U	S	R
Monday	26.5	28.0	52.5	33.7	30.1	13.3	31.3	34.8	28.5

Table 24. Pesticide Application Days.

++DNK = Do Not Know, NR = No Response.

Tuesday

Thursday

Saturday

Sunday

Friday

Wednesday

Number of Districts

*Indicates significant difference between classes of district attribute.

80.0

55.0

17.5

40

25.5 24.2 52.5

24.5 26.7 55.0

25.5 24.8 52.5

55.9

36.6

15.5

161

47.1

31.2

102

9.8

28.9

28.9

30.1

49.4

33.7

83

9.6

31.1

33.2

30.5

62.4

40.0

16.8

190

10.0

10.0

13.3

36.7

30.0

30

6.7

31.3 32.6 25.7

31.3 35.9 26.3

34.4 32.6 25.7 62.5 65.2 50.3

15.6 19.6 10.6

92 179

50.0 41.3

32

33.0

Significant differences were found in district selection of preferred methods for head lice and rat prevention and for fleas and weed management for districts grouped by size. Methods selected for cockroach prevention were significantly different for districts grouped by location and methods selected for mice and rat prevention were significantly different for districts grouped by community.

The presence of pest management guidelines was significantly different for districts grouped by size. In addition, seven significant differences were found between pesticide question responses. Frequency of use was different for both prevention and management, frequency of announcement of application intent was different, and positive response to pesticide application on Mondays, Tuesdays, Wednesdays and Thursdays was different. Districts grouped by location differed in their frequency of pesticide use for management while districts grouped by community had no differences. The trend in positive response to a question was from small to medium to large districts and from southern lower peninsula to northern lower peninsula to upper peninsula districts.

In addition, 80 tests for differences between prevention and management method selection by districts with and without the specific pests were completed. Six significant differences were found between prevention methods selected by districts with and districts without carpenter ants, other ants, cockroaches, flies, mosquitoes and weeds while just three significant differences were found between management methods selected by districts with and those without flies, stinging insects and weeds.

Comparison of methods selected for prevention and those selected for management by all districts combined showed seven significant differences. These were for carpenter ants, other ants, cockroaches, fleas, flies, mice and rats. Only one significant difference, for other ants, was found between prevention and management methods selected by districts with the pest while four significant differences, for carpenter ants, cockroaches, fleas and rats, were found between the methods selected by districts without the pests. This indicates that districts with pest
problems use more similar methods for both prevention and management than do districts without the specific pest problems.

In general, pesticides were selected more frequently by all districts as the preferred method for management compared to prevention. Pesticides were also selected more frequently for prevention by districts with the pests compared to those without the pests. This indicates that districts with pests consider pesticides as their most effective prevention and management method while districts without the pests can afford to be more lenient in their choice of methods for prevention.

Pest Management Execution

Requests for Pest Management

Requests for pest management (Q-20) were reported as made by all types of school personnel, even students. Less than 20% of the districts said that any one group often requests pest management but more than 50% of the districts said that each group sometimes requests management, except for students (Table 25). Almost 93% of the districts said that school administrators have requested pest management. This group was closely followed by kitchen staff with 90.6% of the districts, custodial staff with 88.3% and teachers with 84.4%. Maintenance staff have requested pest management in 76.9% of the districts, grounds staff in 72.6%, other district personnel in 67.8% and students in 29.3%. Responses entered as Other by 2.7% of the districts included parents, neighbors, county health inspector, pest control company and two unidentified supervisors.

No significant difference was found in the number of districts reporting that a particular school personnel group requests pest management when districts were compared by any of the 3 attributes. But when frequency of request was compared, a significant difference was found for school administrators and kitchen staff when districts were compared by size and for custodial and maintenance staff when compared by community type. The number of districts with personnel requesting pest management often increased from small to large districts while few suburban districts reported that personnel requested pest management often compared to urban and rural districts.

Communicable Pest Problems

Health professionals were selected by more than half of the districts (53.3% of 302 respondees) as the personnel responsible for communicable pest problems such as head lice (Q-26, Table 26). These were school nurses or district health employees or a combination of persons from the local and district levels along with an occasional county health department (21.2%, 23.2% and 8.9% of all responding districts). Non-health personnel were selected by

	Percent of 307 Districts Selecting Pest Management Request Frequency for each School Group								
School Group	Often	Sometimes	Never	DNK	NR+				
School Administrators	14.3	78.2	4.2	1.6	1.6				
Teachers	5.5	78.8	7.5	3.6	4.6				
Students	0.3	29.0	47.9	15.6	7.2				
Kitchen Staff	17.3	73.3	3.6	1.6	4.2				
Custodial Staff	14.3	73.9	4.9	2.3	4.6				
Maintenance Staff	10.4	66.4	12.7	2.6	7.8				
Grounds Staff	9.4	63.2	13.7	3.9	9.8				
District Personnel	11.7	56.0	10.7	4.9	16.6				
Other	0.7	2.0		•	97.4				

Table 25. School Groups Requesting Management of Pest Problems.

	Districts S Positive F Frequenc	Selecting Request y++	P-Values for Positive Selection Based on District:				
School Group	Number	(% of 307)	Size	Location	Community		
School Administrators	284	(92.5)	0.926	0.783	0.796		
Teachers	259	(84.4)	0.974	0.966	0.997		
Students	90	(29.3)	0.121	0.883	0.334		
Kitchen Staff	278	(90.6)	0.593	0.135	0.688		
Custodial Staff	271	(88.3)	0.539	0.704	0.638		
Maintenance Staff	236	(76.9)	0.890	0.497	0.802		
Grounds Staff	223	(72.6)	0.652	0.274	0.860		
District Personnel	208	(67.8)	0.140	0.204	0.513		

	Dist Rec	tricts Re questing	porting Pest M	School Gr lanageme	roup as	P-Values for Positive Frequency Selection Based on District:					
School Group	Ofte	en (%)	Somet	Sometimes (%)		Size	Location	Community			
School Adm.	44	(15.5)	240	(84.5)	284	0.003*	0.912	0.813			
Teachers	17	`(6.6)	242	(93.4)	259	0.843	0.956	0.969			
Students	1	(1.1)	89	(98.9)	90		•	•			
Kitchen Staff	53	(19.1)	225	(80.9)	278	0.026*	0.075	0.146			
Custodial Staff	44	(16.2)	227	(83.8)	271	0.428	0.304	0.023*			
Maintenance Staff	32	(13.6)	204	(86.4)	236	0.783	0.879	0.037*			
Grounds Staff	29	(13.0)	194	(87.0)	223	0.249	0.995	0.864			
District Personnel	36	(17.3)	172	(82.7)	208	0.972	0.099	0.37 9			

Table 25 (cont'd).

		Perc	ent of D	istricts	Reportin	g Scho	ol Grou	D as		
		Dy C	izo	rest wid	anageme					aita /
School Group	Frequency	S S	M	I	SIP			By C	S	niy R
									<u> </u>	
School Admin.	Often	10.5	14.0	33.3	15.8	14.1	17.2	19.4	14.6	15.2
	Sometimes	89.5	86.0	66.7	84.2	85.9	82.8	80.6	85.4	84.8
Number Distri	ds	95	150	39	184	71	29	31	89	164
	000	00		00	.04	••	20	0.	00	
Taacham	Otton	57	6 6	0 6	6.0	70	7 4	77	6.2	6 E
reachers	Sometimes	0.7 0/3	0.0	0.0	0.2	0.1	02 B	023	0.3	0.0
	Cometimes	34.0	50.4	31.4	30.0	30.0	92.0	<i>32.</i> 0	33.7	30.5
Number of Di	stricts	88	136	35	161	71	27	26	79	154
Studente	Otton	0.0	• •		4 7	~ ~	0.0	• •	07	• •
Sludents	Sometimes	100.0	100.0	023	1.1	100.0	100.0	100.0	3.7	100.0
	Cometimes	100.0	100.0	52.5	30.0	100.0	100.0	100.0	30.5	100.0
Number of Dis	stricts	39	38	13	58	22	10	5	27	58
Kitabaa	04	400			~~~	40 F	~ ~		~~~~	
Kitchen	Somotimos	10.3	21.0	28.9	22.9	13.5	8.0	25.8	23.9	15.1
	Sometimes	09.1	10.4	01.1	77.1	00.3	92.0	14.2	/0.1	04.9
Number of Dis	stricts	87	153	38	179	74	25	31	88	159
	04447	44.0	40.0	40.0	40.4	40.0	10.0	~~ ~	~ ~	
Custodiai	Sometimes	11.9	18.0	18.9	18.1	10.3	19.2	30.0	9.2	17.5
	Cometimes	00.1	02.0	01.1	51.5	09.7	00.0	70.0	30.0	02.5
Number of Dis	stricts	84	150	37	177	68	26	30	87	154
Maintenance	Often	12 7	14.8	10 3	14 1	11 7	15.0	16 7	53	176
Mantenance	Sometimes	87.3	95.2	89.7	85.9	88.3	85.0	83.3	94.7	82.4
Number of Di		70	100		450				70	400
Number of Dis	SINCIS	79	128	29	156	60	20	24	76	136
Grounds	Often	86	13 7	20 7	12 9	13.3	12 5	13.0	11.3	14 0
	Sometimes	91.4	86.3	79.3	87.1	86.7	87.5	87.0	88.7	86.0
Number of Dis	stricts	70	124	29	147	60	16	23	71	129
	•								_	. –
District Pers.	Often	17.2	16.9	18.8	17.5	22.9	0.0	9.1	21.4	17.9
	Sometimes	82.8	83.1	81.2	82.5	77.1	100.0	90.9	78.6	82.1
Number of Dis	stricts	58	118	32	143	48	17	22	70	106

+DNK = do not know, NR = no response.
 ++Districts in which school group often or sometimes requests pest management.
 *Indicates significant difference between classes of district attribute.

Personnel	Districts Selecting Personnel Number (% of 302)					
Nurse at School where problem exists (local personnel)	64	(21.2)				
District Health Personnel Other	70	(23.2)				
Health Personnel, mixed levels (local, district, county) Health Personnel, mixed levels, with non-health	27	(8.9)				
Personnel, mixed levels	23	(7.6)				
Non-Health Local School Personnel	85	(28.1)				
Non-Health District Personnel	7	(2.3)				
Non-Health Personnel, mixed levels (local, district)	7	(2.3)				
Pest Control Companies	4	(1.3)				
Parents	2	(0.7)				
Do Not Know	13	(4.3)				
Total Number Responding Districts	302					

Table 26. Personnel Responsible for Communicable Pest Problems.

	Districts	Selecting	P-Values for Response Selection Based on District:					
Personnel Type	Number	(% of 283)	Size	Location	Community			
Health	161	(55.7)	0.065	0.509	0.323			
Non-Health	99	(34.3)						
Mix	23	(8.0)						
Local	149	(51.6)	0.187	0.257	0.332			
Districts	77	(26.6)						
Mix	57	(19.7)						

32.7% of the districts. Most often these were principals and teachers but sometimes superintendents were named or personnel at both local and district levels (28.1%, 2.3% and 2.3% of all responding districts). A mix of health and nonhealth personnel was selected by 7.6% of the districts while 1.3% selected pest control companies and 0.7% selected parents.

Selections were compared to determine if there was any difference between districts naming health, non-health or health and non-health personnel. Selections were also compared on the basis of local, district or local and district personnel. No significant differences were found for either personnel type distribution for any district groupings.

Selection of Pest Management Methods

As school districts are composed of personnel with different levels of authority, pest management decisions can be made and executed by different people. Districts were asked whether the selection of pest management methods was the responsibility of those who decide management is required or up to those who actually perform pest management (Q-25). Of 305 responding districts, 80.7% said that the personnel who decide that management is needed at least sometimes decide on the method to be used, 87.9% of the districts said that the personnel who perform pest management decide on the method, and 4.1% of the districts said that others, such as an unidentified supervisor, contractor or director, decide (Table 27). The frequency of district selection of each personnel type was compared against the expected selection frequency for the different district groupings. No significant differences were found.

Districts which said the management methods were selected by those who decide management was needed were evenly distributed between choosing always, often and sometimes as frequency of method selection (27.5% to 26.9% to 26.2%). Districts which said the management methods were selected by those who perform pest management were not as evenly distributed. Always, often and sometimes were selected by 36.7%, 32.1% and 19.0% of the districts . Comparison of selection frequencies showed a significant difference only between districts that said personnel who perform management decide on methods and only

	Percent Person	of 305 nel Make	District Meth	ts Selecti od Decis	ing Fre	quency	y with v	vhich Sp	ecified	
Personnel Who	Always	Oft	en	Sometin	nes	Never	D	NK	NR+	
Decide Mgmt Nee Perform Mgmt Other	ed 27.5 36.7 2.6	26.9 26.2 32.1 19.0 1.3 0.3			4.3 2.6	2. 1.	0 6	13.1 7.9 95.7		
Personnel Who	Districts as Maki Number	Report ng Decis	ing Pe sions++ of 305)	ersonnel	P- Ba Si	Values ased or ze	for Re Distric Loc	sponse t: ation	Selectio Comn	on nunity
Decide Mgmt Need 246 Perform Mgmt 268		(80.7) (87.9))		0. 0.	944 853	0.58	88 96	0.792 0.938	
Di: Personnel Se Who Ak	stricts Reportin lecting Pest N ways (%) Offe	g Perso lanagen en (%) S	nnel as nent M Someti	s eth ods mes (%)	Total	P S S	-Values electior ize	for Free Based Location	านency on Dist า Con	rict: nmunity
Decide Mgmt Need 84 Perform Mgmt 112	4 (34.1) 82 2 (41.8) 98	(33.3) (36.6)	80 (58 ((32.5) (21.6)	246 268	0. 0.	.696 .006*	0.598 0.064	0.4 0.2	10 57
Personnel Who	Frequency	Perce Metho By Siz	ent of E od Alwa ze M	Districts F ays, Ofte L	Reportin on or So By Lo SLP	ng Personnetim cometim cation NLP	sonnel i ies. UP	as Selec By C U	ting ommun S	iity R
Decide Mgmt Need	Always Often Sometimes	35.2 37.5 27.3	32.5 31.7 35.7	37.5 28.1 34.4	34.0 30.6 35.4	35.2 39.4 25.4	32.1 32.1 35.7	50.0 27.3 22.7	32.5 29.9 37.7	32.7 36.1 31.3
Number of Dist	ricts	88	126	32	147	71	28	22	77	147
Perform Mgmt	Always Often Sometimes	33.7 34.8 31.5	42.3 37.3 20.4	59.5 37.8 2.7	46.7 34.9 18.3	32.9 43.8 23.3	34.6 26.9 38.5	51.7 37.9 10.3	46.3 36.3 17.5	37.7 36.5 25.8
Number of Dist	ricts	89	142	37	169	76	26	29	80	159

Table 27. Personnel Who Decide on Pest Management Methods.

+DNK = do not know, NR = no response.

++Districts in which personnel always, often or sometimes make decisions on methods to be used for pest management.

*Indicates significant difference between classes of district attribute.

when districts were grouped by size. More than half of the large districts said these personnel always decide on methods to be used and all but one of the remaining said such personnel decide often.

Since districts could select both personnel types, each district's selections were examined. Twenty-five (8.2%) only selected personnel who decide management is needed, 47 (15.4%) only selected personnel who perform management, 221 (72.5%) selected both, 8 (2.6%) selected other and 4 (1.3%) did not know. No significant differences were found in the distribution of districts selecting either or both personnel types for any district grouping. It was observed that 43 districts (14.1%) selected always for both personnel types. These districts did not belong to any specific district group. This implies that for some districts, the personnel that decide pest management is needed may also be the personnel that perform pest management.

Pest Management Execution

Districts were asked to identify personnel who use (apply) pest management methods such as pesticides, traps and other special equipment not used in normal sanitation and maintenance procedures (Q-27). Three hundred five districts indentified personnel responsible for indoor pest management but only 241 did so for outdoor pest management. The 64 nonresponding districts represented all district attributes and could not be distinguished by any specific characteristic. Those districts may not have considered outdoor pest management a necessity and so failed to select a response.

Indoor Pest Management. Custodial staff was selected most frequently (78.0%) as the personnel type who at least sometimes performed indoor pest management (Table 28). Pest control companies followed closely (73.4%). However, more districts selected pest control companies as most likely to perform pest management than did so for custodial staff (47.2% compared to 45.6%). Maintenance was selected by 62.6% of the districts, kitchen staff by 44.3%, and grounds staff by 38.7%. It is not clear why districts selected grounds staff for indoor pest management. Perhaps these districts did not distinguish between this personnel type and

	Percent of 305 Districts Selecting Frequency with which Each Personnel Group Performs Indoor Pest Management										
Personnel	Most Likely	Sometimes	Never	DNK	RLU	NR+					
Custodial Staff	45.6	32.5	7.9	0.0	•	14.1					
Grounds Staff	15.7	23.0	21.0	1.3		39.0					
Maintenance Staff	28.9	33.8	11.1	1.0		25.2					
Kitchen Staff	17.0	26.9	31.8	1.0	0.3	23.3					
Pest Control Company	47.2	26.2	10.5	3.3	•	12.8					
Other	1.0	0.3	•	•	0.3	98.7					
Other	47.2	0.3		3.3	0.3	9					

Table 28. Personnel Who Perform Indoor Pest Management.

	Distric Frequ	ts Selecting Positive ency Response++	P-Values for Positive Frequency Selection Based on District:				
Personnel	Numb	er (% of 305)	Size	Location	Community		
Custodial Staff	238	(78.0)	0.821	0.942	0.893		
Grounds Staff	118	(38.7)	0.780	0.300	0.943		
Maintenance Staff	191	(62.6)	0.202	0.719	0.412		
Kitchen Staff	135	(44.3)	0.708	0.508	0.304		
Pest Control Company	224	(73.4)	0.001*	0.000*	0.039*		

	Distribution of Districts Selecting Positive Response for Personnel (as Percent of Attribute Class)											
	Size			Locat	ion		Comn	nunity				
Personnel	S	М	L	SLP	NLP	UP	U	sí	R			
Custodial Staff	80.0	78.8	70.0	77.5	77.4	83.3	71.0	78.3	79.1			
Grounds Staff	35.2	40.6	40.0	42.9	31.0	33.3	41.9	39.1	37.9			
Maintenance Staff	62.6	67.9	42.5	65.4	58.3	56.7	54.8	55.4	67.6			
Kitchen Staff	47.6	43.8	37.5	40.8	50.0	50.0	41.9	35.9	48.9			
Pest Control Company	47.6	85.0	95.0	85.9	57.1	40.0	90.3	88.0	63.2			

	Dist	ricts	Perce Perfc	ent Dist orming	tribution Indoor P	of Distric est Man	xts Sele ageme	ecting M nt	ultiple P	ersonn	el as
Number of	Sele	ecting	By S	ize		By Lo	ocation		By C	ommur	nity
Personnel	Personnel Number (%)			М	L	SLP	NLP	UP	U	S	Ŕ
1	64	(21.0)	25.7	17.5	22.5	18.9	26.2	20.0	22.6	20.7	20.9
2	50	(16.4)	17.1	13.1	27.5	14.1	17.9	26.7	19.4	14.1	17.0
3	67	(22.0)	23.8	22.5	15.0	19.9	25.0	26.7	12.9	27.2	20.9
4	74	(24.3)	21.0	30.0	10.0	28.3	16.7	20.0	22.6	23.9	24.7
5	50	(16.4)	12.4	16.9	25.0	18.9	14.3	6.7	22.6	14.1	16.5
Number of											
Districts	305		105	160	40	191	84	30	31	92	182

Table 28 (cont'd).

