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HOMEOWNERS' ATTITUDES ABOUT THE USE OF LAWN CHEMICALS

By

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ABSTRACT

HOMEOWNERS' ATTITUDES ABOUT THE USE OF LAWN CHEMICALS

By

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Greater environmental pressure has resulted in an increasingly complex number of regulations affecting the use and sale of agricultural chemicals. Increased regulation has been perpetuated by the recognition of the potentially adverse effects that improper pesticide use can have on soil, water, plant, and human ecosystems. Many of these chemicals are distributed in urban areas for use by the general public on lawns. Lawn chemical use brings these products into closer contact with humans and animals than occurs in many farming areas.

This research study attempted to measure the attitudes of homeowners to determine how they feel and what they think about lawn chemicals.

The results of the study showed that homeowners are generally ambivalent about the use of lawn chemicals. Homeowners are more concerned about proposed restrictions that are being implemented on lawn chemical use.

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Chapter I

INTRODUCTION

ENVIRONMENTAL ACTIVISM

The environment is a critical, on-going concern to American consumers. It continues to rank among the top six consumer issues, along with quality of education, high medical costs, crime, drug and alcohol abuse and the AIDS problem. Furthermore, the intensity of this concern has been maintained. As of June 1990, about half of all consumers indicated they are more concerned about the environment than they were in 1989-- compared to only 2% who were less worried (Green Action Monitor, 1991).

Three segments of the population are driving environmental concern:

1. **Women.** Women report greater anxiety than men over a broad range of specific environmental issues. They are most likely to engage in environmentally-sensitive behaviors such as recycling, reusing, using less and boycotting the products of polluters.
2. **Consumers between the ages of 25 and 44.** As younger consumers, these people were largely responsible for the growth of environmental concern in the 1970's. Their involvement is now driven by practical, quality of life needs as they seek a better environment for themselves and their

children. These consumers also report greater sensitivity to a variety of environmental issues and a greater likelihood of taking action.

3. **Consumers in the Northeast.** Motivated by the greater salience of some specific environmental problems to their region--vexing issues such as acid rain, decreasing landfill capacity (and related concerns about excess packaging and products that aren't biodegradable), consumers in the Northeast report higher levels of environmental concern. They also constitute a disproportionate number of the most sensitive environmental activist segment, the "Evergreens."

Environmental degradation has been predominantly driven by the enormous amount of raw materials that have been used and released into the biosphere by manufacturers since the beginning of the Industrial Revolution. Human use of raw materials--with the notable exception of timber--was almost insignificant by today's terms until the rise of modern industrial economies in the 19th century (Young, 1990). From then on it grew at an explosive rate.

The most serious environmental issues that have arisen from this degradation include:

1. Air pollution
2. Nuclear and toxic waste disposal
3. Water pollution

4. Oil spills
5. Pesticides/fertilizers
6. Depletion of the forests
7. Auto-pipe emissions
8. Foods containing additives/preservatives
9. Excess product packaging

PESTICIDES

Recent studies indicate that environmental action should take precedence over economic growth. According to Cambridge Reports Research International (1989), "This willingness to sacrifice economic gain for the sake of the environment is evident across the board in qualitative studies on public attitudes about the greenhouse effect, air quality, and the use of pesticides" (p.1). The current state of the environment is more than a public issue; it has become a personal problem. In proprietary surveys majorities of consumers claim that their health has been affected by deteriorating environments, including the poor quality of drinking water and the poor quality of the air they breathe in the workplace (Ketchum Public Relations, 1991). In addition, research indicates that people are willing to sacrifice a wide selection of food in order to reduce the use of pesticides. Commitment to preserving the environment is also evident in the tradeoffs Americans are willing to make in order to avoid pesticide use. For example, a growing majority of Americans say they would pay

higher prices to avoid pesticides in foods, and nearly seven in ten people now say they would put up with a smaller selection of foods for this purpose. (CRI,1990)

The public's alarm and concern about the effects of pesticides on their own health is one of the primary catalysts now driving environmental activism. Polls show that it is this concern for human health, rather than preservation of nature, that is behind the recent surge of environmentalism.

Greater environmental pressure has resulted in an increasingly complex number of regulations affecting the use and sale of agricultural chemicals. Increased regulation has been perpetuated by the recognition of the potentially adverse effects that improper pesticide use can have on soil, water, plant, and human ecosystems. Many of these chemicals are distributed in urban areas for use by the general public on lawns. According to Creason and Runge, (1992) "to date, these nonagricultural uses have received relatively less scrutiny than farm uses. Yet lawn chemical use in urban areas brings these products into closer contact with humans and animals than occurs in many farming areas. Urban landscapes are specifically designed to direct runoff into surface water systems through drains, gutters and storm sewers" (p. i)

For many years, an expanse of green, healthy lawn has been a valued part of a traditional American concept of a

comfortable family home. More than 56 million Americans take part in their own lawn care (National Gardening Association (1987-88). Lawns occupy an area estimated at between 25 million and 30 million acres, nearly 50,000 square miles or the size of the five New England states. The acreage of turfgrass coincides closely with population size. As the U.S. population continues to increase, so too will the turfgrass acreage (Roberts, 1986). With the development of inexpensive commercial fertilizers and pesticides, and rising household incomes in the post World War II era, the lawn care industry has grown into a $1.5 billion enterprise (Stevens, 1990). Concern for human health risks has resulted in tighter regulation of professional applicators at the state and local levels of government. Recognition of the contribution to water quality problems from lawn care practices has had a similar effect. Overall, the picture is one of increased concern about the effects of lawn chemicals by consumers. Over the last two years, there has been a corresponding decline in the use of lawn chemicals. However, the decline in pesticide use appears more widespread. Along with the reduction in the number of people using pesticides on their gardens, trees and vines, those who reported a change in the amount used were twice as likely to report using less lawn chemicals as opposed to more. What may be more significant is the growing proportion of consumers who say they never use any

chemical based pesticide.

Another significant change in lawn chemicals usage are the reasons given by those using fewer chemical pesticides. While in earlier studies a sizable majority said they used less because of fewer problems and reduced need, the proportion giving that reason, reduced by half. There was a corresponding increase in the proportion citing environmental concerns and worry about personal safety (Hamlin, 1990).

PESTICIDE REGULATION

This increased concern has resulted in new regulations being implemented to monitor pesticides. In the United States, new regulations governing lawn care practices have been introduced at both the state and local levels of government. They have generally taken the form of state-level restrictions on pesticides and local-level fertilizer restrictions.

It is helpful to place these efforts within the larger context of the evolution of environmental regulation. This process has occurred in three broad areas: (a) Regulations have evolved from a primary focus on acute (i.e., health) effects to a position that recognizes chronic (i.e., environmental) effects; (b) the scale of pollution has shifted from fixation on point source to awareness of non-point sources; and, (c) the base of regulatory authority has shifted from being centralized to being decentralized.

Environmental regulations date back to the 1947 passage of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (Public Law 80-104). This law required that pesticides be registered by the United States Department of Agriculture (USDA). The registration process was designed to verify manufacturer's claims of effectiveness and to ensure that the product label contained directions for use that were adequate for the protection of the public (Extension Bulletin E-2195). This early form of regulation was interpreted to be narrowly focused on acute effects, and data requirements were highly variable. Even so, the job was soon recognized to be too large for USDA.