Personnel	Districts Personnel Selecting Type+++ Number (%)		Perc Perfc By S	Percent Distribution of Districts Selecting Multiple Personnel as Performing Indoor Pest Management By Size By Location By Community										
Type+++			s	М	L	SLP	NLP	UP	<u> </u>	S	Ŕ			
School PC Both	81 (2 44 (* 180 (*	26.6) 14.4) 59.0)	52.4 9.5 38.1	15.0 15.6 69.4	5.0 22.5 72.5	14.1 15.2 70.7	42.9 13.1 44.0	60.0 13.3 26.7	9.7 22.6 67.7	12.0 16.3 71.7	36.8 12.1 51.1			
Number of Districts	305		105	160	40	191	84	30	31	92	182			

	P-Values for Selections Based on Dis						
Comparison	Size	Location	Community				
Multiple Personnel Performing Indoor Pest Management (1, 2, 3, 4, 5)	0.041*	0.184	0.857				
Personnel Type Performing Indoor Pest Management (School, PC, Both)	0.000*	0.000*	0.000*				

⁺DNK = do not know, RLU = response level unknown because either multiple responses were selected for the personnel category or no response was selected for an entry made under Other, NR = no response.

++Includes districts selecting personnel type as most likely, sometimes or RLU.

+++Personnel types were categorized as local (belonging to the school system), PC (a private pest control company), and Both (somepersonnel belonging to the school system and some part of a private pest control company).

*Indicates significant difference between classes of district attribute.

maintenance or custodial staff. Other personnel were selected by 1.6% of the districts and included a mix of grounds and maintenance (Building and Grounds), indicating that these two staff types are not separate in all districts.

Pest control companies were the only personnel type which showed a significant difference in selection frequency between district groupings. Large and middle sized districts selected pest control companies more than small ones (95.0 and 85.0% compared to 47.6%), districts in the southern lower peninsula selected them more than districts elsewhere (85.9% compared to 57.1 and 40.0%), and urban and suburban districts selected them more than rural ones (90.3 and 88.0% compared to 63.2%).

Many districts made multiple selections. These were totaled for comparison to determine if more personnel perform pest management in certain district types. Fifty (16.4%) of the districts selected all five personnel types, 74 (24.3%) selected four types, 67 (22.0%) selected three, 50 (16.4%) selected two, and 64 (21.0%) selected one. A significant difference was found between districts when grouped by size. But no trend was observed between district size and number of personnel selected.

Districts were further identified by category of personnel selected as performing indoor pest management. Eightly-one (26.6%) of the districts selected just school personnel while 44 (14.4%) only selected pest control companies. Both were selected by 180 districts (59.0%). Highly significant differences were found for district selections grouped by size, location or community type. Approximately 70% of large and medium sized districts selected both compared to 52% of small districts selecting school personnel alone; 70.6% of the southern lower peninsula districts selected both while 86.7% of the upper peninsula districts selected school personnel alone; and almost 70% of urban and suburban community districts selected both while twice as many rural as urban and suburban districts selected school personnel alone.

<u>Outdoor Pest Management</u>. Districts made fewer selections for personnel performing outdoor pest management. Grounds staff was selected most frequently with 175 (57.4%) districts choosing such staff as most likely or sometimes performing outdoor pest management (Table 29). Maintenance staff followed closely with 154 (50.5%) selecting districts. Pest control companies were selected by 44.3% of the districts and followed both custodial and maintenance staff as being most likely to perform outdoor pest management. Custodial staff was selected by 110 (36.1%) of the districts and kitchen staff by 32 (10.5%). A district can interpret kitchen staff as having outdoor responsibilities if they are involved with garbage sanitation or outdoor food facility care.

Significant differences were found for selection of grounds staff between districts grouped by size and location, selection of kitchen staff between districts grouped by location and selection of pest control companies between districts grouped by size, location and community. Selection trends were similar to those for indoor pest management except for an opposite trend in the selection of kitchen staff. Almost four times as many upper peninsula districts selected kitchen staff as did southern lower peninsula districts (23.3% compared to 6.8%).

Multiple selections for personnel types performing outdoor pest management were fewer than for indoor pest management. Only 12 (5.0%) of the districts selected all five categories while 50 to 63 districts made one to four selections. No significant differences in the number of multiple selections were found between district groups.

More districts (44.0%) selected only school personnel for outdoor pest management than did so for indoor pest management. Fewer districts selected only pest control companies (7.5%) or both school personnel and pest control companies (48.5%). Personnel category selection (school only, pest control company only, or both) was significantly different for all district comparisons with selection trend similar to that for indoor pest management.

Pest Control Company Employment

Pest control companies (PCCs) have been employed by approximately three quarters of 310 responding districts (Q-28, Table 30). Of the 221 districts which employed PCCs, 210 indicated that the PCCs performed indoor and/or outdoor pest management. Two districts did

	Percent of 3 Personnel G	05 Districts Se roup Performs	lecting Fre	quency with Pest Manage	which Eac	h
Personnel	Most Likely	Sometimes	Never	DNK	RLU	NR
Custodial Staff	16.3	19.7	19.3	0.0		44.6
Grounds Staff	43.3	14.1	5.2	1.6	•	35.7
Maintenance Staff	25.9	24.6	10.8	1.0	•	37.7
Kitchen Staff	4.3	6.2	41.6	0.7	•	47.2
Pest Control Company	22.3	22.0	14.4	2.6		38.7
Other	1.3	•		•	0.3	98.4

Table 29. Personnel Who Perform Outdoor Pest Management.

	Distric Frequ	ts Selecting Positive ency Response+	P-Values for Positive Response Selection Based on District:				
Personnel	Numb	er (% of 305)	Size	Location	Community		
Custodial Staff	110	(36.1)	0.705	0.175	0.281		
Grounds Staff	175	(57.4)	0.023*	0.016*	0.155		
Maintenance Staff	154	(50.5)	0.302	0.603	0.700		
Kitchen Staff	32	(10.5)	0.228	0.016*	0.080		
Pest Control Company	135	(44.3)	0.001*	0.028*	0.022*		

	Distribution of Districts Selecting Positive Response for Personnel (as Percent of Attribute Class)									
	Size			Locati	ion		Comn	nunity		
Personnel	S	М	L	SLP	NLP	UP	U	S	R	
Custodial Staff	40.0	33.8	35.0	31.4	41.7	50.0	48.4	29.3	37.4	
Grounds Staff	41.0	66.3	65.0	67.0	40.5	43.3	64.5	68.5	50.5	
Maintenance Staff	45.7	56.3	40.0	53.4	44.0	50.0	45.2	46.7	53.3	
Kitchen Staff	14.3	7.5	12.5	6.8	14.3	23.3	16.1	4.3	12.6	
Pest Control Company	26.7	50.0	67.5	51.3	36.9	20.0	61.3	55.4	35.7	

	Disti	ricts	Perc Pers	ent Dist onnel a	ribution s Perfor	of Distric ming Out	ts Sele door Po	cting Mu est Mana	ltiple agement		
Number of	Sele	ctina+++	By S	ize		By Lo	ocation		By C	ommur	nity
Personnel	Num	nber (%)	S	М	<u> </u>	SĹP	NLP	UP	U	S	Ŕ
1	63	(26.1)	31.6	24.2	21.2	22.7	34.4	26.1	28.0	27.3	25.2
2	60	(24.9)	26.3	22.7	30.3	24.0	23.4	34.8	12.0	26.0	26.6
3	56	(23.2)	21.1	25.8	18.2	26.0	21.9	8.7	8.0	26.0	24.5
4	50	(20.7)	15.8	24.2	18.2	22.7	14.1	26.1	40.0	16.9	19.4
5	12	(5.0)	5.3	3.0	12.1	4.6	6.3	4.4	12.0	3.9	4.3
Number of											
Districts	241		76	132	33	154	64	23	25	77	139

Table 29 (cont'd).

Personnel	Districts Selecting+++	Perco Perso By S	ent Disi onnel a ize	tribution s Perfor	of Distric ning Out By Lo	ts Sele door Po ocation	cting Mu est Mana	ltiple agement Bv C	ommur	iity
Туре++++	Number (%)	s	М	L	SLP	NLP	UP	U	S	R
School PC Both	106 (44.0) 18 (7.5) 117 (48.5)	63.2 5.3 31.6	39.4 7.6 53.0	18.2 12.1 69.7	36.7 7.1 56.5	51.6 9.4 39.1	73.9 4.4 21.7	24.0 8.0 68.0	33.8 7.8 58.4	33.2 7.2 39.6
Number of Districts	241	76	132	33	154	64	23	25	77	139

	P-Values for Selections Based on Distric						
Comparison	Size	Location	Community				
Number of Personnel Performing Outdoor Pest Management (1, 2, 3, 4, 5)	0.333	0.408	0.121				
Personnel Type Performing Outdoor Pest Management (School, PC, Both)	0.000*	0.005*	0.013*				

⁺DNK = do not know, RLU = response level unknown because either multiple responses were selected for the personnel category or no response was selected for an entry made under Other, NR = no response.

++Includes districts selecting personnel type as most likely, sometimes or RLU.

+++Sixty-four districts were omitted as 58 did not respond to this part of the question and 6 did not know what personnel type performed outdoor pest management.

++++Personnel types were categorized as local (belonging to the school system), PC (a private pest control company), and Both (somepersonnel belonging to the school system and some part of a private pest control company).

*Indicates significant difference between classes of district attribute.

Pest Control Company	Districts Respons	Selecting		P-Value fo Based on	or Select District:	s Repson			
Employed	Number	(% 01 31	0) 3	Size	LC	bcation	Con	hmunity	
Yes No	221 85	(71.3) (27.4)	ſ	•000.0	0	.000*	0.0	00*	
Pest Control	Distri (as P	bution of ercent of	Districts Attribute	Selecting Class)	Yes Re	sponse			
Pest Control Company Employed	Distri (as P Size S	bution of ercent of M	Districts Attribute L	Selecting Class) Locati SLP	Yes Re on NLP	sponse UP	Comr U	nunity S	R
Pest Control Company Employed Yes	Distri (as P Size S 44.4	bution of ercent of M 82.7	Districts Attribute L 97.5	Selecting Class) Locati SLP 86.5	Yes Re on NLP 54.1	sponse UP 27.2	Comm U 90.6	nunity S 88.2	R 59.5

Table 3	0.	Employment	of	Pest	Control	Companies	by	School	Districts.
		• •				•	-		

*indicates significant difference between classes of district attribute.

not answer the question, eight did not select a response concerning PCCs and one said that PCCs never perform indoor and outdoor pest management. Of the 224 districts which said that PCCs performed indoor and/or outdoor pest management, 14 did not select yes for PCC employment. Thirteen said they did not employ PCCs while one did not answer the question. The multiple response structure of Q-27 may have caused some confusion in district answers. In addition, some districts may have responded no to PCC employment because they perceived this employment as preventative instead of being for pest management (wording used in Q-28).

Yes response selection by districts grouped by size, location or community type were highly significant. Over 80% of all large and medium sized districts, of those in the southern lower peninsula and of those that were located in urban or suburban communities employed PCCs. Only 44.4% of small districts, 27.2% of those in the upper peninsula and 54.1% of those in the northern lower peninsula, and 59.5% of those located in rural communities employed PCCs. Comparison of the proportion of districts indicating that they employ PCCs by the different size classes showed that the proportions of all three were significantly different from each other (44.4%-S, 82.7%-M, 97.5%-L).

<u>Criteria Used to Select PCCs</u>. Districts which employed PCCs identified quality of service as the most important criteria used in hiring decisions (Q-29, Table 31). Cost was named second while being a local business was chosen third (97.2%, 86.3% and 72.6% of all selections). Other responses were mostly concerned with quality of service. Examples included 'qualified personnel', 'safety', 'type of chemicals used', 'reliable', 'liability and reputation', 'knowledge', 'availability' and 'compliance with Right-to-Know'. No difference was found in criteria selection between district groupings.

<u>School Personnel Negotiating PCC Contracts</u>. Both administrative and support service personnel were said to negotiate PCC contracts. The questionnaire presented school (principal and secretary) and district (superintendent and business management) level administration choices (Q-30). These were selected by 215 of the 221 districts employing PCCs (Table 32). In

Selection	Num Sele	ber and F cting Crite	All Districts Selecting Criteria					
Criteria	First		Second		Third		Total	(% of 212)
Quality of Service	184	(86.8)	16	(7.5)	6	(2.8)	206	(97.2)
Cost	14	(6.6)	142	(67.0)	27	(12.7)	183	(86.3)
Local Business	5	(2.4)	31	(14.6)	118	(55.7)	154	(72.6)
Other	6	(2.8)	2	` (0.9)́	4	`(1.9)	12	`(5.7)
Do Not Know	3	(1.4)	2	(0.9)	13	(6.1)	18	(8.5)
No Response	0	(0.0)	19	(9.0)	44	(20.8)	63	(29.7)

Table 31.Selection Criteria Used by Districts Employing
Pest Control Companies.

Level of	Number of Districts	P-Value for Selection of Criteria Based on:						
Importance	Selecting Criteria	Size	Location	Community				
First	209	0.551	0.061	0.773				
Second	191	0.728	0.887	0.985				
Third	145	0.496	0.661	0.631				

+Criteria were selected by 212 of the 221 districts which indicated that they hire pest control companies in response to question 28.

	Percent Group N	of 221 D egotiates	istricts Selectin Pest Control C	g Frequen Company (cy with w PCC) Cor	hich Each Itracts+	Personnel
Personnel	Always	Often	Sometimes	Never	DNK	RLU	NR++
Principal	1.8	2.3	8.6	45.2	0.5		41.6
Secretary	0.5	0.5	0.5	55.2	0.9	•	42.5
Superintendent	19.0	6.3	12.2	29.4	0.9	0.5	31.7
Business Manager Other	28.5	5.4	10.9	18.6	0.9	0.5	35.4
Administration	2.3	0.5		•	•		
Purchasing	1.4	0.5	•	•		•	49.8
Support Services	26.7	12.2	1.4		•	5.9	

Table 32. School Personnel Who Negotiate Pest Control Company Contracts.

	Districts Freque	s Selecting Positive	P-Value for Positive Frequency Selection Based on District:				
Personnel	Numbe	r (% of 221)	Size	Location	Community		
Principal	28	(12.7)	0.208	0.600	0.319		
Secretary Superintendent and	3	(1.4)	•		.++++		
other Administration	90	(40.7)	0.000*	0.029*	0.000*		
and Purchasing	104	(47.1)	0.040*	0.671	0.646		
Support Services	102	(46.2)	0.018*	0.044*	0.148		

	Distribution of Districts Selecting Positive Frequency Response (as Percent of Attribute Class)									
	Śize			Locati	ion		Comn	Community		
Personnel	S	М	L	SLP	NLP	UP	U	sí	R	
Principal	18.8	12.7	5.1	11.4	17.4	11.1	3.4	13.4	14.5	
Secretary	4.2	0.7	0.0	0.6	4.3	0.0	0.0	1.2	1.8	
Superintendent and		-			_					
other Administration	70.8	39.6	7.7	33.7	60.9	55.6	20.7	23.2	59.1	
Business Manager				••••					••••	
and Purchasing	25.0	52.2	56.4	45.8	47.8	66.7	51.7	51.2	42.7	
Support Services	22.9	50.0	61.5	52.4	30.4	11.1	51.7	56.1	37.3	
Number of Districts	48	134	39	166	46	9	29	82	110	

Table 32 (cont'd).

	Dist	tricts	Perc Pers	Percent Distribution of Districts Selecting Multiple Personnel as Negotiating PCC Contracts								
Number of	Sel	ectina+++++	By S	By Size		By Lo	ocation		By C	ommur	nitv	
Personnel	Nur	mber (%)	S	M	L	SLP	NLP	UP	Ū	S	R	
1	138	(62.7)	67.0	58.2	74.4	64.2	56.5	66.7	72.4	65. 9	57.8	
2	59	(26.8)	25.5	29.9	18.0	26.1	30.4	22.2	27.6	23.2	29.4	
3	21	(9.5)	8.5	10.5	7.7	9.1	10.9	11.1	0.0	9.8	11.9	
4	2	(0.9)	0.0	1.5	0.0	0.6	2.2	0.0	0.0	1.2	0.9	
Number of Districts	220		47	134	39	165	46	9	29	82	109	

	Distri	icts	Percent Distribution of Districts Selecting Multip Personnel as Negotiating PCC Contracts							le			
Personnel	Sele	cting+++++	By S	By Size By Location			By C	ommur	nity				
Туре	Num	ber (%)	S	Μ	L	SLP	NLP	UP	U	S	R		
Admin. Support Staff	118 59	(53.6) (26.8)	76.6 10.6	50.0 27.6	38.5 43.6	47.3 32.7	69.6 10.9	88.9 0.0	48.3 37.9	43.9 36.6	62.4 16.5		
Both	43	(19.5)	12.8	22.4	18.0	20.0	19.6	11.1	13.8	19.5	21.1		
Number of Districts	220		47	134	39	165	46	9	29	82	109		

Comparison	P-Value for Selections Based on District:						
	3128	LUCAINIT	Community				
Number of Personnel Who Negotiate PCC Contracts (1, 2, 3-4)	0.451	0.897	0.257				
Personnel Type Who Negotiates PCC Contracts (Adm., Support Staff, Both)	0.002*	0.005*	0.015*				

+Distribution was based on responses made by the 221 districts who indicated that they employ pest control companies in response to question 28.

⁺⁺DNK = do not know, RLU = response level unknown because either multiple responses were selected for the personnel category or no response was selected for an entry made under Other, NR = no response.

+++Includes districts selecting personnel type as Always, Often, Sometimes and RLU.

++++ Statistics were not calculated as few districts selected personnel type.

+++++One district was omitted from comparison as it did not know what personnel type negoitated PC contracts.

*Indicates significant difference between classes of district attribute.

addition, 112 districts wrote in other administrators (6), purchasing personnel (4) and support service personnel (102) such as Director of Building and Grounds, Supervisor of Maintenance, Physical Plant Supervisor, Custodial Supervisor, Director of Transportation, Building and Grounds, Director of Operations, Director of Grounds, Auxilliary Services Director, etc. Administrator write-ins were totaled with superintendent selections while purchasing personnel write-ins were added to business manager selections.