In 1970, President Nixon established the Environmental Protection Agency (EPA) and conferred upon it the duties of pesticide registration according to the requirements of FIFRA. In 1972 Congress amended FIFRA to require reregistration of all pesticides. Re-registration is the process by which EPA guidelines are updated on human toxicology, environmental fate, environmental toxicology, residue chemistry and metabolism. There are several time restrictions in the reregistration process to meet data requirements. If a manufacturer fails to comply with these requirements, the product under registration can be suspended or canceled (Byrum, 1990). These new registrations required more data, and assurances that a pesticide would not cause unreasonable adverse health

effects on the environment. This phase marks a shift towards recognition of potential chronic effects. The re-registration mandate created a new burden for EPA. Congress set, extended, and later removed deadlines for its completion. This process is still incomplete. Also in 1972, the Clean Water Act was amended (PL 92-500). This act was designed to curtail point-source surface water pollution and provide funding for municipal water treatment facilities. This law has been further amended (1977 & 1987) to add emphasis to non point-source pollution control.

Another regulation trend is the shift in scale from centralized to decentralized regulation (Creason & Runge, 1992). Responding to the general paralysis at EPA induced by re-registration burdens and reduced funding, many states and localities have begun enacting their own regulations. There are many examples across the United States. For example, in some states professional applicators are regulated by the state Department of Agriculture. Applicators must be trained and licensed, and equipment is inspected periodically (Schmickle, 1991). Recently, some cities have also responded by regulating fertilizer applicators to post warnings after application.

Based on these facts, the study on homeowners' attitudes about pesticides used on lawns.

THE RESEARCH PROBLEM

Due to increasing concerns by homeowners and the evolution of pesticide regulation standards, this study attempted to measure the attitudes of homeowners to determine how they actually feel and what they think about lawn chemicals. Specific objectives of the study were to:

1. Determine possible relationships between homeowners' attitudes on lawn chemicals and demographic data.
2. Determine possible relationships between homeowners' attitudes about proposed restrictions on lawn chemicals and demographic data.
3. Determine homeowners' attitude about lawn chemicals.
4. Determine which media sources or other sources of information homeowners get their information from about lawn chemicals.

DEFINITION OF TERMS

To add to the understanding of the research problem, it was necessary to define selected terms. The need for definition of terms was especially important because of their complexity.

Attitude(s): "An attitude is a mental and neutral state of readiness, organized through experience, exerting a directive or

dynamic influence upon the individual's response to all objects and situations with which it [attitude] is related" (Allport, 1935, cited in Triandis, 1971, p.2)

Concern(s): A state of uncertainty or apprehension.

Fertilizer: Any organic or inorganic material added to soil or water to provide plant nutrients and to increase the growth, yield, quantity, or nutrificative value of the plants therein (Winburne, 1962).

Gardening: A plot of ground, usually less than an acre, devoted to the growing of vegetables, flowers, herbs, etc., which is often adjacent to a home (Winburne, 1962).

Lawn: Ground covered with grass kept mowed around a house, in a garden or in a park.

Pesticide: Chemicals used to control unwanted pests such as insects, plants, fungi, mites, rodents, bacteria or other pests. The word comes from the Latin pestis, for "plague," and cida, "to kill."

Turf: The upper stratum of soil bound by grass and plant roots into a thick mat.

HYPOTHESES AND RESEARCH QUESTIONS

Each hypothesis and research question relates to a specific project objective. Hypotheses and research questions will be grouped under there specific project objective and answered in Chapter IV.

RESEARCH HYPOTHESIS

The following research hypothesis will be used in this study:

1. There are no differences in homeowner attitudes when compared to demographic data.
2. There will be no significant attitudinal differences between homeowners about proposed restrictions when compared to demographic data.

RESEARCH QUESTIONS

1. What will be the overall attitude of homeowners about the use of lawn chemicals?
2. Which media source will be the primary source of information for homeowners?
3. What will be the most prominent non-media source of information for homeowners?

ASSUMPTIONS

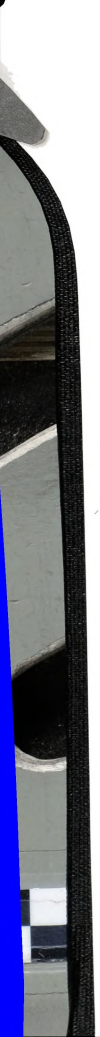
1. Homeowners have different levels of knowledge about pesticides.
2. Homeowners, with rare exceptions, will not have

extensive experience (i.e., actual application) with pesticides.

3. Homeowners receive information about pesticides from a variety of sources.
4. Homeowners' attitudes affect their willingness to learn about pesticides.

LIMITATIONS OF STUDY

The researcher limited the study to U.S. homeowners' attitudes. In addition, the study will be limited to the year it was conducted, 1992. The frame the sample was drawn from and the extent of the research instrument are other limitations.



Chapter II

REVIEW OF LITERATURE

This study involved an analysis of the factors affecting the attitudes of homeowners about the use of lawn chemicals. The foundation for this study emerged primarily from a review of literature related to consumer attitudes about pesticides.

The precedent literature for this study, after lengthy review, was divided into five sections:

1. Chemical product development and safety standards.
2. Public attitudes about pesticides related to food safety.
3. Public attitudes about pesticides at the international level.
4. Public attitudes about pesticides on lawns.
5. Defining public attitude.

Each of these five sections is discussed under a separate heading in this chapter. The intent of the researcher is to help the reader better understand the knowledge base by following a progression from the general literature relating to chemical product formulations and safety standards toward the more specific literature that focuses on research about pesticide application on lawns.

CHEMICAL DEVELOPMENT AND SAFETY STANDARDS

To add clarity to the pesticide issue it is necessary to closely examine chemical product development and safety standards. The information in this section was obtained through face-to-face interviews with technical specialists from DowElanco. (Personal communication, June 1, 1990 to August 31, 1992).

To protect consumers' health, the U.S. Environmental Protection Agency registers the use of pesticides and sets tolerances on the level of residues that may be present in food (van Ravenswaay and Roberts, 1991). These tolerances are enforced by the Food and Drug Administration.

Beginning in 1978, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) imposed new requirements on what must be known about the chronic toxicity and presence of food residues of pesticides before the Environmental Protection Agency (EPA) can approve their use on specific crops. Consequently, pesticides introduced in the last decade have faced tougher scrutiny than ever before.

Before any chemical compound can be marketed it must go through a long, arduous testing and evaluation process known as registration. Registration is only complete after years of testing by competent scientists and review by the Environmental Protection Agency (EPA).

It takes seven to 10 years to complete all the studies required to obtain a registration, and the cost varies

between $30 to $50 million. Only one in 10,000 compounds tested annually has the right characteristics to fit a particular need and receive EPA approval. The reason this process is so time consuming and expensive is because chemical manufacturers need to answer some very specific questions about the compound in order to get an EPA registration.

In terms of product chemistry, chemical manufacturers need to tell what the molecule looks like, how there going to make it, what there going to make it from, what impurities might be present in the starting materials, what impurities might be present in the end product, what the end product is like in terms of color and odor, how heavy it is, what temperatures it melts and boils at, how quickly it evaporates, how easily it pours, how well it dissolves in water, what it will mix with, how stable it is in out of the can, what its pH is, whether or not it's corrosive, whether it explodes, or whether it will burn, how there going to measure it in the environment and how good that measurement is likely to be.

In terms of human toxicology, the manufacturer must use laboratory tests to determine for EPA how toxic this compound is to people orally, dermally and be inhalation; how irritating it is to the eye and skin; where it goes in the body and how it's excreted; how likely it is to cause allergic responses, neurotoxicity or mutations; and how

likely it is to cause tumors, birth defects or other reproductive disorders.

In terms of environmental chemistry and fate, the manufacturer must tell EPA what happens to this product in water and soil with and without sunlight, whether microbes can eat it, whether it leaches or binds to the soil, how this compound reacts in actual field conditions, whether it will cause carryover problems and for which crops and whether it accumulates in fish or birds.

In terms of fish and wildlife toxicology, the manufacturer must tell EPA how toxic this compound is to birds, based on work with two species, and to fish, based on work with three species; how toxic it is to daphnia, shrimp, oysters, green algae and bees; and what effects it has on the reproduction of birds, based on work with two species.

The tests on laboratory animals are conducted very conservatively. They are typically run at much higher doses than anyone would actually receive. For instance, for lifetime feeding tests--EPA requires the animals to receive the maximum tolerated dose--i.e., the maximum dose that the animals can receive on a daily basis and still live long enough to complete the test. If, at the end of that time, an adverse effect has not been found, EPA will probably decide that the maximum tolerated dose has not been reached and require the test to be redone. Typically, the maximum tolerated dose is hundreds to thousands of times greater

than the average person would be exposed too.

Once an adverse effect has been found, the next step is to look for the "no observed effect level." This is the level of exposure where no effects are found in the most sensitive species of animals. From this, EPA will typically set an acceptable daily intake level which is also called the reference dose. This is the maximum amount of residue that is found in the most sensitive species of animals.

As a safety factor, EPA will typically set the acceptable daily intake level between a hundred to a thousand times lower than the "no observed effect level." In practice, our actual exposure to a chemical compound is almost always much less than the "acceptable daily intake level."

FOOD SAFETY

Food safety and its relationship to agricultural chemicals is an issue that touches all people. Food safety has two main areas: food-borne micro-organisms and pesticide residues. Safety experts have concluded that health hazards associated with chemical toxins in food are minuscule when compared with the potential harm from bacterial food-borne illnesses (Extension Bulletin E-2366). Due to the nature of this research, this section of the literature review will specifically deal with pesticide residues and their relationship to food safety.

Problems with public opinion began for the agricultural

chemical industry twenty-two years ago with the publication of Rachel Carson's book, Silent Spring (Best, 1985). Since the release of Carson's book, faith in the government regulatory process has declined (Blair, 1989). Blair's research further indicated that nearly two-thirds said the government is doing too little to ensure food safety. In the 1970's, the public grew increasingly skeptical of the capacity of existing government regulation to protect them from the cumulative effects of pesticides and other chemicals in soil, water and, ultimately, throughout the food chain. Surveys indicate there is a general agreement that the pesticide regulatory system needs fixing (EPA Journal, 1990). Critics claim that the Food and Drug Association has failed to inspect for many pesticide residues found in foods nor inspected sufficient quantities of foods. For example, FDA has been criticized for inspecting only 2% of all FDA regulated food imports.

Research indicates that consumers are concerned enough about enhancing our regulatory system and reducing the risk of pesticide residues that U.S. consumers are willing to pay a substantial amount for guarantees that foods meet federal safety standards (van Ravenswaay & Roberts, 1991). Furthermore, the general public demands that all produce be labeled to identify what pesticides have been used in its' production. Most experts agree that labelling all produce in the supermarket would be an

enormous and impossible task and would provide no safety benefit. Regulation of such an activity to ensure that all labels were accurate would be an even greater challenge. State and federal agencies have been entrusted with the responsibility for setting and enforcing health-based standards to ensure the safety of our food. In addition, the FDA has concluded that any remaining pesticide residues that may occur on a particular food item do not pose an unreasonable health risk. Also, most food does not have any pesticide residue by the time it reaches the supermarket shelf (Byrum, 1990).

By far the biggest blow to public confidence came in the mid-1970's with the revelation that an Illinois-based company that specialized in safety testing for chemical manufacturers, had improperly conducted many tests. Many chemicals had been licensed by Canadian and American authorities based on data from this company. Since this incident, critics have charged that chemical manufactures have incomplete data bases for their chemicals. These incomplete data bases are also referred to as data gaps.

The term data gap is misleading. It implies that there are little or no data about a particular product; however, in the majority of cases this simply is not true. A better term would be data upgrade. Specifically, requirements for pesticide registration are continually revised in response to advances in scientific knowledge or simply in the

equipment or techniques by which testing is conducted. This is not an indication that previous tests are invalid or that products developed before that time are unsafe (Hamlin, 1991).

Elliot (1985) stated that "the social condition that has developed from all this {fear of chemicals} has been described as chemophobia -- an irrational fear of chemicals (p.6). Chemophobia has become a primary factor in shaping public attitudes toward the use of chemicals for pest control in agriculture.

Now, more than ever, consumers are concerned about chemicals in their food. The American public has come to expect the highest possible standard of well-being for themselves and their children and any threat to that well-being, real or imagined, evokes a strong response. They have come to associate the recent problems of industrial chemicals -- e.g., acid rain, the chemical leak in Bhopal, toxic waste sites -- with all chemicals, and tend to connect the word chemicals with danger (Stone, et al, 1986). According to Lehnert (1990) "consumer concerns, do not stem for rational considerations--they stem from fear" (p.47). Pesticide fears have become a fact of modern day life in this country.

Grass-roots activism is also on the rise. In 1990, a California environmental initiative known as "Big Green" set a time-table for banning cancer-causing pesticides. The

food safety and pesticide provision of this initiative would phase out pesticides presumed to be carcinogenic or to cause birth defects (Dragna & Cooper, 1990). The phase out would be accomplished by eliminating new registrations or tolerances of these pesticides and by refusing to extend existing ones. The initiative also calls for the evaluation of existing health standards for pesticide residues in food products, and for the creation of new health standards. This initiative is the most comprehensive environmental initiative ever in the United States. To this point, most of the public concern has focused on the risk of cancer. "Second only to heart disease {in deaths}, cancer is estimated to kill about 500,000 Americans a year (EPA Journal, 1990, p.3). The debate about pesticides and its relationship to cancer depends on whether you worry more about what scientists do know about the risks of pesticides -- or what they do not know. The fact that analytical chemistry can identify substances in minuscule amounts -- as tiny as one part per quintillion--is lost on the general public, and expertly used by the critics who play on the fears to get their views publicized (Across the Table).

Unable to understand the science behind the decision making, particularly when it's communicated in 15-second sound bites, the public and media readily turn to skilled advocates who tell them that public health and safety have been sold out by the very people charged with protecting

publics. Frustration at the complex decisions we face in our modern world then turns to fear and outrage as the public finds its suspicions aroused with no trusted source of information at hand to dispel those concerns. Impelled by fear, people stop consuming products they think may be tainted or unhealthy (Gehring, 1991).

Several studies have sought to estimate the impact that consumer reaction to the new risk information on pesticides has had on consumer food purchases.

One example is ethylene dibromide (EDB), a grain fumigant that became widely used after World War II. In 1983, the EPA announced that it suspected that EDB might be a carcinogen. During that same year the state of Florida developed a more sensitive testing method for detecting trace residues of EDB in food. When they began applying the test in December of 1983, previously undetectable traces of EDB were found in many grain-based products.

The combination of these residue findings and the suspicion that EDB might be carcinogenic were heavily reported in the news media between December 1983 and March 1984. Consumers reacted by curtailing purchases of cake and bread mixes and other grain-based products (van Ravenswaay & Hoehn, 1991a). The EPA finally decided to take EDB off the market, thus putting an end to the public controversy.

Another example is Alar, a growth regulator used principally in apple production since 1963. In 1984, the

EPA announced that it was going to re-examine its risk assessment on Alar because new scientific evidence suggested that Alar, and its derivative, UDMH, might be carcinogens.