Most PCC contract negotiation was said to be performed by district administration and/or support service personnel. Superintendent, business manager and support services personnel were each selected by almost half of the districts (40.7%, 47.1% and 46.2%). Relatively few districts selected local school administrators (12.7% principal, 1.4% secretary).

Frequency of district administration and support services personnel selection was significantly different for several district comparisons. Superintendent selection was highly significant between districts compared by size or community and significant when compared by location. More than 50% of all small districts, northern lower peninsula and upper peninsula districts, and districts located in rural communities selected these personnel. By contrast, business managers personnel selection was significantly different only for districts compared by size with over 50% of medium and large districts selecting these personnel. Support services personnel selection was significantly different for districts compared by size or location. Again, over 50% of all large and medium sized districts as well as of districts located in the southerm lower peninsula selected these personnel.

A number of districts selected several personnel as negotiating PCC contracts. Two districts (0.9%) selected four types, 21 (9.5%) selected three, 59 (26.8%) selected two and 138 (62.7%) selected one. One district selected do not know for all personnel types and was not included for comparison purposes. Although many districts selecting 3 or 4 personnel types were medium sized, located in the southern lower peninsula and found in rural communities, no significant differences were found for the number of multiple selections made by different

district types. Some districts which made multiple personnel selections may have done so because the person responsible for PCC negotiations could be classified as more than one type rather than because different individuals actually negotiate contracts. Question design did not allow for this discrimination.

Districts were also compared on the basis of selection category, that is administration alone, support services personnel alone or both. Highly significant differences were found for district size or location comparisons and a significant difference was found for community type comparison. In general, small sized districts, northern lower peninsula and upper peninsula districts and those in rural communities selected administration personnel. Support staff alone was selected most frequently by large sized districts, those in the southern lower peninsula and those in urban and suburban communities. Both personnel types were selected by 11 to 22% of all district groupings.

Eactors Defined in PCC Contracts. Pest management methods, pesticides used and a requirement for effectiveness evaluation were selected by 70.8, 65.3 and 63.0% of 216 responding districts (Q-31, Table 33). Records filed with school personnel and pest number requiring management were selected by only 38.4% and 20.4% of the districts. Factors written in as Other concerned frequency of service. Four districts said weekly, monthly or regular visitations were specified in PCC contracts. Up to 25% of the districts indicated do not know and an additional 3% to 7% did not respond to each factor. Comparisons between district groups were made only on the frequency of yes responses. No significant differences were found.

Many districts selected multiple factors. The number of factors selected by 192 of the 216 responding districts was totaled. Twenty-four districts were eliminated as they selected do not know for all contract factors. Five factors were selected by 10.9% of the districts, four by 24.5%, three by 30.2%, two by 19.3% and one by 10.4%. Nine districts selected no for each factor implying that they do not negotiate PCC contracts. No significant differences were found in

NR++

6.5

Pest Management Methods to be Used Pesticides to be Used Evaluation of Effectiveness Required Records on Pest Management Action to be filed with School Personnel Other			70.8 65.3 63.0 38.4 1.9	10.6 13.4 11.6 27.8	15.3 16.2 22.2 26.9	3.2 5.1 3.2 6.9 98.1	
Factors	Districts Number	Selecting (% of 2	Yes 16)	P-Value for Size	Yes Selection Location	Based on District: Community	
Post Number		(20.4)		0.250	0.380	0 221	
Pest Number	44	(20.4)		0.350	0.300	0.321	
Pest Mgmt. Methods	153	(70.8)		0.642	0.830	0.807	
Pesticides	141	(65.3)		0.145	0.810	0.497	
Evaluation	136	(63.0)		0.097	0.198	0.383	
Records	83	(38.4)		0.213	0.564	0.739	
Other	4	(1.9)		•	•	•	
	Districto		inlo Eacto	P-Value	for Selection o	f Multiple	
	Districts			is Facioisi			
raciors	numper	(% 01 19	92)***	SIZE	Location	Community	
0	9	(4.7)		0.639	0.676	0.962	
1	20	(10.4)					

Table 33. Factors Defined in Contracts with Pest Control Companies.

+Factors were identified by 216 of the 221 districts which indicated that they hire pest control companies in response to question 28.

++DNK = do not know, NR = no response.

37

58

47

21

(19.3)

(30.2)

(24.5)

(10.9)

Factors

2 3

4

5

+++Twenty-four districts were omitted as they selected do not know for all contract factors.

number of districts selecting multiple contract factors for districts grouped by size, location or community type.

<u>Contract Time Period</u>. Half of the districts (56.4% of 220 employing PCCs) said they negotiate contracts for one year periods (Q-32, Table 34). Several (30.9%) said contracts are in effect only for the duration of a specific job while a few said contracts are negotiated to last two to three years (4.1%). Other responses included unidefined time periods (5 districts) or the combination of job and one year time periods depending on pest and situation (4 districts). Ten districts (4.5%) selected do not know. No significant differences in selection were found for any district grouping.

Pests PCCs are Employed to Manage. PCCs have been employed to manage a minimum of 21 different pests (Q-33). In addition to the 16 pests listed in the questionnaire, moles, silverfish, carpet beetles, red mites and skunks were added as Other. More than half the districts employing PCCs have done so specifically for cockroaches, mice and ants other than carpenter ants (Table 35). Twenty-five to 50% of the districts have employed PCCs for stinging insects, termites, carpenter ants and rats. Ten to 25% have employed them for weeds, fleas, flies, head lice, diseases of outdoor plants and mosquitoes while less than 10% have employed them for insect pests of outdoor plants, bats, birds and others.

The number of districts employing PCCs for each specific pest was compared against the expected number for each district attribute. Significant differences were found for several pests. PCC employment for management of cockroaches, stinging insects, rats, fleas, head lice and bats was significant for districts compared by size. PCC employment for management of carpenter ants and insect pests of outdoor plants was significant for districts compared by location. And PCC employment for management of cockroaches, stinging insects, weeds and bats was significant for districts compared by community type. In general, large districts hired PCCs more frequently than small or medium sized ones. Southern lower peninsula districts hired them more often

Length		Districts Contrac Number	Selectin t Length (% of 22	g 0)+				
Duration of Specific One Year Two Years Three Years Other Do Not Know	Job 1	68 124 5 4 9 10	(30.9) (56.4) (2.3) (1.8) (4.1) (4.5)					
Pest Control Company Employed	Districts Respons Number	Selectii se (% of	ng 201)	P-Value fo Based on I Size	P-Value for Selection of Yes Repsonse Based on District: Size Location Community			
Specific Job One Year Multiple Years	68 124 9	(32.4) (59.0) (4.3)		0.184	0.413	0.130		

Table 34. Length of Pest Control Company Contracts.

+Factors were identified by 220 of the 221 districts which indicated that they hire pest control companies in response to question 28.

	Percent of 221 Districts Employing PCCs (Pest Control Companies) for Each Specific Pest							
Pest	Yes	No	DNK	NR+				
Cockroaches	61.4	28.2	5.0	5.5				
Mice	58.2	30.9	2.3	8.6				
Other Ants	52.7	35.0	3.2	9.1				
Stinging Insects	37.7	45.5	4.1	12.7				
Termites	33.2	44.5	7.3	15.0				
Carpenter Ants	29.1	47.3	9.5	14.1				
Rats	26.4	51.8	4.1	17.7				
Weeds	21.4	60.0	2.7	15.9				
Fleas	13.2	60.0	8.6	18.2				
Flies	13.2	62.7	7.7	16.4				
Head Lice	10.9	63.2	9.1	16.8				
Diseases of Outdoor Plants	10.5	64.5	5.0	20.0				
Mosquitoes	10.0	64.1	8.2	17.7				
Insect Pests of Outdoor Plants	9.5	64.5	5.0	20.9				
Bats	9.1	66.4	5.9	18.6				
Birds	5.9	69.1	5. 9	19.1				
Other	3.6	0.9	0.0	95.5				

Table 35. Pests which Pest Control Companies have been Employed to Manage.

	Districts I for Specia	Employing PCs fic Pest Mgmt	P-Value for Based on I	Yes Respon Districts:	SÐ
Pest	Number (% of 221)	Size	Location	Community
Cockroaches	135	(61.4)	0.016*	0.978	0.028*
Mice	128	(58.2)	0.131	0.570	0.198
Other Ants	116	(52.7)	0.762	0.806	0.640
Stinging Insects	83	(37.7)	0.012*	0.571	0.005*
Termites	73	(33.2)	0.944	0.042*	0.096
Carpenter Ants	64	(29.1)	0.409	0.579	0.334
Rats	58	(26.4)	0.011*	0.940	0.188
Weeds	47	(21.4)	0.915	0.996	0.026*
Fleas	29	(13.2)	0.000*	0.199	0.194
Flies	29	(13.2)	0.663	0.199	0.599
Head Lice	24	(10.9)	0.024*	0.999	0.822
Diseases of Outdoor Plants	23	(10.5)	0.143	0.354	0.364
Mosquitoes	22	(10.0)	0.125	0.511	0.103
Insect Pests of Outdoor Plants	21	(9.5)	0.608	0.036*	0.288
Bats	20	(9.1)	0.033*	0.361	0.011*
Birds	13	(5.9)			
Other	8	(3.6)	•	•	-

Table 35 (cont'd).

<u></u>	Distrib	Distribution of Districts Employing PCs for Management of the									
	Size	ic pesis	(as Perc	ent of Attr	ibute Ci	ass)	Comm	u nitv			
Pest	S	М	L	SLP	NLP	UP	U	S	R		
Cockroaches	35.4	64.7	82.1	61.2	60.9	66.7	78.6	74.4	47.3		
Mice	47.9	55.6	79.5	60.6	47.8	66.7	71.4	65.9	49.1		
Other Ants	47.9	55.6	48.7	54.5	47.8	44.4	46.4	58.5	50.0		
Stinging Insects	29.2	33.1	64.1	40.0	32.6	22.2	57.1	48.8	24.5		
Termites	33.3	32.3	35.9	38.8	15.2	22.2	53.6	34.1	27.3		
Carpenter Ants	20.8	30.1	35.9	30.3	28.3	11.1	42.9	25.6	28.2		
Rats	20.8	21.8	48.7	26.1	28.3	22.2	42.9	23.2	24.5		
Weeds	22.9	20.3	23.1	21.1	21.7	22.2	42.9	15.9	20.0		
Fleas	14.6	5.3	38.5	10.9	21.7	11.1	21.4	15.9	9.1		
Flies	12.5	12.0	17.9	10.9	21.7	11.1	17.9	14.6	10.9		
Head Lice	4.2	9.8	23.1	10.9	10.9	11.1	14.3	9.8	10.9		
Diseases of Outdoor											
Plants	4.2	10.5	17.9	12.1	4.3	11.1	17. 9	11.0	8.2		
Mosquitoes	12.5	6.8	17.9	9.7	13.0	0.0	14.3	14.6	5.5		
Insect Pests of											
Outdoor Plants	6.3	9.8	12.8	9.7	4.3	33.3	17.9	7.3	9.1		
Bats	6.3	6.8	20.5	9.1	6.5	22.2	25.0	6.1	7.3		
Birds	2.1	3.0	20.5	7.3	2.2	0.0	17.9	4.3	1.8		
Other	2.1	4.5	2.6	3.0	6.5	0.0	3.6	3.7	3.6		
Number of Districts	48	133	39	165	46	9	28	82	110		

	Pest Presence in Districts Employing PCs for Management of the Specific Pests							
Pest	Total Number	Those Pest (With % of Total)	Thos Pest	e Without (% of Total)			
			// · · · · · · · · · · · · · · · · · ·		(//////////////////////////////////////			
Cockroaches	135	94	(69.6)	41	(30.4)			
Mice	128	114	(89.1)	14	(10.9)			
Other Ants	116	103	(88.8)	13	(11.2)			
Stinging Insects	83	69	(83.1)	14	(16.9)			
Termites	73	41	(56.2)	32	(43.8)			
Carpenter Ants	64	29	(45.3)	35	(54.7)			
Rats	58	20	(34.5)	38	(65.5)			
Weeds	47	34	(72.3)	13	(27.7)			
Fleas	29	10	(34.5)	19	(65.5)			
Flies	29	24	(82.8)	5	(17.2)			
Head Lice	24	23	(95.8)	1	(4.2)			
Diseases of Outdoor Plants	23	10	(43.5)	13	(56.5)			
Mosquitoes	22	15	(68.2)	7	(31.8)			
Insect Pests of Outdoor Plants	21	10	(47.6)	11	(52.4)			
Bats	20	10	(50.0)	10	(50.0)			
Birds	13	9	(69.2)	4	(30.8)			

Table 35 (cont'd).

	Districts With P	ositive Pes	t Presence tha	t Employ	PCs
Pest	Total Number++	Those PCs fe Pest (e Which Hire or Specific % of Total)	Those Which Hire PCs for Specific and/or Other Pests (% of Total)	
Cockroaches	118	94	(79.7)	106	(89.8)
Mice	234	114	(48.7)	173	(73.9)
Other Ants	221	103	(46.6)	169	(76.5)
Stinging Insects	218	69	(31.7)	166	(76.1)
Termites	51	41	(80.4)	50	(98.0)
Carpenter Ants	51	29	(56.9)	44	(86.3)
Rats	40	20	(50.0)	30	(75.0)
Weeds	175	34	(19.4)	133	(76.0)
Fleas	43	10	(23.3)	37	(86.0)
Flies	198	24	(12.1)	143	(72.2)
Head Lice	226	23	(10.2)	162	(71.7)
Diseases of Outdoor Plants	51	10	(19.6)	38	(74.5)
Mosquitoes	127	15	(11.8)	89	(70.1)
Insect Pests of Outdoor Plants	52	10	(19.2)	39	(75.0)
Bats	62	10	(16.1)	48	(77.4)
Birds	81	9	(11.1)	63	(77.8)

+DNK = do not know, NR = no response.
++Total number of districts with positive pest presence was the number of districts reporting pest presence in response to question 3.
*Indicates significant difference between classes of district attribute.

for insect pests of outdoor plants. Urban and suburban districts both employed PCCs more frequently for cockroaches and stinging insects while urban districts hired them most often for weeds and bats.

With the exception of carpenter ants, rats, fleas, diseases of outdoor plants and insect pests of outdoor plants, over 50% of the districts employing PCCs for each pest reported that they had that pest (Q-5). The best match between districts that had a specific pest and who also employed PCCs for management of the pest occurred for mice, ants other than carpenter ants, stinging insects, flies and headlice (over 80%). Rats were reported by only 34.5% of the districts which hired PCCs for their control, the lowest presence of all the pests. Possibly those districts which hired PCCs for pests which they did not report as problems believe that the PCCs prevented these pests from becoming problems.

The number of districts which had the specific pests and hired PCCs for their management compared to the number of all districts which reported that they had the specific pests varied greatly. As few as 10.2% of the districts (head lice) and as many as 80.4% of the districts (termites) which said that they had the pests also hired PCCs for their management. The percentage of districts with cockroaches that hired PCCs for cockroach control was almost as high as that for termites (79.7%). This was followed by the percentage of districts with carpenter ants, rats, mice and ants in general which hired PCCs for their control (46.6% to 56.9%). A lower percentage probably meant that the districts placed lower priority on that particular pest's management, as in the case of birds, mosquitoes, flies, bats, insect pests of outdoor plants, weeds and diseases of outdoor plants, (all between 10 and 20%). Fleas (23.3%) and stinging insects (31.7%) were probably considered low management priority as well. The employment of PCCs for head lice management, however, cannot be used as a measure of importance as head lice require a different management strategy.

The percent of districts with specific pest problems that hired PCCs in general was high, (that is, the district may have had the pest but did not hire the PCC for control of the specific

pest). Almost 100% of the districts which reported termites and over 80% of the districts with cockroaches, carpenter ants and fleas employed PCCs. Except for mosquitoes, a greater percent of districts with pest problems hired PCCs compared to the percent of all districts (71.3%) hiring PCCs.

Methods Used or Recommended by PCCs. Except for changes in turf/landscape care practices, PCCs were reported as using or recommending all types of methods presented as choices in the question by over 50% of 219 districts which employed them (Q-34, Table 36). Trap use was reported most frequently, followed by recommendations for changes in student and staff behavior, improvement in sanitation, use of pesticides, repair or modification of facility structure, and turf/landscape care modification (92.2%, 75.3%, 70.8%, 68.0%, 62.6% and 44.7%). Only one significant difference was found when frequency of method selection was compared to expected frequency for different district groupings. This was for districts selecting turf/landscape care modification when compared by size. Large districts selected the method more often than small or medium sized districts.

<u>PCC Report Recipients</u>. PCCs were reported as providing promotional and follow-up information to both administration and support services personnel. Superintendents, school principals and district business managers were selected as PCC report recipients by 43.6 to 45.5% of 220 districts (Q-35, Table 37). Local school secretaries were selected by only 15.9% of the districts. Many districts wrote in Other responses (35.5%) which were all support services personnel.

Selection of superintendents for districts grouped by size and selection of support services personnel for districts grouped by location were the only response distributions which differed significantly from expected numbers. Superintendents were selected more frequently by small districts while support services personnel were selected most often by southern lower peninsula districts.

	Percent o Recomm	Percent of 219 Districts Selecting Frequency for Method Use or Recommendation ⁺									
Method	Always	Often	Sometimes	Never	DNK	N R++					
Sanitation	16.4	17.4	37.0	18.7	5.5	5.0					
Facility	4.1	13.7	44.7	25.6	5.0	6.8					
Landscape	5.0	8.2	31.5	32.9	11.9	10.5					
Traps	5.5	24.2	45.7	12.8	3.7	8.2					
Pesticide	17.4	37.0	37.9	1.8	3.2	2.7					
Education	10.5	18.3	39.3	21.5	5.5	5.0					

Table 36. Methods Used or Recommended by Pest Control Companies.

Method	District	s Selecting	P-Value fo	or Selection o	of Positive
	Numbe	r (% of 219)	Size	Location	Community
Sanitation	155	(70.8)	0.411	0.857	0.284
Facility	137	(62.6)	0.078	0.319	0.690
Landscape	98	(44.7)	0.020*	0.581	0.106
Traps	202	(92.2)	0.967	0.989	0.887
Pesticides	149	(68.0)	0.082	0.176	0.282
Education	165	(75.3)	0.547	0.373	0.547

	Distribution of Districts Selecting PCC Methods (as Percent of Attribute Class)										
•• ••	Śize			Locati	on		Comn	nunity	_		
Method	<u> </u>	<u>M</u>		SLP	NLP		<u> </u>	<u> </u>	R		
Sanitation	58.3	72.0	82.1	71.5	71.1	55.6	81.4	79.3	61.8		
Facility	43.8	63.6	82.1	66.7	53.3	33.3	70.4	65.9	58.2		
Landscape	22.9	47.7	61.5	46.1	44.4	22.2	59.2	52.4	35.5		
Traps	89.6	92.4	94.9	92.7	91.1	88.9	96.3	95.1	89.1		
Pesticides	47.9	69.7	87.2	73. 9	51.1	44.4	85.2	73.2	60.0		
Education	64.6	76.5	84.6	80.0	60.0	66.7	85.2	80.5	69.1		
Number of Districts	48	132	39	165	45	9	27	82	110		

+Methods were identified by 219 of the 221 districts which indicated that they hire pest control companies in response to question 28.