This action by the EPA evoked much controversy, and several states and consumer groups petitioned the EPA to immediately ban Alar. The controversy escalated in 1989 when a major news show, CBS 60 Minutes, reported that the Natural Resources Council, a widely known environmental group, had determined that Alar was a dangerous carcinogen to children. Public panic resulted and sales of apples and apple products fell.

It has been estimated that fresh apple purchases fell as much as 10% after the initial announcement by the EPA in 1984 that Alar might be a carcinogen, and by as much as 30% following the 60 minutes program (van Ravenswaay and Hoehn, 1991a).

The Alar episode is a good example of the kind of fears pesticides can engender when the media uses scientific language to manipulate the public--and raise their the level of fear. In that specific instance, an advocacy group hired a public affairs firm, Fenton Communications, to bring its concerns about food safety to public attention. The firm spotlighted a suitably vulnerable older chemical used on apples to prevent fruit drop and predicted, based on the advocacy group's extreme worst case evaluation, that thousands of children would get cancer and possibly die from

their exposures to residues of the compound. Lehnert (1991) stated, "it seems that the intensity of public fears is not related to the nature of the problem itself but to the amount of attention that can be focused on it, and the way in which the problem can be made to look as if it is intensifying" (p.46).

When the "Alar Crisis" took place two years ago, thousands of Americans, concerned about news reports suggesting a link between eating apples and cancer, turned to the scientific community for answers. For the most part, consumers were disappointed and confused. This confusion and disappointment were the result of the scientific community attempting to convey too much information to the American public. The government experts said one thing, and food industry experts said another. In the end, the public did not know any more about Alar than it did at the beginning (Lehnert, 1991).

According to the Environmental Protection Agency (EPA), the World Health Organization and the United Nations Food and Agricultural Organization, Alar did not pose a meaningful risk of cancer in animals, let alone humans (Extension Bulletin E-2366). A recent survey shows that two years after the "Alar crisis" consumers are still concerned about pesticide residues, although their confidence in the safety of fresh fruits and vegetables has rebounded to pre-Alar levels (Chou, 1991). A study by the Washington based

Food Marketing Institute (FMI) found that 77% of those surveyed perceived chemical residues as a hazard (Best, 1985). A telephone survey of Michigan households conducted for the Michigan Department of Agriculture (MDA) in March 1990 obtained similar results to the FMI study (Atkin, 1990). The MDA study asked respondents how confident they were that the food in their local store was safe. Thirty-seven percent of respondents said they were very confident, 49% were somewhat confident, 9% were somewhat doubtful, 3% were very doubtful, and 2% didn't know. A similar question in two nationwide telephone polls conducted by the Center of Produce Quality (CPQ) in January and March of 1989 (i.e., before and after Alar and at about the same time as the Chilean grape incident in March). CPQ asked respondents how confident they were that fruits and vegetables available to consumers are safe to eat. In January 1989, 25% of respondents were very confident, 56% were somewhat confident, 14% were not too confident, and 4% were not at all confident. In March 1989, 21% reported they were very confident, 49% were somewhat confident, 23% were not very confident, and 6% were not at all confident. The MDA survey in March 1990 obtained similar results (van Ravenswaay, 1990). Jefferson Davis Associates found 57% of consumers are concerned about pesticides and food safety and about 19% say they are greatly concerned. Of the 57% who say they are concerned, 47% name their concern as the pesticides farmers

use and 36% name chemical additives in food. In 1990 a survey by the Maritz Marketing Research, Inc., found that 78 percent of those surveyed were either concerned or very concerned about pesticide use, with women somewhat more concerned than men (EPA Journal, 1990).

According to Sachs, Blair and Richter (1987) "consumers were more concerned with pesticide issues in 1984 than in 1965"
(p. 96). This study indicates that pesticide concern has increased in terms of its impact on wildlife, on farmers, and on individual health. Furthermore, concern about pesticides is widespread and is not centered in any specific population group. Blair (1989) stated "people are significantly more concerned about pesticides than they were in the 1960's" (p.18). The percentage with a great deal of or some concern about the use of pesticides more than doubled since 1965.

At the same time, a growing majority of consumers are willing to accept a smaller selection of foods as a trade-off for pesticide-free food. Surveys by MDA (Atkin, 1990), Ott and Maligaya, and Ott et al. suggest that more than half of consumers are willing to pay more for pesticide free food, but not much more than 5% to 10%. There has also been a noticeable increase in the number of consumers willing to pay higher prices for food without pesticides, and a significant decline in the group unwilling to accept food

slightly damaged by pests (Cambridge Reports, Inc.). A small increase since 1987 leaves a near-majority of consumers calling for increased government intervention to ensure the safe use of pesticides. More specifically, however, a clear plurality believe the EPA standards for maximum allowable levels of pesticide residues are sufficient to protect human health (Cambridge Reports, Inc.).

Conversely, Hammit (1986) found "conventional food buyers generally think that pesticides and other chemicals and growing practices used in large scale conventional agriculture do not present a significant health hazard" (p.62). These consumers appear to base their conclusion on the belief that, if such practices did pose a threat, either the government or the supermarkets would warn and protect them or they would have observed evidence of harm.

The gender gap between men's and women's concerns about pesticide residues parallels the gap that emerged between men's and women's concerns about every aspect of food safety and health (Chou, 1991). As the level of concern for food safety increased, so did the tendency to purchase organically grown produce or to grow produce in home gardens using organic methods (Loftis & Kendall, 1991). Chou (1991) stated:

> "although a majority of both men and women still agree in 1991 that the health benefits of eating fresh fruits

and vegetables far outweigh the risks from possible pesticide residues, the confidence levels of only men remained stable" (p. 526).

INTERNATIONAL LEVEL

Over the past twenty years researchers have watched the issue of pesticide application intensify in the United States. This intensification has resulted in a ripple effect around the globe. A number of countries are finding their respective populations questioning the necessity and safety of pesticide application.

Many studies have been conducted overseas to ascertain the feelings of other cultures besides our own. For example, a study was conducted in Britain by Carr to ascertain the attitudes about pesticide application. Carr (1987) stated that "conservationalists were almost all concerned about the use of pesticides and also about the loss of hedgerows, trees and other wildlife habitat" (p.133). Furthermore, 10% of the people surveyed in this study saw pesticides as the main threat to the countryside. Conversely, farmers in this study did not consider pesticides a conservation-related issue. The fact that farmers did not see pesticide application as a conservation issue suggests that they are either unaware of any pressure to reduce their pesticide use or that the pressure is coming from sources they do not take seriously (Carr, 1987).

Zaida (1987), who conducted a study in Pakistan analyzing the perceptions of pesticides as a cotton crop strategy, stated: "A majority of farmers in all categories of land tenure and farm size lack the proper understanding of the use of pesticides" (p.1). Zaida concluded that pesticide spraying provides a feeling of security to farmers who have invested a lot in seedlings and fertilizer.