++DNK = do not know, NR = no response.

****Includes districts selecting a method type as always, often and sometimes. *Indicates significant difference between classes of district attribute.

	Percent of 220 Districts Selecting Frequency that Each Personnel Group Receives PCC Information+									
Personnel	Always	Often	Sometimes	Never	DNK	RLU	NR++			
Principal	10.0	10.0	25.5	25.5	5.9		23.2			
Secretary	0.9	3.2	12.7	46.8	7.3		29.1			
Superintendent	18.2	10.5	16.8	27.7	6.4		20.5			
Business Manager	18.2	9.1	16.4	20. 9	6.8	•	28.6			
Support Services	22.3	8.2	5.0	0.0	0.0	5.5	59.1			

Table 37. School Personnel to Whom Pest Control Companies Provide Information Concerning Pest Problems and Management Actions.

Personnel	Districts Positive	Selecting	P-Value for Selection of Positive Frequency Based on District:					
	Number	r (% of 220)	Size	Location	Community			
Principal	100	(45.5)	0.939	0.719	0.233			
Secretary	35	(15.9)	0.136	0.360	0.349			
Superintendent	100	(45.5)	0.039*	0.112	0.135			
Business Manager	96	(43.6)	0.326	0.537	0.842			
Support Services	78	(35.5)	0.178	0.022*	0.765			

	Distrib (as Pe	ution of rcent of							
	Śize	Size Location							
-	S	М	L	SLP	NLP	UP	U	ś	R
Principal	43.8	45.1	48.7	46.7	39.1	55.6	64.3	46.3	40.0
Secretary	14.6	14.3	28.2	15.2	23.9	11.1	25.0	18.3	13.6
Superintendent	64.6	43.6	28.2	40.0	60.9	66.7	35.7	36.7	54.5
Business Manager	33.3	48.9	38.5	45.5	34.8	55.6	50.0	43.9	41.8
Support Services	22.9	36.8	46.2	41.8	17.4	11.1	42.9	35.4	33.6
Number of Districts	48	133	39	165	46	9	28	82	110

	Distr	ricts	Perc Pers	ent Dist onnel to	tribution Whom	of Distrie PCs Re	of Districts Selecting Multiple PCs Report				
Number of	Sele	cting++++	By S	ize		By Lo	ocation		By C	ommun	ity
Personnel	Num	nber (%)	S	М	L	SLP	NLP	UP	U	S	R
0	6	(2.8)	0.0	3.9	2.6	2.5	4.9	0.0	0.0	2.5	3.8
1	90	(42.5)	48.9	39.5	44.7	40.7	48.8	44.4	25.9	46.3	43.8
2	48	(22.6)	22.2	23.3	21.1	25.9	9.8	22.2	40.7	20.0	20.0
3	37	(17.5)	15.6	19.4	13.2	17.9	14.6	22.2	11.1	18.8	18.1
4	29	(13.7)	13.3	13.2	15.8	12.4	19.5	11.1	18.5	11.3	14.3
5	2	`(0. 9)́	0.0	0.8	2.6	0.6	2.4	0.0	3.7	1.3	0.0
Number of											
Districts	212		45	129	38	162	41	9	27	80	105

	Dist	ricts	Perc Pers	ent Dist onnel to	tribution Whom	of Distri PCs Re	cts Sele port	ecting M	ultiple	ltiple		
Personnel	Sele	cting++++	By S	ize		By L	ocation		By C	ommun	nity	
Туре	Num	ber (%)	S	M	L	SLP	NLP	UP	U	S	R	
Admin. Support	116	(56.3)	73.3	54.0	43.2	50.0	74.4	88.9	48.2	53.9	60.4	
Staff	48	(23.3)	13.3	23.4	35.1	27.2	10.3	11.1	18.5	29.5	19.8	
Both	42	(20.4)	13.3	22.6	21.6	22.8	15.4	0.0	33.3	16.7	19.8	
Number of Districts	206		45	124	37	158	39	9	27	78	101	

Comparison	P-Value fo Size	r Selection Based Location	on District: Community
Number of Personnel to Whom PCs Report (0,1, 2, 3, 4-5)	0.873	0.491	0.285
Personnel Type to Whom PCs Report (Adm., Support Services, Both)	0.058	0.015*	0.236

⁺Personnel Types were identified by 220 of the 221 districts which indicated that they hire pest control companies in response to question 28.

++DNK = do not know, RLU = response level unknown because either multiple responses were selected for the personnel category or no response was selected for an entry made under Other, NR = no response.

+++Includes districts selecting a personnel type as always, often, sometimes and RLU.

++++ Eight districts were omitted as they did not know if any personnel were contacted by pest control companies.

*Indicates significant difference between classes of district attribute.

Almost half of the districts selected only one personnel type as recipient of PCC reports. Two, three, four and five recipients were selected by 22.6%, 17.5% ,13.7% and 0.9% of the remaining districts. Six indicated that no personnel received such reports. Eight did not know who received them and were dropped for comparison purposes. No statistical differences were found between district groups selecting multiple personnel.

Districts were also identified by personnel type selected as recipient of PCC reports. Approximately half selected administration personnel only while support services personnel or both were selected by 22.6% and 19.8%. Comparison of selections between districts grouped by location showed a significant difference. Upper peninsula districts did not select both while up to 23% of southern lower peninsula districts did.

Summary

Seventy-nine tests for differences between response selection to pest management execution questions were performed for each district attribute. Twenty significant differences were found for responses grouped by district size, 14 significant differences were found for responses grouped by district location and 15 significant differences were found for responses grouped by district community type. The trend in positive response to a question was generally from small to medium to large districts, from southern lower peninsula to northern lower peninsula to upper peninsula districts and from rural to suburban to urban districts.

Districts grouped by size differed in their reporting of the frequency with which school administrators and kitchen staff request pest management. They did not differ in regard to the personnel type who decides on methods to be used for pest management. A significant difference was found in the frequency of pest control company (PCC) employment for both indoor and outdoor pest management. Significant differences were also found when comparing district selection of personnel type negotiating PCC contracts. Small districts selected the superintendent more frequently than the other districts types while the business manager or support services staff were selected most frequently by large districts, in accordance with the usual positive selection trend. Differences were found in the reported frequency for which PCCs were hired to control cockroaches, fleas, head lice, stinging insects, bats and rats and for the frequency with which pest control companies recommend modification in tur/landscape care practices. The final difference found between districts grouped by size was in the reporting of PCC report recipients. Small districts reported superintendents more frequently than did the other district sizes.

Districts grouped by location and community type differed for many of the same response selections although fewer differences were found between positive response selection of PCCs for management of specific pests. The usual selection trend was observed with the same exceptions as found for districts grouped by size, namely, superintendents were selected most frequently as the personnel who negotiate PCC contracts both by districts in the upper peninsula and by districts in rural communities than by either of the other districts groups. In addition, upper peninsula districts selected kitchen staff most frequently as the personnel performing outdoor pest management and they hired PCCs more frequently for control of outdoor plant insect pests.

Pest Management Evaluation and Satisfaction with Effectiveness

Effectiveness Evaluation

Approximately 75% of 306 responding districts said that pest management effectiveness is evaluated in their districts (Q-36, Table 38). Twenty-one percent said it is not evaluated and a few (3.6%) did not know. No significant differences were found to exist though yes responses were selected more often by large and medium sized districts, those located in the entire lower peninsula and those located in urban and suburban communities than were selected by small districts, ones located in the upper peninsula and those in rural communities.

Personnel Performing Evaluations

Pest management evaluations were said to be performed most frequently by the personnel who decided that management was necessary (83.0% of 230 districts which said that evaluations were performed in their districts). Personnel performing the action and pest control companies were selected by more than 50% of the districts while support service personnel were written in as Other by 15.2% (Q-37, Table 39). Frequency of personnel selection was compared to expected frequency for districts grouped by the different attributes. Only selection of support service personnel showed a significant difference for districts grouped by size or location. Large districts and those located in the southern lower peninsula selected this personnel type more frequently than other district groups.

Approximately 70% of the districts selected several categories of personnel as performing pest management evaluations. Four types were selected by 3.5% of the districts while three, two and one selections were made by 36.5%, 29.6% and 30.4% of the districts. Comparison of the number of selections made by districts grouped by location showed a significant difference. Most upper peninsula districts selected one or two personnel types while many lower peninsula districts selected two, three or four.

Evaluation	Districts Respon	Selecting se	P-Value for Selection of Yes Response Based on District:					
Performed	Number	(% of 306)	Size	Location	Community			
Yes	231	(75.5)	0.150	0.218	0.413			
No	64	(20.9)						
Do Not Know	11	(3.6)						

Table 38. Evaluation of Pest Management Effectiveness.

Table 39. Personnel Performing Pest Management Evaluation.

	Percent of 230 Districts Selecting Frequency that Personnel Perform Evaluation+									
Personnel	Always	Often	Sometimes	Never	DNK	RLU	NR++			
Decided Need	45.7	22.6	14.8	1.3		•	15.7			
Performed Action	21.7	21.7	19.1	7.0	1.3	0.9	28.2			
Pest Control Co.	17.0	12.2	22.2	17.0	0.9	•	30.9			
Support Service	9.6	2.6	0.9	•	•	2.3	84.8			

	Districts Positive	Selecting Frequency+++	P-Value for Positive Frequency Selection Based on District:					
Personnel	Number	(% of 230)	Size	Location	Community			
Decided Need	191	(83.0)	0.966	0.917	0.767			
Performed Action	146	(63.5)	0.807	0.571	0.995			
Pest Control Co.	118	(51.3)	0.340	0.259	0.452			
Support Service	35	(15.2)	0.019*	0.025*	0.072			

	Distribution of Districts Selecting Positive Frequency for Personnel Performing Pest Management Evaluation (as Percent of Attribute Class) Size							nel e Class)	
Personnel	S	М	L	SLP	NLP	UP	U	S	R
Decided Need	84.6	82.4	82.4	81.4	85.7	88.9	72.0	87.2	82.7
Performed Action	64.6	64.9	55.9	65.4	64.3	44.4	64.0	64.1	63.0
Pest Control Co.	40.0	55.7	55.9	56.4	42.9	33.3	64.0	55.1	46.5
Support Service	6.2	16.0	29.4	19.9	7.1	0.0	32.0	14.1	12.6
Number of Districts	65	131	34	156	56	18	25	78	127
Table	39	(CO	nt'd).						
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Number of	Dis Sel	tricts lecting	Perce By S	Percent Distribution of Districts Selecting N By Size By Location					s Selecting Multiple Personnel				
Personnel	Nu	mber (%)	S	М	L	SLP	NLP	UP	U	S	Ŕ		
1	70	(30.4)	35.4	27.5	32.4	29.5	28.6	44.4	32.0	26.9	32.3		
2	68	(29.6)	35.4	29.0	20.6	22.4	44.6	44.4	12.0	28.2	33.9		
3	84	(36.5)	27.7	40.5	38.2	43.6	25.0	11.1	48.0	42.3	30.7		
4	8	`(3.5)	1.5	3.1	8.8	4.5	1.8	0.0	8.0	2.6	3.2		
Number										-			
of Districts	230		65	131	34	156	56	18	25	78	127		

	P-Value for Multiple Selection Based on District:					
Comparison	Size	Location	Community			
Number of Personnel Types Who Evaluate Effectiveness (1, 2, 3-4)	0.254	0.001*	0.126			

+Only responses of the 231 districts who said they maintain pest management records in answer to question 38 are presented. One of those districts did not respond to this question.
++DNK = do not know, RLU = response level unknown because either multiple responses were selected for the personnel category or no response was selected for an entry made under Other, NR = no response.

+++Includes districts selecting personnel type as Always, Often, Sometimes and RLU. *Indicates significant difference between classes of district attribute.

Satisfaction with Pest Management Effectiveness

Al least 70% of 300 responding districts said that all school groups were satisfied or very satisfied with pest management effectiveness (Q-43, Table 40). Two groups, school administration and school custodians, were said to be satisfied in 94.0% and 92.7% of the districts. Over 80% of the districts said that school maintenance, district administration, teachers/librarians, school groundskeepers, district maintenance and district custodians were satisfied. Two Other responses were entered as being satisfied, one for a food service manager and one for a superintendent of building and grounds. This last entry indicates that district personnel cannot always be placed into separate groups.

Most districts selected a specific response for each school group but approximately 25% of the districts did not know whether students or parents of the students were satisified and 10-14% indicated that school groundskeepers, district custodians and district groundskeepers did not exist within their district by selecting not applicable responses. Few districts said that the specific school groups were not satisfied (3 maximum per group). No significant differences were found in the frequency of each school group reported as satisfied between districts classed by any attribute type.

Most districts reported that many school groups were satisfied. Almost 50% (144 districts) said that all 11 were satisfied. Another 29% said that 8 to 10 groups were satisfied, while16.3% said 4 to 7 groups and 4.0% said 1 to 3 groups were satisfied. Only 18 districts (6.0%) selected no groups as being satisfied. These districts gave a combination of do not know, group not in existence and no response to the specific groups.

Concern with Pest Management

Concern over pest management has been expressed by school personnel as well as by some students and parents (Q-45). This concern could be focused on pest management effectiveness, methods used in pest management or a combination of both. Almost 40% of 305 responding districts said that school administrations have expressed concern (Table 41).

	Percent of 300 Districts Selecting Persons Satisfaction Level As									
Persons	Very	Satisfied	Not	DNK	NA	NR+				
School Administration	23.0	71.0	0.3	4.0	1.0	0.7				
Teachers/Librarians	18.0	67.0	0.7	9.7	2.0	2.7				
Students	16.3	54.0	0.3	22.0	4.0	3.3				
Parents of Students	13.3	50.7	1.0	27.0	4.3	3.7				
School Custodians	20.0	72.7	1.0	2.7	2.0	1.7				
School Groundskeepers	17.0	64.7	0.3	3.3	10.0	4.7				
School Maintenance	19.3	68.0	0.7	3.3	4.7	4.0				
District Administration	18.0	68.0	0.0	5.0	6.0	3.0				
District Custodians	16.3	63.7	0.7	3.0	12.3	4.0				
District Groundskeepers	16.0	60.0	0.3	3.3	14.0	6.3				
District Maintenance	17.3	64.0	0.3	3.7	9.3	5.3				
Other		0.7		•	•	99.3				

Table 40. Satisfaction of Different Persons with Effectiveness of CurrentPest Management Efforts.

	Districts	Indicating	P-Value for Satisfaction Selection				
Persons	Number (% of 300)		Based or Size	District: Location	Community		
School Administration	282	(94.0)	0.951	0.958	0.960		
Teachers/Librarians	255	(85.0)	0.331	0.974	0.303		
Students	211	(70.3)	0.505	0.827	0.693		
Parents of Students	192	(64.0)	0.332	0.816	0.726		
School Custodians	278	(92.7)	0.912	0.996	0.981		
School Groundskeepers	245	(81.7)	0.817	0.877	0.896		
School Maintenance	262	(87.3)	0.890	0.983	0.925		
District Administration	258	(86.0)	0.702	0.943	0.788		
District Custodians	240	(80.0)	0.329	0.747	0.464		
District Groundskeepers	228	(76.0)	0.088	0.349	0.607		
District Maintenance	244	(81.3)	0.248	0.530	0.565		

+DNK = do not know, NA= not applicable, NR = no response. ++Includes districts selecting very satisfied and satisfied.

	Percent of 305 Districts Indicating Concern Expressed						
Persons	Yes	No	DNK	NR+			
School Administration	39.3	52.5	5.9	2.3			
Teachers/Librarians	32.5	55.1	9.2	3.3			
Students	10.2	67.9	17.4	4.6			
Parents of Students	19.0	59.0	18.7	3.3			
School Custodial, Grounds,							
or Maintenance Staff	34.8	53.8	7.9	3.6			
District Administration	32.1	52.8	9.8	5.2			
District Custodial, Grounds,							
or Maintenance Staff	29.5	55.1	9.8	5.6			
Other	0.7	•	•	99.3			

Table 41. Persons Who have Expressed Concern with Pest Management Efforts.

	Districts Concerr	Indicating 1 Expressed	P-Value for Yes Response Based on District:				
Persons	Number	(% of 305)	Size	Location	Community		
School Administration	120	(39.3)	0.059	0.157	0.806		
Teachers/Librarians	99	(32.5)	0.053	0.469	0.530		
Students	31	(10.2)	0.534	0.395	0.402		
Parents of Students	58	(19.0)	0.042*	0.659	0.082		
School Custodial, Ground	ds.	v v					
or Maintenance Staff	106	(34.8)	0.093	0.006*	0.697		
District Administration	98	(32.1)	0.141	0.058	0.821		
District Custodial. Ground	s.	V - V					
or Maintenance Staff	90	(29.5)	0.008*	0.005*	0.272		

	Distrib (as Pe	Distribution of Districts Indicating Concern Expressed (as Percent of Attribute Class)								
	Śize			Locati	on		Comn	nunity		
Persons	S	М	L	SLP	NLP	UP	U	S	R	
School Administration	32.3	38.8	60.0	44.4	33.3	25.0	45.2	40.7	37.7	
Teachers/Librarians	27.6	30.6	52.5	34.9	31.0	21.9	38.7	36.3	29.5	
Students	10.5	8.8	15.0	10.6	11.9	3.1	3.2	12.1	10.4	
Parents of Students	15.2	17.5	35.0	20.1	19.0	12.5	12.9	27.5	15.8	
School Custodial, Ground	Is.									
or Maintenance Staff	26.7	35.0	50.0	42.9	25.0	12.5	41.9	36.3	32.8	
District Administration District Custodial, Ground	26.7 s.	31.9	47.5	38.1	23.8	18.8	32.3	35.2	30.6	
or Maintenance Staff	21.9	29.4	50.0	36.5	19.0	15.6	32.3	34.1	26.8	

	Dist Sel	tricts ecting	Perco	ent Dis erned	stributio	on of I ns	Distric	cts Sele	cting Diff	erent N	umber	s of
Number of	Tot	al	By S	ize			By Lo	ocation		By Co	mmun	ity
Persons	Nur	nber (%)	S	М	L		SĹP	NLP	UP	U	S	Ŕ
1	23	(14.1)	15.2	12.6	16.7	' 1	1.4	25.0	0.0	5.6	15.4	15.1
2	34	(20.9)	17.4	26.4	10.0) 2	21.1	17.5	33.3	22.2	13.5	24.7
3	19	(11.7)	19.6	9.2	6.7	' 1	3.2	10.0	0.0	16.7	11.5	10.8
4	26	(16.0)	8.7	18.4	20.0) 1	6.7	12.5	22.2	27.8	21.2	10.8
5	29	(17.8)	19.6	17.2	16.7	' 1	7.5	15.0	33.3	22.2	13.5	19.4
6	17	(10.4)	10.9	8.1	16.7	,	9.7	12.5	11.1	5.6	13.5	9.7
7	15	(9.2)	8.7	8.1	13.3	1	0.5	7.5	0.0	0.0	11.5	9.7
Number												
of Districts	163		46	87	30	1	14	40	9	18	52	93
Number of Persons	T	otal lumber (%)	<u></u>	Distri Perso Size S	bution ons (as M	of Dis Perc L	tricts ent of Lc Sl	Indicat Attribu cation P NU	ing Multip te Class) _P UP	ole Conc Co U	ærned mmun S	ity R
Multiple	16	63 (53.4)		43.8	54.4	75.0	6	0.347	.628.1	58.	1 57.	1 50.8
Number of Districts	30	5		99	154	40	18	33 78	3 32	31	87	175
Comparison					 (5	P-Valu Conce Size	ue for erned	Indica Based Lo	tion of Mu on Distriction	ultiple Pe ct: Co	ersons	as ity
Districts Indi	cating	Multiple Co	ncern	ed Per	sons ().070		0.	049*	0.7	743	

Table	41	(cont'd).	
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*DNK = do not know, NR = no response. *Indicates significant difference between classes of district attribute.

Affirmative responses for school custodial, grounds and maintenance staff as a group, teachers/librarians, district administration, and district custodial, grounds, and maintenance staff as a group followed with 34.8%, 32.5%, 32.1% and 29.5% of the districts selecting each. Only 10.2% and 19.0% of the districts reported that students and their parents have expressed concern. At least twice as many districts (17.4% and 18.7%) did not know if these two groups had ever expressed concern compared to other groups.

There were significant differences in the expressed concerns of parents and district custodial, grounds, or maintenance staff between districts grouped by size. Significant differences were also found for reported concerns for both school and district custodial, grounds, or maintenance staff between districts grouped by location. More large districts and those located in the southern lower peninsula said that these groups have expressed concern.

Almost half the districts (46.6%) did not select any groups as expressing concern. Of the 163 districts reporting concerned groups, only 14.1% selected just one. All remaining districts selected between 2 and 7 groups (20.9%, 11.7%, 16.0%, 17.8%, 10.4% and 9.2%). When concern is expressed within a district, it appears to be widespread. The distribution between attribute classes of districts that selected at least one school group as expressing concern was significantly different for location. Sixty point three percent of the southern lower peninsula districts said that at least one school group had expressed concern compared to only 28.1% of the upper peninsula districts. Although distribution for districts grouped by size was not quite significant, a distinct range in percent of the large districts selected at least one group as expressing concern existed. Seventy-five percent of the large districts selected at least one group while only 43.8% of the small districts did so. District community distributions were very close ranging from 50.8% of rural community districts to 58.1% of urban districts. No significant difference was found in the number of school groups selected as expressing concern for districts selecting at least one group when such districts were classed by any attribute.

Concern over Pesticide Use in the School Environment

Districts reported almost the same type and number of school groups as expressing concern over the use of pesticides in the school environment as they had reported as expressing concern over pest management in general (Q-46, Table 42). School administrators were again selected as expressing concern most often by 34.3% of 306 districts. Teachers/librarians, school custodial, grounds, or maintenance staff as a group, district administration, district custodial, grounds, or maintenance staff as a group, parents and students followed in the number of districts selecting them as expressing concern (28.4%, 28.4%, 26.1%, 23.9%, 14.1% and 7.8%).

Comparison of responses to the questions on concern over pest management and concern over pesticide use showed that at least 45% of these districts were the same (64.8% for school administration, 60.9% for teachers/librarians, 45.8% for students, 67.4% for parents, 66.7% for school custodial, grounds, or maintenance staff, 63.8% for district administration, and 67.1% for district custodial, grounds, or maintenance staff.) This indicates that at least half the concern over pest management is with regard to pesticide use.

Except for students, highly significant differences were found for all group selections between districts categorized by size. Each group was selected most often by large districts. Significant differences were also found for selection of district custodial, grounds, or maintenance staff between districts categorized by location and for selection of teachers/librarians as well as district custodial, grounds, or maintenance staff between districts categorized by community type. Both southern lower peninsula districts and those located in urban communities selected the groups more often than other district types.

Of 149 districts which reported groups as being concerned with pesticide use, 76.5% selected more than one group. Two to seven different groups were selected by 16.1%, 18.1%, 12.8%, 11.4%, 7.4%, and 10.7% of the districts. The remaining 23.5% selected only one group. Again, concern tends to exist within many district groups when it is expressed. However, comparison of the number of districts selecting at least one group as expressing

	Percent of 306 Districts Indicating Concern Expressed						
Persons	Yes	No	DNK	NR+			
School Administration	34.3	54.9	9.2	1.6			
Teachers/Librarians	28.4	56.2	12.7	2.6			
Students	7.8	68. 6	19.6	3.9			
Parents of Students	14.1	62.4	19.6	3.9			
School Custodial, Grounds,							
or Maintenance Staff	28.4	60.5	8.2	2.9			
District Administration	26.1	56.5	11.4	5.9			
District Custodial, Grounds,							
or Maintenance Staff	23.9	58. 5	10.8	6.9			
Other	1.3			98.7			

Table 42. Persons Who have Expressed Concern Over the Use of Pesticides in the School Environment

	District Conce	s Indicating rn Expressed	P-Value for Yes Response Based on District:				
Persons	Numbe	er (% of 306)	Size	Location	Community		
School Administration	105	(34.3)	0.011*	0.092	0.084		
Teachers/Librarians	87	(28.4)	0.000*	0.062	0.003*		
Students	24	`(7.8)	0.064	0.236	0.325		
Parents of Students	46	(14.1)	0.000*	0.296	0.056		
School Custodial, Ground	S.						
or Maintenance Staff	87	(28.4)	0.023*	0.121	0.512		
District Administration	80	(26.1)	0.015*	0.130	0.126		
District Custodial, Grounds	5.	()					
or Maintenance Staff	73	(23.9)	0.003*	0.025*	0.020*		

	Distrib (as Pe	Distribution of Districts Indicating Concern Expressed (as Percent of Attribute Class)										
	Śize			Locati	on		Comn	nunity				
Persons	S	М	L	SLP	NLP	UP	U	S	R			
School Administration	28.3	31.9	60.0	39.7	28.2	18.9	48.4	41.3	28.4			
Teachers/Librarians	18.9	27.5	57.5	32.8	25.9	9.4	51.6	35.9	20.8			
Students	6.6	6.3	17.5	8.5	9.4	0.0	12.9	9.8	6.0			
Parents of Students	9.4	10.0	42.5	16.4	11.8	6.3	19.4	20.7	9.8			
School Custodial, Ground	ls.											
or Maintenance Staff	25.5	25.0	50.0	33.3	21.2	18.8	35.5	31.5	25.7			
District Administration	20.8	24.4	47.5	30.7	20.0	15.6	35.5	32.6	21.3			
or Maintenance Staff	17.0	22.5	47.5	29.6	16.5	9.4	35.5	32.6	17.5			

	Distric Select	ts ing	Perce Conce	nt Dist erned	ributio Persor	n of Disti ns	ricts \$	Select	ing Di	fferent N	lumber	s of
Number of Persons	Total Numbe	ər (%)	By Siz S	e M	L	By I SLF	_ocat	tion LP	UP	By C U	ommun S	ity R
1	35 (23	3.5)	26.2	26.7	12.5	20.0	24	.2 5	54.6	28.6	22.2	23.0
2	24 (16	5.1)	19.1	14.7	15.6	16.2	18	.2	9.1	9.5	11.1	21.6
3	27 (18	3.1)	16.7	20.0	15.6	20.0	15	5.2	9.1	9.5	22.2	17.6
4	19 (12	2.8)	14.3	9.3	18.8	11.4	15	5.2 1	8.2	14.3	11.1	13.5
5	- 17 (1 [.]	1.4)	4.8	17.3	6.3	15.2	3	0.0	0.0	19.1	14.8	6.8
6	11 (7	7.4)	9.5	4.0	12.5	6.7	' 9).1	9.1	9.5	5.6	8.1
7	16 (10).7)	9.5	8.0	18.8	10.5	15	5.2	0.0	9.5	13.0	9.5
Number	4.40		40	76	0.0	105	•	•		04	F 4	74
	145		42	75	52	105		<u> </u>	<u> </u>	21	54	/4
Number of	Distr Tota	icts I	Dis (as Siz	tributi Perce	on of E ent of A)istricts I Attribute (Lo	ndica Class Dcatic	iting N) on	Aultiple	Conce	rned Pe	INSONS
Persons	Num	ber (%)	S	Μ	L	S	LP	NLP	UP	U	S	R
Multiple	149	(48.7)	39.	648	.788	3.9 5	5.6 3	38.8	34.4	67.7	7 58.7	40.4
Number of Districts	306		106	15	4 36	6 18	39	85	32	31	92	183
Comparison					P C S	-Value fo oncerne ize	or Inc d Bas	dicatio sed o Loca	n of M n Distr ation	lultiple F ict: Co	ersons	as ity
Districts Mal	king Multij	ole Selec	ctions		0	.001*		0.08	37	0.	.034*	

Table 42	(cont'd).
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*DNK = do not know, NR = no response.
*Indicates significant difference between classes of district attribute.

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concern over pesticide use was significantly different for districts grouped by either location or community type, comparisons that were not significantly different for expression of concern over pest management efforts in general. Comparison by location was highly significant with 88.9% of the large districts selecting at least one school group and only 39.6% of the small districts doing so. Sixty-seven point seven percent of the urban districts selected at least one group compared to 40.4% of the rural districts. No significant difference was found in the number of school groups selected as expressing concern for districts selecting at least one group when such districts were classed by any attribute.

Summary

Thirty-five tests for differences between response selection to pest management evaluation, satisfaction over pest management efforts and concern regarding pest management and pesticide use in the school environment were performed for each district attribute. Ten significant differences were found for responses grouped by district size, six were found for responses grouped by district location and three were found for responses grouped by district community type.

No differences existed between district response selection for execution of pest management evaluation. But the selection of support services staff as the personnel responsible for performing effectiveness evaluations was significantly different for districts grouped both by size and by location. The usual trend was observed in frequency of selection with large districts and those in the southern lower peninsula selecting support services staff more frequenly than the other district groups.

No differences were found in the reporting of school personnel satisfaction with existing pest management efforts for any district grouping. However, significant differences were found between districts grouped by size and by location in the reporting of three different school groups as having expressed concern over pest management efforts. Selection of parents and of district custodial, grounds and maintenance staff was significantly different for districts

grouped by size while selection of local school as well as of district custodial, grounds and maintenance staff was significantly different for districts grouped by location.

Significant differences were also found for districts grouped by size in the reporting of six different school groups as having expressed concern over pesticide use in the school environment. Response selections for local school and district administration, teachers/librarians, parents, and local school and district support services staff were all significantly different. Positive response selection was significantly different for only one school group, district support services staff, when districts were grouped by location while response selection for two school groups, teachers/librarians and district support services staff was significantly different when districts were grouped by community. Large districts, those located in the southern lower peninsula and those in urban communities all selected positive expression of concern more frequently than the other district types.

Pest Management Records

Record-Keeping

Approximately one-third of 306 responding districts said that they kept pest management records (Q-38, Table 43). Fifty-seven percent said they did not keep records and 6.2% did not know. Differences in yes response selection were significant between districts grouped by size, location or community type. Just over 72% of the large sized districts kept records while only 17.8% of small ones did so. Almost half of the southern lower peninsula districts and approximately half of both urban and suburban districts kept records while15 to 27% of the other district classes kept records. Comparison of the proportion of districts grouped by size which indicated that they kept pest management records found a significant difference between all proportions (17.8%-S, 40.9%-M, 72.5%-L).

These records were accessible for review in 84.5% of the 110 responding districts which kept them (Q-39, Table 44). No significant different in record accessibility was found between districts classed by any attribute.

Pest Management Record Information

At least 74% of 112 record-keeping districts answered that they retain information on the different record types listed in the questionnaire (Q-40, Table 45). Information on pest problem location was selected most frequently as always, often or sometimes being kept in 92.9% of the districts. Information on the type of pest problem and management methods used were both kept by 89.3% of the districts while records on the cost of management, the person who decided management was needed, the person performing management, and evaluation of effectiveness were reported kept by 87.5, 83.0, 77.7 and 74.1% of the districts. No significant difference was found for frequency of type of record maintenance between districts classed by any attribute.

Most districts said they kept more than one type of record. Over 60% selected all seven types. Six, five, four, three and one types were reported by 11.7, 9.0, 9.0, 5.4 and 3.6% of the remaining districts. Districts were identified as keeping few (one, three or four types) or as

Records	Districts Respons	Selecting se	P-Value for Selection of Yes Response Based on District:					
Kept	Number	(% of 306)	Size	Location	Community			
Yes	113	(36.9)	0.000*	0.001*	0.004*			
No	174	(57.0)						
Do Not Know	19	` (6.2)						

Table 43. Maintenance of Pest Management Records by School Districts.

	Distrib (as Pe	ution of rcent of	Districts Attribute	Selecting Class)	Yes Re	sponse			
Records	Śize			Locati	on		Comm	unity	
Kept	S	M	L	SLP	NLP	UP	U	S	R
Yes	17.8	40.9	72.5	47.1	22.4	15.6	45.2	52.7	27.7
Number of Districts	107	159	40	189	85	32	31	91	184

*Indicates significant difference between classes of district attribute.

Table 44. Review Accessibility of Maintained Pest Management Records.

Districts Records Respon		Selecting se	P-Value for Based on D	P-Value for Selection of Yes Response Based on District:				
Accessible	Number	(% of 110)+	Size	Location	Community			
Yes	93	(84.5)	0.768	0.889	0.962			
No	5	(4.5)						
Do Not Know	12	(10.9)						

+Only responses of the 113 districts who said they maintain pest management records in answer to question 38 are presented. Three of those districts did not respond to this question.

	Percent (as	of 112 Distri	icts Selecting Attribute Class		that Record	nformation is
Record Type	Always	Often	Sometimes	Never	DNK	N R++
Pest Problem Location of Problem Person Deciding	42.0 46.4	22.3 21.4	25.0 25.0	5.4 3.6	2.7 2.7	2.7 0.9
Need for Action Mgmt Methods Used Person Performing	40.2 54.5	19.6 18.8	23.2 16.1	4.5 3.6	4.5 2.7	8.0 4.5
Mgmt Action Cost Evaluation	46.4 59.8 28.6	16.1 19.6 16.1	15.2 8.0 29.5	8.0 5.4 9.8	6.3 2.7 6.3	8.0 4.5 9.8
	Districts	Selecting	++	P-Value fo	or Positive Fr	equency
Record Type	Number	(% of 112)		Size	Location	Community
Pest Problem Location of Problem Person Deciding	100 104	(89.3) (92.9)		0.793 0.794	0.944 0.953	0.956 0.991
Need for Action Mgmt Methods Used Person Performing	93 100	(83.0) (89.3)		0.762 0.966	0.813 0.975	0.877 0.885
Mgmt Action Cost Evaluation	89 98 83	(77.7) (87.5) (74.1)		0.840 0.934 0.944	0.438 0.493 0.811	0.766 0.867 0.575
Number of Record Types	Districts Records	Keeping +++ (% of 111)		P-Value fo (1-3-4/5-6 Size	or Multiple Re -7) Based on Location	District:
1 3 4 5	4 6 10 10	(3.6) (5.4) (9.0) (9.0)		0.141	0.306	0.107

Table 45. Pest Management Record Information.

*Only responses of the 113 districts who said they maintain pest management records in answer to question 38 are presented. One of those districts did not respond to this question. +*DNK = do not know, NR = no response.

+++Includes districts selecting personnel type as Always, Often and Sometimes.

(11.7)

(61.3)

13

68

6

7

++++One district was not included as it answered do not know for all record types.

*Indicates significant difference between classes of district attribute.

keeping many (five, six or seven types). There was no significant different for any district attribute between districts keeping few records and those keeping many.

Pest Management Record-Keeping Time Period

Approximately half of 108 record-keeping districts said that they maintain the different records for one year (Q-41, Table 46). Fewer than 10% selected one month time periods and only one district said that they keep specific record types for a week. Ten to 15% of the districts said that they maintain records for two or more years as written-in responses for Other. Up to 25% of the districts did not know how long records are maintained and several (up to 15%) did not select a response for each record type. Comparison of one and two year selections was made for districts grouped by size, location or community type. No significant differences were found.

Record Storage Location

Pest management records were said to be kept most frequently in district maintenance offices (56.4% of 110 districts selected location as always, often or sometimes). This was followed by offices of the local school administration, district custodians, superintendent, school maintenance and school custodians (44.5%, 41.8%, 40.0%, 37.3% and 30.9%). Additional locations noted under other included two pest control companies, one nurse, nine business manager/purchasing offices and four support service offices not identified by school or district level (Q-42, Table 47).

A significant difference was found for selection of the superintendent's office between districts grouped by size or by community type. More than 50% of small districts and of those in rural communities selected the superintendent's office compared to 3.7% in large districts and 15.4% in urban communities.

Over 50% of the districts selected multiple record storage locations. All six locations were selected by 9.1% of the districts while five, four, three and two locations were selected by

	Percent of 108 Districts Selecting Time Period for Record Type									
Record Type	2+ Years	Year	Month	Week	DNK	NR++				
Pest Problem	15.7	50.9	5.6	0.0	25.0	2.8				
Location of Problem Person Deciding	14.8	50.0	9.3	0.0	20.4	5.6				
Need for Action	12.0	48.1	6.5	0.9	24.1	8.3				
Mgmt Methods Used Person Performing	13.9	55.6	2.8	0.0	23.1	4.6				
Mgmt Action	12.0	51.9	3.7	0.0	22.2	10.2				
Cost	15.7	60.2	2.8	0.0	19.4	1.9				
Evaluation	10.2	45.4	3.7	0.0	25.9	14.8				
	Districts Sel	ectina Tim	e Period	P-Valu Period	e for Select Based on [ion of Tim				

Table 46. Time Period for which Pest Management Records have been Maintained.