A study conducted in British Columbia found that responses to hazards are controlled more by perceptions of the hazard events than the objective reality of those events (Deardon, 1987). The hazard that was under investigation in this particular study was technological--the application of the herbicide 2,4-D. The media in British Columbia discussed the potential adverse effects of 2,4-D using worst case scenarios portraying this compound as a carcinogen. The findings of the British Columbia Study are based on incomplete information (Mullison, 1989). The authors of this study did not specifically examine 2,4-D; they attempted to link cancer to the number of acres treated with herbicides and total fuel oil and gasoline purchases. The authors acknowledge that no specific link can be made with any material including 2,4-D to Non-Hodgkin's lymphoma. After careful examination of the data, Health Welfare of Canada reported that Saskatchewan farmers as a group had the same rate of Non-Hodgkin's lymphoma as non-farmers. The media used a variety of media outlets (i.e., newspaper,

radio, television) to generate fear and opposition to the application of 2,4-D. Hamlin stated (1991) that:

> "The herbicide 2,4-D has been used effectively for more than 40-years in crop protection, power line maintenance, roadside brush control, and home lawn care. Numerous government regulatory agencies and scientific organizations have studied its environmental impact on both applicators and manufacturing employees. Their scientific evaluations conclude that 2,4-D can be produced and used with minimal risk when appropriate work practices are followed."

This type of manipulation of the facts by the media is similar to events that have taken place in the United States.

A study in the Phillipines found that farmers did not give any attention to pesticide residues or accumulation in the environment and their bodies (Medina, 1987). They only considered pesticides a serious problem when hospitalization was necessary.

These respective studies indicate that the issue of pesticide application now exceeds the boundaries of the United States.

HOME LAWNS

Increasing environmental pressure throughout the United States and the world has resulted in the regulations affecting chemicals to be increased over the past several

years. Many of these chemicals are used by the public on their lawns. The proximity of these products brings these products into close contact with humans and animals (Creason & Runge, 1990).

Increased public concern has resulted in the lawn chemical industry becoming more closely regulated. The regulations that are most strongly favored by homeowners are: A) giving surrounding neighbors at least 48 hours notice of intended use of pesticides; B) requiring a town permit for pesticide application; C) all pesticide spraying must be done only by licensed applicators; D) requiring the posting of signs on pesticide applied areas for 72 hours after application. These four areas of regulation are gradually being adopted by states and local municipalities across the country. The public concern about pesticides used on lawns has coincided with common fears of pesticide residues in food. According to Rogers (1990), "when the public sees spray, they assume that it is a pesticide, that toxic stuff on television, especially when the applicator is wearing what looks like a World War II gas mask that they associate with chemical warfare" (p.12). Homeowners feel that through contact with their lawns they are being exposed to excessive amounts of chemicals (Maniscelo, 1991). Multi-sponsors surveys, Inc. found that 67% of homeowners are very concerned about the possible harm to their family as a result of using pesticides around their home. Furthermore,

only 52% of homeowners felt that if you use the correct amount of a specific pesticide and the pesticide recommended for the pest problem, that pesticides are not harmful to those living nearby. Only 30% of homeowners across the United States believe that the Environmental Protection Agency does not allow pesticides which would harm the environment to be sold for home use (Hamlin, 1990). It is evident that the public does not have a high level of confidence in the bodies that regulate chemical use.

The public is scared and emotional about the chemical-use issue because it lacks an understanding of risks. Most people do not know when an announced risk is real, trivial or virtually non-existent. Government and the media have failed to communicate the risk involved in using lawn chemicals compared to other hazards (Dietz, 1990). Although informing the public of potential health risks is certainly the responsibility of the news media, some prefer to capture the publics attention with the flare for the dramatic rather than the facts (Brandenburg, 1990).

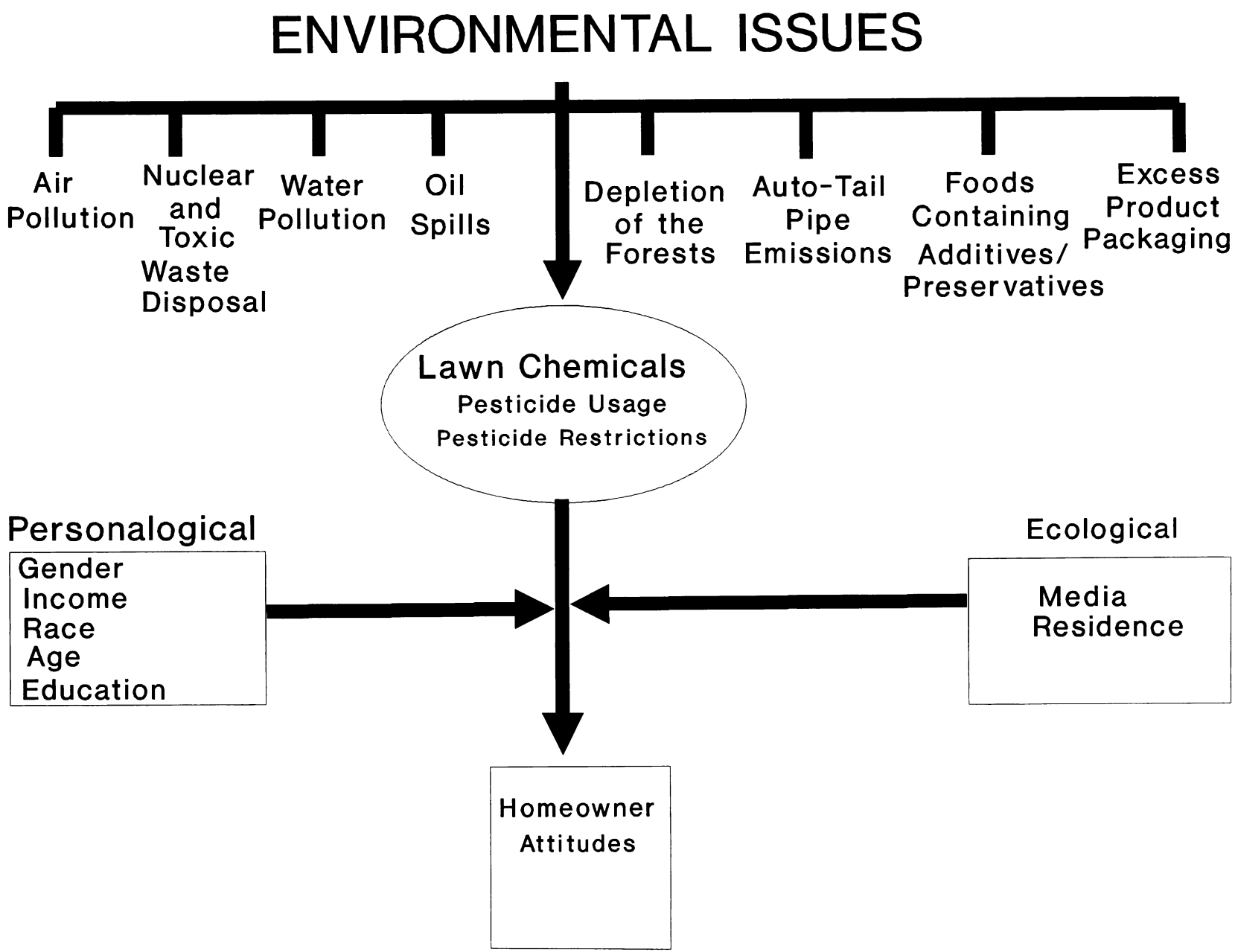
ATTITUDES

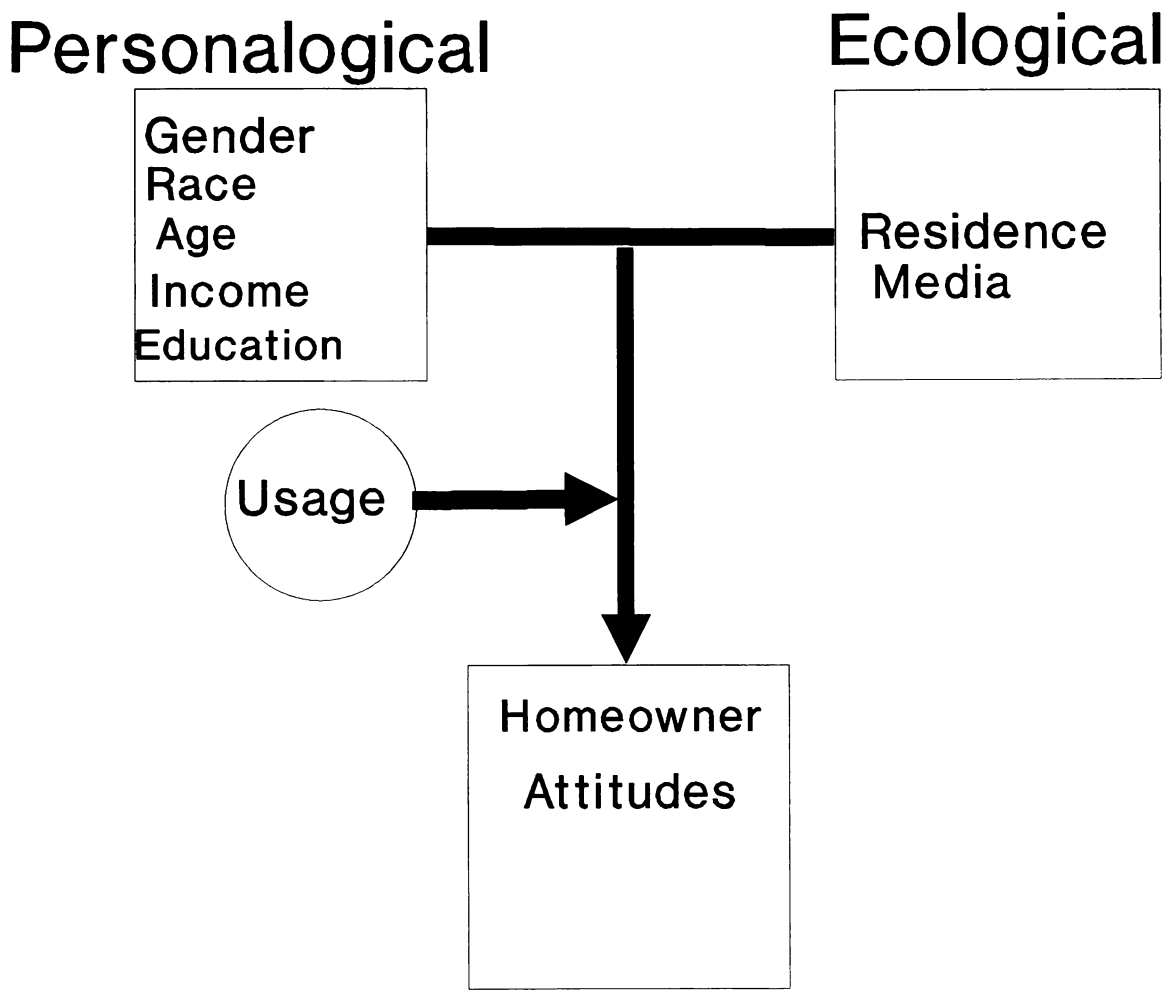
Attitude, a term once equated with social psychology had established more than half a century ago a strong reputation as "the most distinctive and indispensable concept in contemporary American psychology" (Allport, 1935). This term has stirred major conceptual and theoretical controversies and has further expanded its

influence beyond the boundaries of social psychology to be found today in many other theory and research areas. The primary problem seemed to be researcher's concept of attitude, and the ability to determine, empirically, differences between cognition (belief) and affect (feeling). Nagy (1978) asserted that, "If the distinction between feeling and belief can be made, empirically, results of studies which do not make this distinction should be questioned" (p. 355).

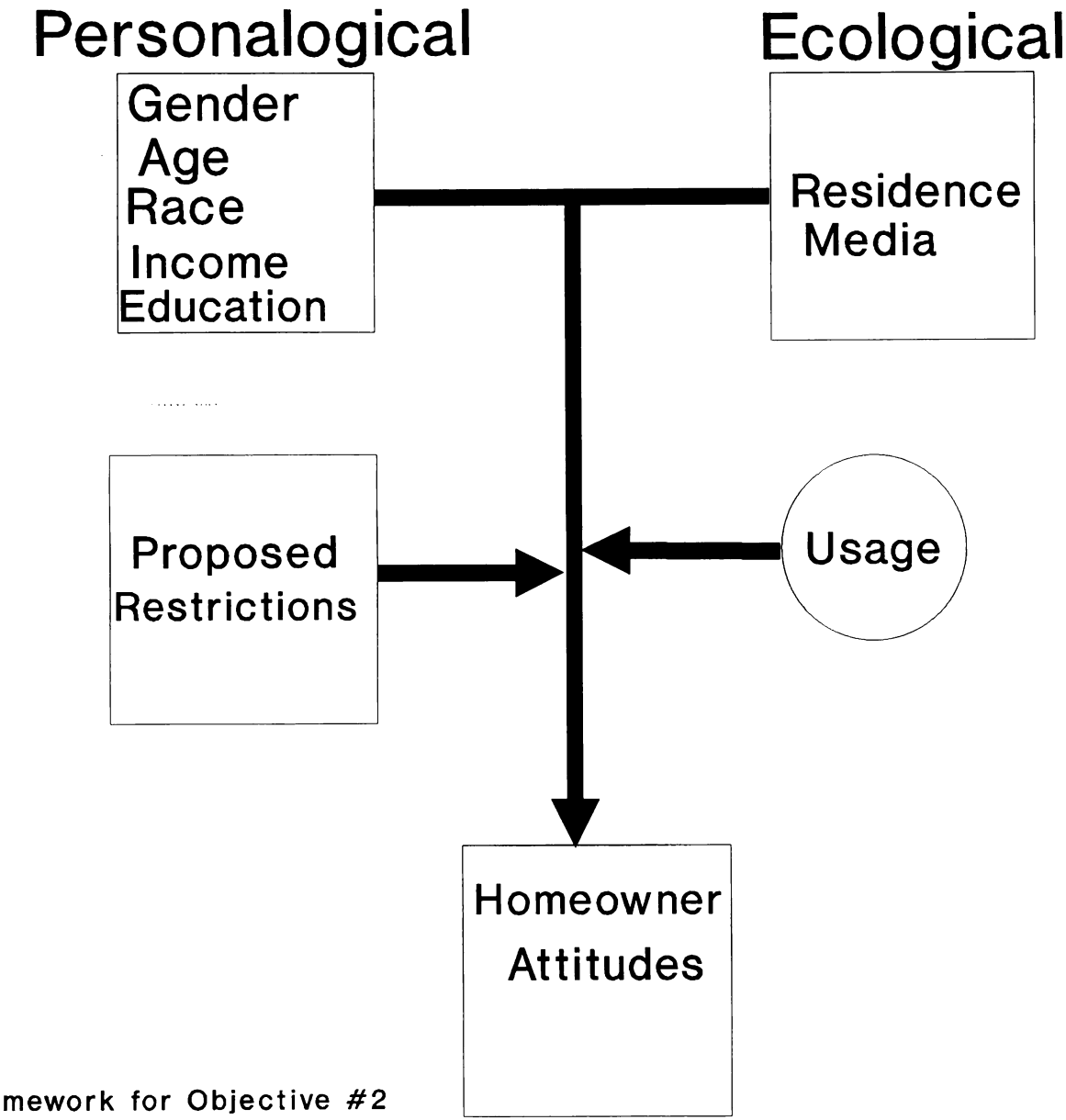
To gain greater understanding of this problem, the researcher turned to the literature on attitude and attitude measurement. Review of literature on attitudes and attitude measurement revealed lack of a concrete definition of attitude. Likert (1932) noted that his contemporaries favored two chief conceptions: first that attitudes were dispositions to overt action and second, that they were verbal substitutes for overt action. He observed that, "The verbal declarations of opinion and attitude are regarded as an indirect method of measuring dispositions which are most easily signified and expressed in verbal form" (p. 9). Subsequently, researchers demonstrated consensus on conceptual elements of attitude, agreeing with Allport's interpretation in 1935: "An attitude is a mental and neural state of readiness, organized though experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is

related" (cited in Triandis, 1971, p.2).