	Dist	ricts Selec	tina	Time Peri	iod	P-Value Period E	for Selection Based on Dis	n of Time trict:
Record Type	2+`	/ears (%)	1 ¥(ear (%)	Total	Size	Location	Community
Pest Problem	17	(23.6)	55	(76.4)	72	0.195	0.395	0.197
Location of Problem Person Deciding	16	(22.9)	54	(77.1)	70	0.199	0.226	0.120
Need for Action	13	(20.0)	52	(80.0)	65	0.405	0.267	0.223
Mgmt Methods Person Perfoming	15	(20.2)	60	(80.0)	75	0.088	0.411	0.260
Mgmt Action	13	(18.8)	56	(81.2)	69	0.138	0.546	0.142
Cost	17	(20.7)	65	(79.3)	82	0.244	0.600	0.378
Evaluation	11	(18.3)	49	(81.7)	60	0.116	0.656	0.179

*Only responses of the 113 districts who said they maintain pest management records in answer to question 38 are presented. Five of those districts did not respond to this question. **DNK = do not know, NR = no response.

	Percent	of 110 D	istricts Selectin	g Frequen	cy Respo	onse for	
	Maintain	ing Reco	rds at Office Lo	cation+			
Office	Always	Öften	Sometimes	Never	DNK	RLU	NR++
School Administration	19.1	7.3	18.2	24.5	5.5	_	25.5
School Custodial	8.2	6.4	16.4	39.1	3.6		26.4
School Maintenance	14.5	4.5	18.2	36.4	2.7		23.6
Superintendent	24.5	6.4	9.1	32.7	5.5		21.8
District Custodial	19.1	5.5	17.3	29.1	1.8		27.3
District Maintenance	32.7	8.2	15.5	19.1	1.8		22.7
Other	11.8	0.9		•	•	1.8	85.5
	Districts	Selecting		P-Value	for Positi	ive Frea	uency
	Positive	Frequen	cv+++	Selection	n Based (on Distri	ct:
Office	Number	(% of 1	10)	Size	Loca	tion	Community
School Administration	49	(44.5)		0.574	0.8	41	0.400
School Custodial	34	(30.9)		0.623	0.4	44	0.450
School Maintenance	41	(37.3)		0.623	0.6	21	0.342
Superintendent	44	(40.0)		0.002*	0.1	13	0.013*
District Custodial	46	(41.8)		0.446	0.2	92	0.117
District Maintenance	62	(56.4)		0.828	0.5	41	0.565

	Table 47.	Location	Where	Pest	Management	Records	have	been	Maintained
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	Distribution of Districts Selecting Positive Frequency for Maintaining Records at Office Location (as Percent of Attribute Class)										
	Size			Locat	ion		Comn	nunity			
Office	S	М	L	SLP	NLP	UP	U	S	R		
School Administration	57.9	43.8	37.0	43.0	47.4	60.0	23.1	43.5	51.0		
School Custodial	42.1	28.1	29.6	32.6	31.6	0.0	15.4	37.0	29.4		
School Maintenance	47.4	32.8	40.7	36.0	47.4	20.0	15.4	43.5	37.3		
Superintendent	63.2	48.4	3.7	33.7	57.9	80.0	15.4	26.1	58.8		
District Custodial	36.8	37.5	55.6	45.3	36.8	0.0	38.5	56.5	29.4		
District Maintenance	47.4	59.4	55.6	58.1	57.9	20.0	46.2	65.2	51.0		

Number of	Districts	Selecting	P-Value for Multiple Record Selection (1-2, 3-4, 5-6) Based on District:					
Locations	Number	r (% of 110)	Size	Location	Community			
1	45	(40.9)	0.064	0.360	0.400			
2	17	(15.5)						
3	12	(10.9)						
4	13	(11.8)						
5	13	(11.8)						
6	10	(9.1)						

Table 47 (cont'd).

Type of	Districts	Selecting	P-Value f Based or	P-Value for Office Type Based on District:				
Office	Number	(% of 110)	Size	Location	Community			
Local (School)	48	(43.6)	0.139	0.677	0.117			
District	10	(9.1)						
Both	51	(46.4)						
Neither++++	1	(0.9)						
Administration	35	(31.8)	0.185	0.252	0.092			
Support Service	26	(23.6)						
Both	48	(43.6)						
Neither++++	1	(0.9)						

+Only responses of the 113 districts who said they maintain pest management records in answer to question 38 are presented. Three of those districts did not respond to this question. ++DNK = do not know, RLU = response level unknown because either multiple responses were selected for the personnel category or no response was selected for an entry made under Other, NR = no response.

+++Includes districts selecting personnel type as Always, Often, Sometimes and RLU. ++++The district that selected neither office type location selected the offices of a pest control company.

*Indicates significant difference between classes of district attribute.

11.8%, 11.8%, 10.9% and 15.5%. No significant difference was found for number of locations selected between districts grouped by any attribute.

Districts were further identified by the types of offices selected as record storage locations. Local school locations alone were selected almost as often as both local and district office locations (43.6% compared to 46.4%). District office locations alone were selected by 9.1% of the districts. One district selected neither local school or district office locations. Instead it selected the offices of a pest control company. Districts were also identified by the type of personnel found in the offices were pest management records were said to be located. Administrative offices alone were selected by 31.8% of the districts, support service offices alone were selected by 23.6% while a combination of both was selected by 43.6%. The distribution of either type of selection (local, district, both or adminitration, support service, both), showed no significant difference for districts classed by any attribute.

Summary

Few significant differences were found between responses to questions on pest management records. Thirty-six tests were performed for each district attribute. Only two differences were found for districts grouped by size, one for districts grouped by location and two for districts grouped by community type.

Significant differences for all district groupings were found for the number of districts reporting that pest management records were maintained. Selection of the superintendent's office as a location for record storage was significantly different for districts grouped by size and community. In both cases, small districts or ones located in rural communities selected the superintendent's office more frequently than did either medium sized or suburban districts which in turn selected them more frequently than did either large or urban districts. This indicates that although the act of record-keeping is dependent on district size, location or community type, the specifics of record-keeping are not.

Technical Assistance and Pest Management Program Development

Pest Management Information Sources

Only 163 districts reported that technical assistance (TA) on pest management was available (Q-50) while 297 districts selected sources of pest management information (Q-51). The 60 districts which had said no to TA availability all selected information sources and 78 of those which did not know of TA availability also selected sources. Apparently the term technical assistance was not understood to include information sources and many districts perceived themselves as not having assistance with their pest management programs.

Twelve possible sources of pest management information were listed in the questionnaire. A few districts wrote in government agencies and pesticide sales people as additional sources and the telephone book was listed as the one miscellaneous source (Table 48). Six sources were selected by districts as most important. Pest control companies were listed as the most important source by almost half the districts (46.8%) and as the major source of information for 71.4% (all districts selecting as either first, second or third in importance). Cooperative extension service materials and personnel, district past experience, conferences and meetings, personal contacts and trade publications with commercial sponsors followed in order of selection as the most important sources of information (22.2%, 9.8%, 7.4%, 5.1% and 3.0%).

When ranked by overall importance, past experience followed pest control companies as the second major information source (51.9% of the districts). Cooperative extension service, personal contacts, conferences and meetings, and trade publications were selected by 47.8%, 38.7%, 27.3% and 15.8% of all districts. Selection of these six information sources was significantly different only for districts grouped by community type for comparison of sources selected as most important. Rural districts selected pest control companies as the most important source less frequently (40.6%) than suburban or urban (52.7% and 64.5%).

Information Source		Distr Fi rs t-	ibution of Most (%)	297 Dis Seco	stricts S nd (%)	electing Thir	informa 1 (%)	ation So Tota	urce al-Majo	or (%)
Pest Control Companies Experience Cooperative Extension Personal Contacts Conferences/Meetings Trade Publications	5	139 29 66 15 22 9	(46.8) (9.8) (22.2) (5.1) (7.4) (3.0)	47 59 29 53 28 16	(15.8) (19.9) (13.1) (17.9) (9.4) (5.4)	26 66 37 47 31 22	(8.8) (22.2) (12.3) (15.8) (10.4) (7.4)	212 154 142 115 81 47	2 (71. 4 (51. 2 (47. 5 (38. 1 (27. 7 (15.	4) 9) 6) 8) 2) 8)
Non-Extension Universi Text/Reference Books Popular Periodicals Government Agencies Scientific Periodicals Pesticide Sales People Radio/Television Miscellaneous College/Technical Court	ty ses	1 2 3 7 1 2 0 1 0	(0.3) (0.7) (1.0) (2.4) (0.3) (0.7) (0.0) (0.3) (0.0)	18 9 5 2 4 1 0 0	(6.1) (3.0) (1.7) (0.7) (0.7) (1.4) (0.3) (0.0) (0.0)	3 9 3 4 1 3 0 0	(1.0) (3.0) (3.0) (1.0) (1.4) (0.3) (1.0) (0.0) (0.0)	22 20 17 12 7 4 1	2 (7.) (6. 7 (5. 2 (4. 7 (2. 7 (2. 4 (1.) (0.)) (0.)	4) 7) 7) 1) 4) 4) 3) 3) 0)
No Response		0	(0.0)	14	(4.7)	36	(12.1)	50) (16.	B)
Comparison				P-Val Size	ue for S	election Loca	n Based ation	on Dist Cor	rict: nmuni	ty
Six Most Important Infor Six Major Information So	mation S urces	ourc	8 5	0.160 0.224)	0.19 0.22	6 3	0.0 0.4	38* 17	
Most Important Information Source	Percent Total Number	Distr By S	ibution of Size M	District L	s Select By Lo SLP	ing Info ocation NLP	ormation UP	n Source By Co U	es ommur S	nity R
Pest Control Company Cooperative Extension Experience Conferences Contacts Trade Publications	139 66 29 22 15 9	40. 28. 14. 6. 8. 1.	0 52.6 9 20.4 4 9.9 7 9.2 9 4.0 1 4.0	60.5 23.7 2.6 5.3 2.6 5.3	56.8 18.8 9.1 8.0 4.0 3.4	37.7 29.9 13.0 7.8 7.8 3.9	37.0 37.0 11.1 7.4 7.4 0.0	66.7 10.0 6.7 6.7 0.0 10.0	54.6 21.6 8.0 11.4 3.4 1.1	43.8 27.2 12.4 6.2 7.4 3.1

Table 48. Sources of Pest Management Information.

*Indicates significant difference between classes of district attribute.

90 152 38 176

77

27

280

Number of Districts

30 88 162

Technical Assistance Adequacy or Need

Most districts said that current technical assistance (TA) is adequate (85.4% of 302 districts). Comparison of yes response selection showed no significant differences although more small districts and those in rural communities responded that current TA was adequate (Table 49).

The need for new TA to implement new pest management programs was expressed by 41.3% of 303 districts (Q-53, Table 50). Eighty-seven of these respondees said that current TA was adequate for current needs. The 38 other respondees had said that it was not adequate. Comparison of yes response selection showed a significant difference only between districts classed by size. Almost twice as many large and medium sized districts expressed a need for new TA than did small districts. Comparison of the proportion of these district sizes which indicated that new TA would be needed showed a significant difference between small districts and the other two class sizes which were not different from each other (23.1%-S, 51.3%-M, 48.7%-L).

Pest Management Method Review Process

Few districts said that a pest management method review process exists (15.2% of 303). Over 75% said no while 9.2% did not know (Q-47, Table 51). Significant differences were found for yes response selection between districts grouped by size or community. Large districts and urban and suburban districts reported the existence of review processes more frequently than other district types.

Many districts offered comments on their pest management review process. A number of these concerned cooperation with the state "Right-to-Know" policy, "compliance with Right-to-Know, board policy". Others indicated that review was dependent on an effectiveness evaluation saying, "if it doesn't work, we review and look for another approved product to use". Some districts reported who performs the review, such as "school board" or "safety committee" or "head custodian".

Technical Assistance	Districts Respon	Selecting se	ting P-Value for Selection of Yes Response Based on District:					
Adequate	Number	(% of 302)	Size	Location	Community			
Yes	258	(85.4)	0.569	0.961	0.624			
No	44	(14.6)						

Table 49. Adequacy of Available Technical Assistance.

Table 50. Need for New Technical Assistance for New Programs.

Technical Assistance	Districts Selecting Response			P-Value for Selection of Yes Response Based on District:					
Need	Number	(% of 30	03)	Size	L	ocation	Con	nmunity	
Yes No	125 119	(41.3) (39.3)		0.002*	().475	0.1	80	
Do Not Know	59	(19.5)							
Technical	Distr	ibution of	Districts	s Selecting	Yes Re	sponse (% of Attrib	ute Clas	 s)
Assistance	Size			Locati	on		Comm	unity	
Need	S	М	L	SLP	NLP	UP	U	S	<u>R</u>
Yes	23.1	51.3	48.7	43.9	39.8	29.0	54.8	47.3	35.9
Number of Districts	104	160	39	189	83	31	31	91	181

Table 51. Pest Management Method Review Process.

Existence of Review	Districts Respons	istricts Selecting			or Selection of Yes Response				
Process	Number	(% of 30)3)	Size	Lo	ocation	Соп	nmunity	
Yes No Do Not Know	46 229 28	(15.2) (75.6) (9.2)		0.019*	0	.533	0.0	34*	. <u>.</u>
Existence of Review	Distr Size	ibution of	Districts	s Selecting Locati	Yes Res	sponse (%	6 of Attrib Comr	ute Clas	s)
Process	S	М	L	SLP	NLP	UP	U	S	R
Yes	9.6	5 15.1	30.0	16.9	13.4	9.4	23.3	22.0	10.4
Number of Districts	104	159	40	189	82	32	30	91	182

*Indicates significant difference between classes of district attribute.

Pest Management Program Development and Execution

More districts selected a pest control company or private pest consultant as the developer of new pest management programs than any other group, 43.4% of 302 (Q-47, Table 52). Response selections listed in the questionnaire also included local educational agency and qualified educational institution. These two selections were intended to represent the local school district and an institution such as a university or college which researches educational issues. It is not certain that district interpretation was similar. Almost equal numbers selected a local educational agency or a qualified educational institution (22.8% and 21.9%). Other entries included a mix of the three listed agencies as well as six miscellaneous agencies, Health Department, MSBA (Michigan Small Business Association), Michigan Department of Education, State Health and Education Departments and a mix of the local community, school board and staff.

Significant differences were found for agency selection between districts grouped by size and community. Local educational unit was selected most frequently by small or rural districts, educational institution was selected most by medium or suburban districts, and pest control companies as well as a mix of the three listed agencies were selected most often by large or urban districts.

More than 50% of 308 districts said that the execution of any newly developed pest management program should be the responsibility of existing district personnel (Q-49, Table 53). Existing personnel in individual schools and pest control companies followed (20.1% and 16.6%). Only 2.9% of the districts said that a new district pest manager position should be developed. Other entries included a mix of the listed options as well as one miscellaneous response which was for a state-paid county advisor.

Comparison of response selections between districts classed by any attribute were significantly different. Small, upper peninsula or rural districts selected existing personnel in individual schools most often while existing district personnel were selected most by the other

Agency		Districts Selecting Agency Number (% of 302)			P-V Bas Size	alue for ed on D e	Selection istrict: Location	Community	
Local Educational Agend Educational Institution Pest Control Company Other: Mix of the Above	cy a	69 66 131 30	(22.8) (21.9) (43.4) (9.9)		0.04		0.214	0.028*	
Miscellaneous		6	(2.0)	<u></u>					
Agency	Perc By S S	ent Dis ize M	tribution (of Distric By L SLP	cts Sele location NLP	cting Ag UP	jency By Corr U	imunity S R	
Local Educational Unit Educational Institution Pest Control Company Other: Mix of Above Miscellaneous	33.7 18.3 37.5 8.7 1.9	18.2 25.8 44.0 9.4 2.5	12.8 15.4 56.4 15.4 0.0	17.0 22.9 46.3 11.7 2.1	31.7 20.7 39.0 7.3 1.2	34.4 18.8 37.5 6.3 3.1	9.7 1 16.1 2 54.8 4 19.4 1 0.0	4.4 29.3 5.6 21.0 4.4 40.9 3.3 6.6 2.2 2.2	
Number of Districts	104	159	39	188	82	32	31	90 181	

Table 52. Persons Selected as New Pest Management Program Developer.

Table 53. Persons Selected as	Responsible for	r New	Program	Execution.
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Executed by	Distri Pers Numi	cts Selecting onne/Agency ber (% of 308)	P-Value fo Based on I Size	Community	
Personnel in Schools	62	(20.1)	0.000*	0.002*	0.001*
District Personnel	156	(50.6)			
New District Pest Manager	9	(2.9)			
Pest Control Company	51	(16.6)			
Other (Mix and Misc.)	29	` (9.7)			

	Percent Distribution of Districts Selecting Agency								
	By Si	ze		By Lo	ocation		By C	ommun	ity
Executed by	S	Μ	L	SLP	NLP	UP	U	S	R
Personnel in Schools	35.9	14.8	0.0	12.0	31.0	40.6	12.9	6.5	28.3
District Personnel	39.6	54.3	65.0	53.7	48.8	37.5	58.1	58.1	45.7
New District Pest Manager	0.9	3.1	7.5	3.7	2.4	0.0	3.2	6.5	1.1
Pest Control Company	15.1	16.1	22.5	18.8	11.9	15.6	12.9	15.1	17.9
Other (Mix and Misc.)	8.5	11.7	5.0	12.0	6.0	6.3	12.9	14.0	7.1
Number of Districts	106	162	40	192	74	32	31	93	184

*Indicates significant difference between classes of district attribute.

district types. Pest control companies were selected most often by large districts, those in the southern lower peninsula and those in rural communities.

Summary

Seven tests were performed for each district attribute to assess differences between responses to technical assistance and questions concerning new pest management program development and execution. Four significant differences were found for district size and community type comparisons. Only one was found for location comparisons indicating little influence of location on district response selection.

Only districts grouped by community differed in their selection of the top six pest management information sources. All other district comparisons showed no difference in district use of technical information sources.

Districts grouped by size differed significantly in their indication of a need for new technical assistance, should a new pest management program be implemented. Large districts selected positive responses to the need for new sources most frequently. Districts grouped by size also differed in their positive response to the existence of a pest management review process, in their selection of a new pest management program developer, and in their selection of who should execute a new pest management program.

Districts grouped by location only differed significantly in their selection of the personnel who should execute a new pest management program. Districts grouped by community type differed in their positive response to the existence of a pest management review process, in their selection of a new pest management program developer, and in their selection of who should execute a new pest management program.

A pest control company was selected most frequently by large sized districts as a new pest management program developer while small districts selected the local education unit (including district personnel) most frequently. A pest control company was also selected most frequently by urban district communities while rural districts selected the local educational unit more frequently than either urban or suburban districts.

Existing district personnel was selected most frequently by large districts, those in the southern lower peninsula and those in urban communities as the personnel type that should be responsible for execution of a new pest management program. Small, upper peninsula and rural districts selected an existing person within the individual schools more often than did any of the other district types. Clearly pest management program development and execution is dependent on district size and community type.