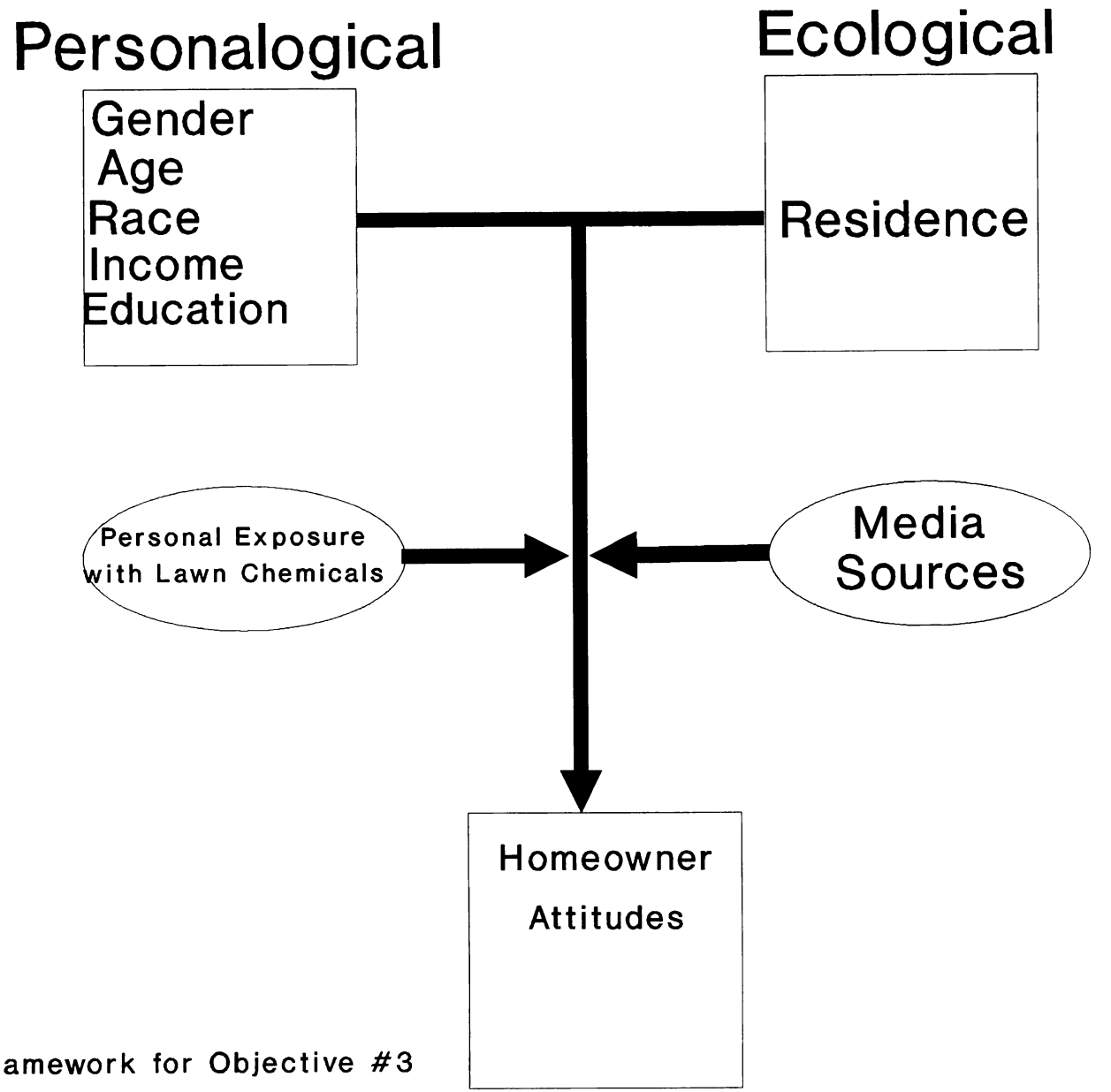

ENVIRONMENTAL ISSUES
Air Pollution
Nuclear and Toxic Waste Disposal
Water Pollution
Oil Spills
Depletion of the Forests
Auto-Tail Pipe Emissions
Foods Containing Additives/ Preservatives
Excess Product Packaging
Lawn Chemicals
Pesticide Usage
Pesticide Restrictions
Personalogical
Gender
Income
Race
Age
Education
Ecological
Media
Residence
Homeowner
Attitudes



Operational Framework for Objective #1.



)perational Framework for Objective #2



Operational Framework for Objective #3

Chapter III

DESIGN AND METHODOLOGY

The purpose of the study was to examine homeowner attitudes about lawn chemical use. The study used a descriptive survey component. The study employed one research designs. The descriptive survey component used a one shot case study.

DESCRIPTIVE SURVEY COMPONENT

The one-shot case study is used as a minimum reference point for guiding future research studies. Any appearance of absolute knowledge, or intrinsic knowledge about singular isolated objects, is found to be illusory upon analysis (Campbell and Stanley 1963). The design is:

X O

The data obtained from the survey questionnaire data were used to describe homeowners' attitudes about pesticides used on lawns.

Descriptive research is concerned primarily with determining "what is" (Borg and Gall, 1983). The purpose of such research is to "document processes, relationships and/or outcomes so thoroughly that it will be possible to

formulate hypothesis (or research questions) about the phenomena being documented." (Ward, 1984, cited in Shaink, 1985). Descriptive research studies are designed to obtain information concerning the current status of phenomena. They are directed toward determining the nature of a situation as it exists at the time of the study. The aim is to describe "what exists" with respect to variables or conditions in a situation (Ary, Jacobs, and Razavieh, 1990).

One of the goals of this study was to provide data, draw conclusions, examine possible implications, and generate knowledge that could contribute toward the development of future research activities in the area of lawn chemicals.

The survey method of research is an established strategy that offers many advantages. Babbie (1983) stated that

> "survey research is probably the best method available to the social scientist interested in collecting original data for describing a population too large to observe directly. Surveys are also excellent vehicles for measuring attitudes and orientations in a large population." (p. 209)

Measuring attitudinal characteristics was the primary concern in providing relevant information that would assist the researcher in generating answers to the research questions. For purposes of this study, attitude was defined

as "a mental and neutral state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it [attitude] is related." (Allport, 1935, cited in Triandis, 1971, p.2)

Attitudinal characteristics can be viewed as descriptors of the range of views toward individual statements and clusters of statements.

Objective 1 investigated differences in the attitudes of homeowners relating to lawn chemicals based on demographic data. The objective stated:

1. Determine possible relationships between homeowners' attitudes on lawn chemicals and demographic data.

Objective 2 investigated the possible differences in homeowners' attitudes about proposed restrictions. The objective stated:

2. Determine possible relationships between homeowners' attitudes about proposed restrictions on lawn chemicals and demographic data.