CONCLUSIONS

Summary of School District Responses

A data base of school district pests, pest management practices, pest management performance, effectiveness evaluation and satisfaction, record-keeping and future pest management needs has been developed. Of the 567 school districts found in Michigan, 311 returned usable questionnaires (54.9% of the total). Distribution by size was 34.7% with one to three buildings, 52.4% with four to ten and 12.9% with eleven or more. Distribution by location was 62.1% in the southern lower peninsula, 27.3% in the northern lower peninsula and 10.6% in the upper peninsula. Distribution by community was 10.3% urban, 30.2% suburban and 59.5% rural.

Pest Presence. Certain pests perceived of as problems by K-12 public schools were found to vary in intensity and variety based on district size, location or community type.

Current pest presence was reported as significantly different for districts grouped by size or location. Of the 300 districts responding to the question on pest presence or absence, 97.7% either currently had or previously had pests in their school buildings or on their school grounds. More than half the districts said that pests were a current problem (52.7%). Large districts, those in the southern lower peninsula and those in urban communities reported a significantly greater current pest presence. Tolerance of pest presence was low. Three-quarters of 297 districts said that no pests are acceptable. Only 1.3% said there is no concern over pest presence.

Districts differed in there selection of cockroaches as both the most important and the major school district concern. Again, large districts, those in the southern lower peninsula and those in urban communities reported significantly more concern with cockroaches. They did not differ in their selection of head lice which were selected as the number one school pest concern by

Traps were most preferred for prevention and management in districts with mice and rat problems. Districts without these pests selected traps, sanitation and facility modification almost equally for prevention while more selected traps for management.

For districts reporting weeds, outdoor plant diseases and outdoor plant insect pests, the most preferred prevention and management methods were modification of landscape care practices and use of pesticides. For outdoor plant disease prevention, twice as many districts preferred landscape care modification to pesticides, while each of the two options was selected by equal portions of the districts for disease management. For outdoor plant insect pest prevention, equal numbers preferred landscape care modification and pesticides, while for management pesticides were more preferred. Districts which did not report presence of these pests either preferred landscape care modification or did not know what method was preferred.

A significant difference was found between districts reporting the presence of written pest management guidelines when grouped by size with more large districts reporting their existence. Just over 90% of 303 districts said pesticides were safe and effective with 9.6% saying they were not.

Significant differences were found in the frequency of pesticide use for both prevention and management when districts were grouped by size and location. Pesticides were said to be used by 69.9% of 306 districts for prevention and by 96.1% for management. Seventy-eight percent of 304 districts said they either always, often or sometimes announce intended pesticide use but only 45.1% said they post notices once a pesticide has been applied.

Pesticides were said to be applied on all days of the week. Significant differences were found for application on Mondays, Tuesdays, Wednesdays and Thursdays when districts were grouped by size with large districts reporting their application more frequently.

Pest Management Execution. Different school district personnel were found to be respon-sible for pest management execution dependent on district size, location and community type.

Two significant differences were found in district reporting of personnel who request pest management action. These were for school administrators and kitchen staff when districts were grouped by size with small districts reporting the personnel types more frequently and for custodial and maintenance staff when grouped by community type with urban districts reporting them most frequently. No significant differences were found for the personnel reported as responsible for communicable pest problems.

Pest management methods were said to be selected in over 80% of 305 districts by both the personnel deciding management is needed and the personnel who perform the pest management. Differences were found to exist only between districts grouped by community type.

Custodial staff and pest control companies (PCCs) were reported most frequently as the personnel who performed indoor pest management. Grounds staff, maintenance staff and PCCs were reported most frequently as personnel said to perform outdoor pest management. A significant difference was found for the selection of PCCs by all district groupings with more large districts, those located in the southern lower peninsula and those in urban communities reporting their employment.

PCCs were said to be employed by 71.3% of 310 districts. Quality of service was the most important criteria used in selecting a company. Both administrative and support service personnel were said to negotiate PCC contracts. Superintendents, business managers and support services personnel were selected differently by the different district groupings. No differences were found to exit between district selection of factors said to be written into PCC contracts, nor in the length of time for which PCC contracts were negotiated.

PCCs were said to be hired to manage 21 different pests. More than half of the 221 districts employing PCCs have done so specifically for cockroaches, mice and ants other than carpenter ants. Twenty-five to 50% of the districts have employed PCCs for stinging insects, termites, carpenter ants and rats. Ten to 25% have employed them for weeds, fleas, flies, head lice, diseases of outdoor plants and mosquitoes. Fewer than ten percent have employed them for insect pests of outdoor plants, bats, birds and miscellaneous others. Significant differences were found in the reporting of PCCs hired for management of cockroaches, fleas, head lice, stinging insects, termites, bats, rats, weeds and outdoor plant insect pests by the different district groupings.

Except for head lice management, the hiring of PCCs indicates perceived pest importance better than any other measure. This is especially apparent when the number of districts reporting that they have had a specific pest is compared to the number reporting that they have hired PCCs for control of that pest. Approximately 80% of 51 districts reporting termites and 80% of 118 reporting cockroaches said they have hired PCCs for control of those pests.

PCCs were said to report to both administrative and support services personnel. Superintendents and district business managers were selected as PCC report recipients differently by districts grouped by size and location.

Pest Management Satisfaction and Concern. The level of satisfaction with current pest management efforts and control achieved did not differ by any district grouping. However, the amount of concern over pest management and pesticide use in the school environment did differ in expression between districts grouped by size, location and community type.

The reporting of concern expressed over pest management by local and district custodian, grounds and maintenance personnel as well as by parents was significantly different between districts grouped by size and location. The reporting of concern expressed over pesticide use by all school groups except students (i.e. local and districts administrators, teachers, parents, local and district support services staff), was significantly different for districts grouped by size. Large districts reported each group as expressing concern more frequently. One difference was also found for districts grouped by location and three for districts grouped by community type.

Pest Management Records. The types of pest management records kept by districts and the time periods for which they were maintained did not differ. However, the actual act of

record-keeping was significantly different for districts grouped by either district size, location or community type.

Technical Assistance and Pest Management Program Development. Interest in new pest management technical assistance and program development varied depended on district size, location or community type.

Little difference was found in the reporting of sources of technical assistance, but a significant difference was found in the need expressed by large districts for new technical assistance for new pest management program implementation.

A significant difference was found between districts indicating who should be responsible for new pest management program development when grouped by size and community type. More small and rural districts selected local school personnel while more large and urban districts selected pest control companies.

The selection of personnel who should be responsible for new pest management program execution was significantly different for all district groupings. More small, upper peninsula and rural districts selected local school personnel while more large, southern lower peninsula and urban districts selected district school personnel.

Questionnaire Concerns

Dillman's Total Design Method, TDM, (1978) was used as a general guide during survey preparation and implementation. Initially it was believed that that all questions were worded in accordance with Dillman's principles. However, upon analysis of survey returns, the true challenge of question wording became apparent. Probably the most serious problems were those of using words which were not uniformly understood and of making questions too vague.

For example, a fine line exists between pest prevention and pest management and the two practices may not be perceived as being separate in all districts. This probably made response selection variable as some districts may have selected the same answers for both prevention and management. Others may have answered only questions on management while still others might have answered only questions on prevention omitting answers on management since they would have felt they'd already responded. Questions with this fault included Q-10 and Q-11.

The same situation occurred in the effort to have districts indicate which personnel decide pest management is needed, which select methods to be used for pest prevention and/or management and which actually apply the methods. In some districts, the same personnel may perform all three tasks. These districts may have considered the response selections (or entire questions) to be redundant, and selected the same responses for all of the personnel types. Alternatively, they may have selected a response to only one question. In other districts, different personnel may have been responsible for different combinations of the three tasks while in still other districts, different personnel may have actually performed the different tasks. Response selection may therefore have meant different things to different respondents depending on personnel responsibilities. Questions with this limitation included Q-25, Q-37, Q-40 and Q-41.

Question Q-48 was also vague as no definition was given for "local educational agency" or "qualified educational institution". "Local educational agency" was intended to mean the school district itself while "qualified educational institution" was to have meant an institution such as Michigan State University or the University of Michigan. Districts could have interpreted the "qualified educational institution" as an agency that services education or even the Department of Education.

As the questionnaire was sent to districts of all sizes with different hierachies of administration and management, an effort was made to include all possible types of personnel within a district. Since some districts contain only one school, this may have made some questions appear to have duplicate responses (i.e., in such districts there is little distinction between school principal and district superindentant). In questions Q-20, Q-27, Q-30, Q-35, Q-42, Q-43, Q-45 and Q-46 school personnel were listed as response selections, followed by their district-wide counterparts. Respondees in small districts may have had difficulty deciding

whether to select from both lists, the local list only or the district list only. Some pairs of questions (the pairs Q-21/Q-22 and Q-23 /Q-24) would have appeared to be completely redundant to respondees in such districts, as the questions were identical, but with one question listing only district-level personnel as selection responses, and the other listing only local-level personnel. No analysis was attempted for such question pairs.

Questions Q-1 and Q-15 contained double negatives. Answers to Q-1 were analyzed as no response contradiction was evident. However, responses to Q-15 were in conflict and analysis of the question was dropped. Question Q-13 presented two concepts, making response interpretation possible only by reviewing the respondees' written explanations. Question Q-27 contained two separate requests (one a response for indoor pest management, and the other a response response for outdoor pest management) for each personnel type. While most districts did select two responses, several did so for indoor only. Responses to questions Q-18 and Q-19 were not analyzed as the information obtained was judged irrelevant to the survey focus.

It was not uncommon for five to six districts to decline answering any specific question. No pattern to such lack of response was evident. Analysis of questions was based on the responses of districts which did answer them. More difficulty in analysis was created by districts which gave incomplete responses to the questions. Districts may not have responded to certain parts of questions because (1) the lack of an answer was an implied no, (2) the provided responses did not apply, (3) the answer was not known by the respondent or (4) the answer was know n, but the respondent did not want to admit to a specific response. In these situations only the number of positive response selections were compared between districts grouped by attribute. Questions with large numbers of do not know responses were handled the same way.

The questionnaire was formatted as a 6-1/4" by 8-1/2" booklet with a cover designed to interest respondents and encourage them to respond. A cover letter to establish contact and a letter of endorsement were included. Contrary to the TDM, only one follow-up was mailed

instead of three. This was sent out four weeks after the questionnaire itself. Usable questionnaire return was low by TDM standards, 54.9% compared to a TDM low of 58%.

The main complaint made about the questionnaire by respondees was that it was too long and that the questions were beyond their scope of involvement. Concern was expressed over collected data reliability and validity. Some districts did not feel that pest presence or management was a problem of concern. One district felt that survey results would lead to more school pest management regulation which would cost money. A few districts said that there is a real need for information and for an ongoing program of pest control.

Certain responses may have been different if a shorter and more defined questionnaire had been prepared and implemented. However, it is not possible to determine the extent of such variation. The number of districts answering each question varied between 294 and 310, with the exception of the question concerning outdoor pest management, which was responded to by only 241 districts. Reported percentages were based on the number of districts actually responding to each specific question.

Comments made concerning this survey as well as observations made during survey response analysis indicated that future assessments of district pest concerns and pest management practices would be best served by developing surveys directed toward districts of specific sizes. A series of short surveys with the focus of subsequent questionnaires being built upon the findings of completed surveys would allow for more detailed evaluation of school district concerns and needs and would prevent respondent fatigue over questionnaire completion.

Implications of Survey Findings for Pest Management Program Development

This survey found that districts classed by size exhibited the most significant differences in their selection of question responses. This was probably due to differences in administrative structure and school personnel responsibilities as well as to differences in the potential number of pest problems due to different numbers of buildings.

Any new pest management program would need to take these size differences into account. In fact, different programs geared for districts of different sizes might meet with the most success. Throughout the questionnaire small districts selected superintendents and local school personnel while large and medium sized districts selected support service district personnel most frequently as the personnel type most responsible for pest management decision-making. When asked who should be responsible for new pest management program execution, small districts indicated local school personnel most frequently while large districts indicated district personnel.

This indicates that two different types of pest management programs would probably be most successful, one for small district implementation directed toward individual schools and one for medium and large district implementation directed toward the concurrent pest management needs of a number of buildings.

Most small districts responded that current technical assistance was adequate for their projected pest management needs while more than 50% of both medium and large districts said that new technical assistance would be needed for new programs. This further implies that large districts may be more receptive to new program implementation.

A key figure in any new program development would be the pest control company (PCC). Almost 100% of the large districts said they hire PCCs while 83% of medium and 45.7% of small sized districts reported doing so. In fact, over 50% of the large districts selected a pest control company as the agency that should develop new pest control programs for their district. This indicates that regardless of any new school pest management program development, pest control companies should be trained in school pest management and required to follow certain defined procedures in their pest management performance.
APPENDICES

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Appendix A. Cover Letter.

MICHIGAN STATE UNIVERSITY

DEPARTMENT OF ENTOHOLOGY

EAST LANSING • MICHIGAN • 48824-1115

October 19, 1987

Dear School District Superintendent,

The 1985 report to the Governor's Cabinet Council on Environmental Protection titled "A Strategy for Improved Pesticide Management in Michigan," recommended that model pest management guidelines be developed for public schools. In response to this recommendation, we have designed the enclosed questionnaire, "Pest Management Within Michigan Public Schools," to gather information on school pests and pest management practices. Responses to the questionnaire will be analyzed and used to support future decisions concerning the development of pest management guidelines and implementation procedures for Michigan public schools. Your district's participation will directly influence these decisions.

This questionnaire concerns only those buildings in which students attend classes. Questions are asked concerning:

- prevalence of pests,

- practices used to manage pest problems,
- school personnel involved in making pest management decisions,
- satisfaction with practices used and control achieved, and
- need to implement or improve pest management guidelines.

We have addressed this questionnaire to you and other school district superintendents, but we would like it to be completed by the individual within each school system who has the most comprehensive understanding of pest management as it is practiced in your school facilities. Upon completion, that person should return the questionnaire in the enclosed pre-addressed stamped envelope. We request that completed questionnaires be returned by November 15th.

You may be assured of complete confidentiality. The return envelope has an identification number for mailing purposes only. A follow-up request will be sent to those school districts from which a completed questionnaire has not been recorded as received.

If you have questions concerning the purpose or content of this questionnaire or if you wish to obtain a copy of the summarized results, send a separate request to either Deborah Miller, Project Coordinator, or Dr. George W. Bird, Professor, care of the Department of Entomology, 243 Natural Science Building, Michigan State University, East Lansing, MI 48824, Phone: (517) 355-4662.

Enclosed you will find a copy of a letter from the Michigan Department of Education encouraging your cooperation in this project. Your participation is greatly appreciated.

Sincerely,

Deborah Miller, Coordinator

Appendix B. Letter of Endorsement.

STATE OF MICHIGAN



July 13, 1987

Lansing, Michigan 48909

DEPARTMENT OF EDUCATION STATE BOARD OF EDUCATION BARBARA ROBERTS MASON President DOROTHY BEARDMORE Ine President CHERRY JACOBUS DR. GUMECINDO SALAS Trainer DR. EDMUND F. VANDETTE N.SBE Drivate CARROLL M. HUTTON ANNETTA MILLER NORMAN OTTO STOCKMEYER. SR Governor JAMES J BLANCHARD Ex-Officie

MEMORANDUM

TO: School District Superintendents Gary D. Hawks FROM:

In 1985, a report to the Governor's Cabinet Council on Environmental Protection entitled, "A Strategy for Improved Pesticide Management in Michigan," identified school system pest management programs as an area for study. Michigan State University has initiated a research project to assess existing pest problems and pest management procedures in Michigan schools. In the near future, you will be receiving a research questionnaire covering this important topic.

As the issue of pests and pest management impacts the health of our students, I encourage your cooperation in distributing the questionnaire to the appropriate individual within your district for completion. Results will be analyzed to assess the need for development of s school integrated pest management program.

All efforts will be made to maintain the confidentiality of your response.

Your cooperation will be greatly appreciated.

Thank you.



Appendix C. Questionnaire.

	SECTION A
ed to gather information on pests the pest management practices	First, we would like to find out what pests have been troublesome in your school district. By a pest we mean any insect, disease, animal or other living thing that has caused problems.
estions can be answered either by tering a response number into a box. es of your time to complete.	Q-1 Have pests occurred within schools and/or on school grounds in your district? (Circle appropriate number.)
	1 YES, BUT WE DO NOT HAVE ANY PESTS NOW
question. Then select the	2 YES, AND WE HAVE PESTS NOW
are most appropriate for	3 NO, WE HAVE NEVER HAD ANY PESTS.
ely return the questionnare dressed, stamped envelop. eturn address is given at the end	Q-2 Which of the following would best describe the general feeling of school administrators toward pests in your district? (Circle appropriate number.)
	1 PESTS OF ANY NUMBER ARE NOT ACCEPTABLE
do not identify your le questionnaire or the	2 THE PRESENCE OF A FEW PESTS IS NOT OF CONCERN AS LONG AS THEY DO NOT HARM PEOPLE
	3 THERE IS NO CONCERNIOVER THE PRESENCE OF PESTS
rill help influence future decisions management guidelines and ligan public schools.	Q-3 Other schools have reported problems with the pests listed below. Please select those 3 pest, whose preserve <u>its of tarbuild be</u> of most concern to schools in your district. (Place the numb of each important pest in the appropriate box. These do not need to be pests previously encountered in your district in order to be considered important.)
	EIEST MOST SCOND MOST IHED MOST MORT MOST MOST MOST ANT PEST MEORTANT PEST
	PESIS
	1. Carpenter ants (only) 11. Birds 2. Other ants 12. Mice
	4. Fleats 14. Weeds
	5. Flies 15. Diseases of outdoor plants 6. Heartinger intervention
	7. Mosquitoes 17. Other
	8. Stinging insects (wasps, bees, etc.) specify 9. Termites
	10. Bats specify

This questionnaire has been designed to gather information on pest found in Michigan public schools and the pest management practice used to control them. Almost all questions can be answered either circling a response number or by entering a response number into a It may take approximately 30 minutes of your time to complete.

•

- (1) Please carefully read each question. Then select the response or responses that are most appropriate for your school district.
- (2) Upon completion, immediately return the questionnare within the enclosed pre-addressed, stamped envelop.
 (If this has been misplaced, a return address is given at the end of the questionnaire.)
- (3) To maintain confidentiality, do not identify your school district on either the questionnaire or the return envelope.

Your participation in this project will help influence future decisions concerning the development of pest management guidelines and implementation procedures for Michigan public schools.

2 Que How numerous would each of the following pests need to become in your achool district before they would be considered a problem that must be managed?

	(Circle of	umber of Pr	este lor each item)
Preis	W	FEW	MANY
1. CARPENTER ANTS (only)	-	~	
2. OTHER ANTS	-	2	
3. COCKROACHES	-	2	e)
4. FLEAS	-	2	
5. FLIES	-	~	e
6. HEADLICE	-	~	
7. MOSQUITOES	-	~	
8. STINGING INSECTS (waspe, etc.)	-	~	0
9. TERMITES	-	2	
10.BATS	-	~	•
11.BIRDS	-	2	60
12.MICE	-	~	67
13.RATS	-	~	0
14.WEEDS	-	~	6
15. DISEASES OF OUTDOOR PLANTS	-	8	•
16. INSECT PESTS OF OUTDOOR PLANTS	-	~	6
17.0THER apecify	-	N	•
18.0ThER specify	-	~	9

Q-S Considering all the schools within your district, approximately what proportion of them have had, or currently have, problems with the following pests?

	8 4	Circle	one ru	ncela w	ith Prob	iems em)	
Peets	NONE	1	1/2	374	AL	DO NOT	
1. CARPENTER ANTS (only)	-	~		4	5	w	
2. OTHER ANTS	-	~	•	4	5	60	
3. COCKROACHES	-	~	•	4	s	60	
4. FLEAS	-	8		4	5	ø	
5. FLIES	-	~	•	4	ŝ	¢	
6. HEADLICE	-	3	•	•	5	6	
7. MOSQUITOES	-	~		4	ŝ	ø	
8. STINGING INSECTS (wasps, etc.)	-	8		4	ŝ	¢	
9. TERMITES	-	~		4	ŝ	6	
10.BATS	-	2		4	ŝ	5	
11.BIRDS	-	~	e	4	ŝ	9	
12.MICE	-	~	9	•	ŝ	S	
13.RATS	-	N		4	5	8	
14.WEEDS	-	~		4	ŝ	•0	
15. DISEASES OF OUTDOOR PLANTS	-	~	•	•	нî	ø	
· 16. NSECT PESTS OF OUTDOOR PLANTS .	-	~		4	ŝ	•0	
17.0THER specify	-	~		•	шî	•0	
18.OTHER	-	N		4	ŝ	60	

specify



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. 0 4



In this section we ask questions about pest management methods used in your achool district.

O-10 From the list below, select the 2 most preferred methods used to <u>ROVENT</u> peris <u>belove</u> they become problems into use bod sinicit. (Face also an under of the pest management method weat in the appropriate bour in from of each part).

	∝ 8	_		
FIRST SECOND METHOD METHOD MODE CHODE PESTIS	1. 8409 1. 8409 1. 8409 1. 44 14 14 14 14 14 14 14 14 14 14 14 14	GENERIT METHODS	dilactived dilactive collactive collactive collactive di dilactive di di di di di di di di di di di di di	
FIRST SECOND METHOD METHOD MODICE CHOICE PESTIS	1. 0.0450/ERAMTS 1. 0.0450/ERAMTS 2. 0762/ARTS 2. 0762/ARTS 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.126 7.12 7.126 7.12 7.126 7.12 7.126 7.12 7.1	PEST MANA	1. Settimbic performance and an angle of the set of the	

11

5

0-11 From the list below, elect the 2 most pretented methods used for **managing** petits <u>aller</u>. Upper Decome a problem to pur school caller, (Please he number of the pest management method used in the appropriate box in fixer of each seal.)

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SECTION C

Now we would like to find out who, within your school district, holds responsibility to decide when pest management needs to occur and what methods of management to use.

Q-18 To better interpret your responses, we need to know how personnel duties and titles relate. Please state the job titles and scope of responsibilities corresponding to the tracks listed below. L

					pe of Reapo ox below for	nsibilities" r explanation)	
	Dutles/Tasks		atif. Gol.	ONLY(1) SCHOOL	DISTRICT ONLY(2)	BOTH SCHOOL & DISTRICT(3)	
÷	CLEAN FACILI	TES	specify	-	~	ę	
Ň	MANTAN GPC	SONIO	specify	-	5	ę	
ຄ່	MAINTAIN & F BUILDINGS	TEPAIR	specify	-	~	e	
	MAINTAIN & F OUTDOOR FA	REPAIR CIUTTES	specify	-	~	n	
		Explana	ation of Scope of Responsibilities				
	2 4 4 8 5 5 : (2) (2) 	reonnel reonnel distric me pere trrict	ere assigned to a specific school work as needed at different school it correl as assigned to specific sch orrel as assigned to different schools to k as needed at different schools to	ole through Toole while throughout (77 2		

C-15 Does a district office (or manager) exist which coordinates activities of the above personnel? (Circle appropriate response.)

1. YES

Q ₹

Q-20 How frequently do each of the following school groups request that a pest problem be managed?

Ξ

School Group School Group School ADMINISTRATORS		<u> a</u>	equenc Circle o	y Mana ne numi	gement ber for	Requested
SCHOOL ADMINISTRATORS 1 2 3 TEACHERS 1 2 3 STUDENTS 1 2 3 KITCHEN STAFF 1 2 3 KITCHEN STAFF 1 2 3 CUSTODIAL STAF 1 2 3 MAINTENANCE STAFF 1 2 3 GROUNDS STAFF 1 2 3 DISTRICT PERSONNEL, AS ARESULT OF DISTRICT PERSONNEL, AS ARESULT	School Group		NHO	IL MOS	A HINJA	NON TO
TEACHERS 1 2 3 STUDENTS 1 2 3 KITCHEN STAFF 1 2 3 CUSTODIAL STAF 1 2 3 CUSTODIAL STAF 1 2 3 MAINTENANCE STAFF 1 2 3 OROUNDS STAFF 1 2 3 DISTRICT PERSONNEL, AS A RESULT OF DISTRICT	SCHOOL ADMINISTRATOF	S) -	. a	4 60	
STUDENTS 1 2 3 KITCHEN STAFF 1 2 3 CUSTODIAL STAF 1 2 3 CUSTODIAL STAFF 1 2 3 MAINTENANCE STAFF 1 2 3 MAINTENANCE STAFF 1 2 3 GROUNDS STAFF 1 2 3 DISTRICT PERSONNEL AS ARESULT OF DISTOVERME AND ARESULT OF DISTURCT PERSONNEL AS ARESULT OF DISTRICT PERSONNEL AS ARESULT PERSONNEL AS ARESULT PER	TEACHERS	•••••••••••••••••••••••••••••••••••••••	-	~	en	•
KITCHEN STAFF 1 2 3 CUSTODIAL STAF 1 2 3 CUSTODIAL STAF 1 2 3 MAINTENANCE STAFF 1 2 3 GROUNDS STAFF 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DISTRICT PERSONNEL AS A RESULT PERSONNEL AS A RESULT OF DISTRICT PERSONNEL AS A RESULT	STUDENTS		-	2		•
CUSTODIAL STAF 1 2 3 MAINTENANCE STAFF 1 2 3 GROUNDS STAFF 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DISTRICT PERSONNEL AS A RESULT OF DISCOVERING PROBLEM DURING 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DISCOVERING PROBLEM DURING 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DISCOVERING PROBLEM DURING 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DISCOVERING PROBLEM DURING 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DISCOVERING PROBLEM DURING 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DISCOVERING PROBLEM DURING 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DURING 1 2 3 DISTRICT PERSONNEL AS A RESULT OF DURING 1 2 3	KITCHEN STAFF	••••••	-	~		•
MAINTENANCE STAFF	CUSTODIAL STAF	• • • • • • • •	-	~		•
GROUNDS STAFF	MAINTENANCE STAFF .	• • • • • • • •	-	~	e	•
DISTRICT PERSONNEL AS A RESULT OF DISCOVERNG PROBLEM DURING FACILITY INSPECTION	GROUNDS STAFF		-	N		•
OTHER 1 2 3	DISTRICT PERSONNEL AS DISCOVERING PROBLEM D FACILITY INSPECTION	A RESULT OF JRNG	-	8	e	•
	OTHER		-	~	e	4
specify	specify					

(Please Continue.)







0-21





Q-24

<u>led al School with Peat Problem</u> Ners that apply for each item)	A COLOR AND A COLO	6 4 4 8 6 40	6789	6 7 8 9	6 7 8 9	6 7 8 9	6 7 8 9	6789	6 7 8 9	6 7 8 9	e 8 7 8	6 7 8 9	6 7 8 9	6 7 8 9		6 7 8 9	6 7 8 9	6789		6 7 8 9
Circle all nur (Circle all nur	COENCE AND COENCE	5 s 4 e 7 a	2 3 4 5	2 3 4 5	2 3 4 5	2 3 4 5	5 7 2	2 3 4 5	2 7 2	2 4 5	5 4 5	5 + 2	3 4 5	5 7 2	2 4 5	3 7 7	9 7 8	5 7 2		0 •
	Parts Prefs	1. CARPENTER ANTS (only). 1 2	2. OTHER ANTS 1 2	3. COCKROACHES 1 2	4. FLEAS 1 2	5. FLIES	6. HEADLICE 1 2	7. MOSQUITOES	8. STINGING INSECTS 1 2	9. TERMITES	10.BATS 1 2	11.BIRDS 1 2	12.MICE 1 2	13.RATS 1 2	14.WEEDS 1 2	15.DISEASESOFOUTDOOR PLANTS1 2	16. INSECT PESTS OF OUTDOOR PLANTS 1 2	17.0THER 1 2	Aineda	18.0THER 1 2 specify 1 2

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2

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5. PRIVATE PEST CONTROL COMPANY

specify

6. OTHER

e





- 3 DONDTRNDW
- Q-29 What criteria are used in selecting a pest control company? (From the list below, place the number of the criterion used in the appropriate box.)



C-30 Who regoliates contracts with pest control companies?

specify 5. Do Not Know



Q-31 Which of the following factors are specifically defined in contracts negotiated with pest control companies?

	Eactors Defined	YES Circle or		DO NOT KNOW Der for each item)
_	PEST MUMBERS THAT MUST BE PRESENT BEFORE PEST MANAGEMENT METHOOS CAN BE USED	-	~	ø
Ň	TYPES OF PEST MANAGEMENT METHODS THAT CAN BE USED	-	~	ø
Э.	TYPES OF PESTICIDES THAT CAN BE USED	-	~	e
4	EVALUATION OF MANAGEMENT EFFECTIVENESS TO TAKE PLACE	-	N	e
en i	RECORDS ON PEST NUMBERS, MANAGEMENT METHODS USED AND THER EFFECTIVENESS THAT ARE TO BE FILED WITH SCHOOL PERSONNEL	-	N	e
ġ	OTHER	-	~	ю

- C-32 For what time period are contracts with pest control companies negotisted? (Circle most appropriate response.)
- 1 DURATION OF SPECIFIC JOB
- 2 ONE YEAR
- 3 TWO YEARS
- 4 THREE VEARS
- 5 OTHER
- specify
 - 6 DONOTIONOW



End Section D. Please continue.

OTHER specify

18.

specify

OTHER

MICE . . .

4. 15. 16. 17.

13.

BATS

<u>0</u> Ξ. 12.

ø

ø

BIRDS

HEADLICE

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4

si. ø

C-34 How inequently are the following methods of pest control used or recommended by pest control companies to manage pests within schools in your district?

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Pests

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SECTION E

8

In this section we ask questions about the effectiveness of pest management methods used, pest management records that may be kept, and the degree of satisfaction with current pest management efforts.

Q-36 Does anyone evaluate the effectiveness of pest management methods used in schools in your district?

- 1 YES
- Q ≈
- 3 DO NOT KNOW

Q-37 If yes, who evaluates the effectiveness of methods used?

	Evaluator	Circle of C		of Evaluation ben for		(Ē
.	SCHOOL PERSONNEL WHO DECIDED THAT PEST MANAGEMENT WAS NEEDED	TANK -	NJL-10 ~	AL ACE E	ANNA .	eret s
Ň	SCHOOL PERSONNEL WHO USED THE PEST MANAGEMENT METHOD	-	~		4	ŝ
Ň	PEST CONTROL COMPANY THAT USED THE PEST MANAGEMENT METHOD	-	~		4	5
4	OTHER specify	-	2	n	4	S

C-38 Are incords lept within your school district concerning any aspect of pest management? (Circle appropriate response.)

- 89 -
- Go To Q 43 2
 - - 3 DONOTIONOW

C-30 Are these records accessible for review? (Circle appropriate response.)

- 1 YES
- **9** ≈
- 3 DONOTINOW

Q-44 How many parents of the students attending your schools know about the pest management methods used in your district? (Circle appropriate response.)

3/4	AL
4	ŝ
NONE	11
-	~

DO NOT KNOW
ø
~
1
e

Q-45 Have any of the following persons or groups ever expressed concern with any aspect of

0	urrent pest management efforts?				1
	Persons or Groups	VES (Circle o	Q P	DO NOT KNOW ber for each item)	
-	ADMINISTRATORS WITHIN THE SCHOOLS	-	~	e	
è.	TEACHERS/LIBRARIANS	-	~	Ð	
ė	students	-	~	Ð	
4	PARENTS OF THE STUDENTS	-	~	ē	
ν.	CUSTODIAL GROUNDS OR MAINTENANCE STAFF WITHIN THE SCHOOLS	-	~	e	
ø	DISTRICT ADMINISTRATORS	-	~	e	
Υ.	DISTRICT CUSTODIAL, GROUNDS OR MAINTENANCE STA	-	~	ę	
ø	OTHER	- 1	~	n	

182

Q-46 Have any of the following persons or groups ever expressed concern over the use of pesticides in the school environment and the impact these substances may have on people in this location?

			5	
	Pennons or Groups	YES Circle o	Q E	DO NOT KNOW ther for each item
<u>_</u> :	ADMINISTRATORS WITHIN THE SCHOOLS	-	~	
	TEACHERS/LIBRARIANS	-	~	6
ற்	STUDENTS	-	~	ę
4	PARENTS OF STUDENTS	-	~	e
ທີ່	CUSTODIAL GROUNDS OR MANTENANCE STAFF WITHIN THE SCHOOLS	-	~	6
6	DISTRICT ADMINISTRATORS	-	~	ę
~	DISTRICT CUSTODIAL, GROUNDS OR MAINTENANCE STAFF .	-	~	ũ
ġ	ОТНЕЯ	-	~	Ð
	specify			

Litelihood of Presence (Circle one nº ther (ur each item)	MONO 43N MAN 431-2 ANN	WINSTRATION OFFICE OF SCHOOL HAVING PC 00 go かい ひ い の ST PROBLEM	STOOML OFFICE OF SCHOOL HAVING PEST PROBLEM 1 2 3 4 5	NTENANCE OFFICE OF SCHOOL HAVING ST PROBLEM	STRICT SUPERINTENDENT'S OFFICE 1 2 3 4 5	STRICT CUSTODIAL OFFICE 1 2 3 4 5	STRICT MAINTENANCE OFFICE	HER1 2 3 4 5 4pecity1 2 3 4 5	venses of current pet management efforts? (Select NOT APPLICABLE only if such a does not exist in your school district.)	(Circle one number for each item)	MINISTRATORS WITHIN THE SCHOOLS 1 2 3 4 5	ACHERS/LIBRARIANS	UDENTS	RENTS OF STUDENTS	HOOL CUSTODIAL STAFFS 2 3 4 5	HOOL GROUNDS STAFFS1 2 3 4 5	HOOL MAINTENANCE STAFFS1 2 3 4 5	STRICT ADMINISTRATORS1 2 3 4 5	STRICT CUSTODIAL STAFF 1 2 3 4 5	ITRICT GROUNDS STAFF	STRICT MAINTENANCE STAFF1 2 3 4 5	HER 1 2 3 4 5
	Location	1. ADMINISTRAT	2. CUSTODALC	3. MAINTENANC PEST PROBI	4. DISTRICT SU	5. DISTRICT CU	6. DISTRICT M	7. OTHER	effectiveness of group does not	Persons or G	1. ADMINISTRA	2. TEACHERSA	3. STUDENTS	4. PARENTS OF	5. SCHOOL CU	6. SCHOOL GR	7. SCHOOL MA	8. DISTRICT AC	9. DISTRICT CL	10.DISTRICT GF	11. DISTRICT MI	12.OTHER

25

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2

- S NO
- 3 DONOTIONOW
- B. If yes, please describe this process.

- Q-43 If a comprehensive pest management program was prepared for your school district, who do you think should develop if? (Circle appropriate number.)
- 1 LOCAL EDUCATIONAL AGENCY
- 2 OUALIFIED EDUCATIONAL INSTITUTION
- 3 PEST CONTROL COMPANY OR PRIVATE PEST CONSULTANT
 - 4 OTHER specify
- Q-49 Who do you think should be responsible for execution of a new pest in your achool district? (Circle appropriate number.)
- 1 EXISTING PERSONNEL WITHIN THE NOWDUAL SCHOOLS
- 2 EXISTING DISTRICT PERSONNEL
- 3 A NEW PEST MANAGER POSITION CREATED WITHIN THE SCHOOL DISTRICT
- 4 A PEST CONTROL COMPANY
- specify 5 OTHER
- G-50 is technical assistance in juest management currently available to you and your school district? (Circle appropriate response.)
- 1 YES
- 9 2 2
- 3 DO NOT KNOW

Q-51 From the list below, please select the three sources you most frequently use to gain foromation no pair management. (Place the number of the information source within the spropriate box.)



G-52 is this technical assistance adequate for your current needs? (Circle appropriate response.)

specify

183

- 1 YES
 - 2 10

Q-53 Would new technical sestistance be needed to help implement a new pest management program? (Citcle appropriate response.)

- .1 YES
- 8
- 3 DONDTINOW

End Section E. Please Continue.

SECTION F

The remaining questions concern general school district characteristics.

Q-54 How many school buildings are located in your district? (Enter number in box. Do not include non-school structures.)

Q-55 Considering all the school buildings in your district, please indicate the proportion that fall within each of the age categories listed below. (Circle appropriate response for each.)

		Proport	lion of Sch	बाव	
<u>Ace in Years</u>	NONE	1/4	1/2	3/4	ALL
1. 0.5	-	~		4	ŝ
2. 6 - 10	-	~	e	4	ŝ
3. 11 - 20	-	8	•	4	ŝ
4. 21 - 30	-	~	•	4	ŝ
5. GREATER THAN 30	-	~	•	•	ŝ

Q-56 Which of the following ranges best represents the 1987-1988 student enrollment in your school district? (Circle appropriate number.)

5001 - 10,000	GREATER THAN 10,001
4	ŝ
0 - 1000	1001 - 2500
-	2

Q-57 Which of the following best describes the general character of neighborhoods or surroundings within your school district? (Circle appropriate number.)

1 UPBAN 3 PURAL

2 SUBURBAN

Q-58 Within what county is your school district located?

End Section F.

Thank you for completing this questionnairell!

We would appreciate knowing what position you hold within your school district..

If you have any additional comments you would like to make concerning pests, pest management practices or the need for development of school pest management guidelines, please add them to this page.

Please return the questionnaire within the enclosed pre-addressed, stamped envelope.

If the envelope has been misplaced, the questionnaire should be mailed in an unmarked envelope to:

School Survey Department of Entomology Michigan State University 243 Natural Science Building East Lansing, Michigan 48824

LIST OF REFERENCES

LIST OF REFERENCES

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