Objective 3 investigated the attitudes of homeowners about lawn chemicals. The objective stated:

3. Determine homeowners' attitude about lawn

chemicals.

Objective 4 sought to determine how homeowners received information about lawn chemicals. The objective stated:

4. Determine which media sources or other sources of information homeowners get their information from about lawn chemicals.

INSTRUMENT DEVELOPMENT

In addition to an extensive review of literature, the focus group methodology of research was used in this study to develop the survey instrument. This qualitative technique involved a small group dynamics approach to research. Eight specifically recruited respondents were involved in a roundtable discussion directed by an experienced moderator. This type of interactive setting encouraged the free and open exchange of ideas. Feelings and motivations are often uncovered that typically do not surface through conventional methods of research.

The focus group was held at Michigan State University, East Lansing, Michigan on April 8, 1992. Respondents were local chemical sales representatives, turf grass specialists and personnel from the Pesticide Education Center at Michigan State University. Focus group participants were specifically recruited by the researcher. These individuals were selected based on their knowledge of lawn chemical use.

Due to the small size of the discussion groups and the screened recruitment process used, it should be noted that the focus group method of research is exploratory in nature. Focus groups are qualitative, not quantitative in design. Therefore, findings should be viewed as directional, not projectionable to a larger population.

Personal interviews with homeowners in residential areas were used to develop the survey instrument. Homeowners were selected randomly from the phone book. Personal interviews were conducted the week of April 13, 1992 in 12 households in the greater Lansing, Michigan area. Households were selected based on their geographic location and the fact they had lawns. Participants discussed their awareness of pesticide use on lawns, the reasons they are used, and awareness of potential alternatives, such as mechanical, organic and biological methods of pest control. Attitudes were elicited, and respondents discussed awareness of pesticides used in and around their communities.

The Total Design Method (TDM) of conducting surveys (Dillman, 1978) was followed in all stages of the questionnaire construction and implementation process. A Likert-type scale with a five point range (strongly disagree, disagree, undecided, agree, strongly agree) was used in the questionnaire.

VALIDITY

The instrument was checked for face validity by specialists in the area of lawn chemicals and pesticide education. The instrument was modified based on their recommendation.

Content validity was established by a panel of experts familiar with lawn chemicals and instrument development. Changes were made accordingly to reduce ambiguity.

RELIABILITY

Reliability of the instrument was checked by means of a field test of homeowners in Michigan who were not part of the sample population. The instrument had two primary constructs: a.) homeowners attitudes about lawn chemical use; b.) proposed restrictions about lawn chemicals. Reliability was calculated using Cronbach's Alpha. The coefficient was .75 for the section about attitudes about lawn chemical use, and .78 on proposed restrictions. The reliability of a measuring instrument is the degree of consistency with which it measures whatever it is measuring, stated Ary, Jacobs, and Razavieh (1990, p.268).

POPULATION

The target population for the survey was all homeowners in the United States. Using Krejcie and Morgan (1970), the researcher determined a sample size of 384 homeowners to be representative for the purposes of the study to establish a 95 percent confidence level with a 5 percent sampling error.

The sample population of 384 homeowners was the accessible population.

The frame the sample was drawn from came from a direct mail house in Lansing, Michigan. The total number of homeowners in this frame was 85,977,458.

NON-RESPONSE ERROR

Non-response was controlled by the following the Total Design Method (Dillman, 1978). One week after the first mailing, a follow-up postcard was mailed to the sample population. Two weeks after the follow-up postcard, non-respondents were mailed a follow-up letter with a replacement questionnaire. Two follow-up mailings were sent to non-respondents with replacement questionnaires.

Returned questionnaires were coded by the date they were received. Non-respondents were compared statistically to respondents on their responses to survey questions. T-tests were used to determine if any differences existed between early and late respondents. No significant differences were found between early and late respondents, therefore, information in this research study can be generalized to the entire homeowner population.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS/PC+). Descriptive statistics were used to describe homeowners attitudes. Inferential

statistics (correlations, regressions and ANOVA) were used to determine relationships and differences between selected groups.

CHAPTER IV

FINDINGS

Objective 1

Objective 1 was to determine possible differences in homeowners' attitudes on lawn chemicals and demographic data. The response rate for the entire study was 58%. The independent variables for Objective 1 were geographic region, gender, age, ethnic identification, place of residence, education level and household income. The dependant variable was homeowners' attitudes about the use of lawn chemicals.

Demographic Information

Gender of respondents

Figure 1 shows the percentage of male and female respondents from the survey. Seventy percent of the respondents were male and 30% were female.

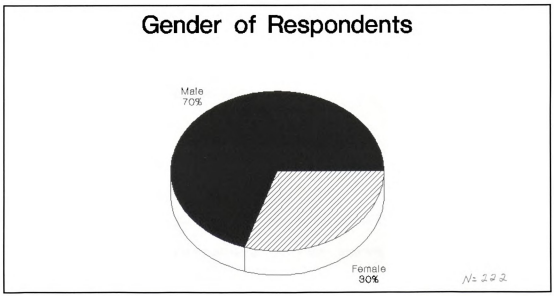


Figure 1. Gender of Respondents

Age of Respondents

Homeowners were asked to specify their age. Twenty percent of the respondents were between the ages of 26-35. Twenty-four percent indicated they were between the ages of 36-45. Sixteen percent indicated they were between the ages of 56-65. Finally, 19% indicated they were over the age 65. Figure 2 shows the percentages for each category.

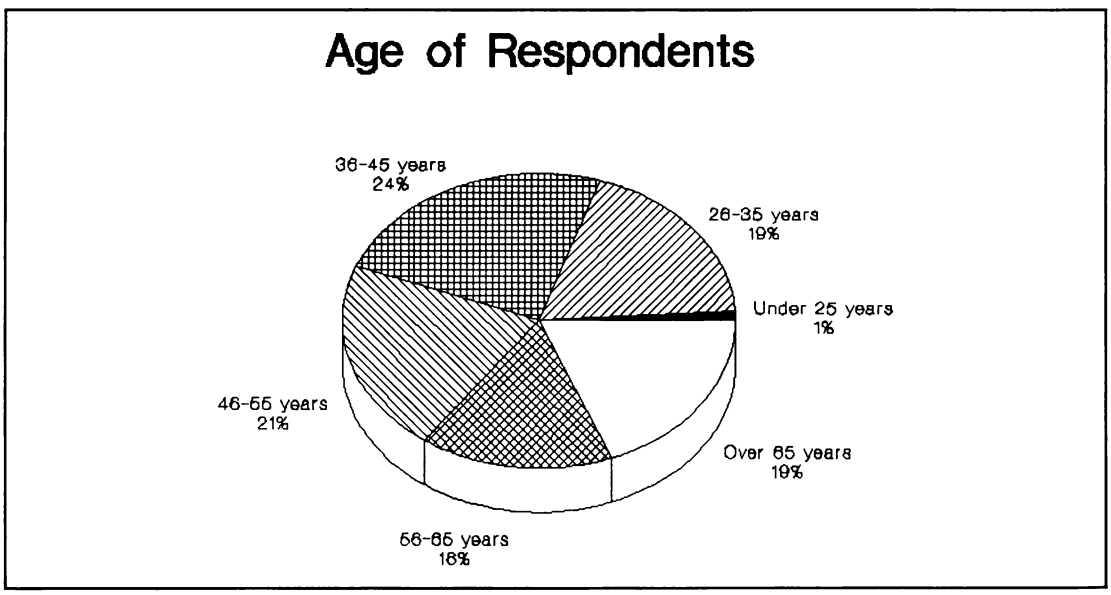


Figure 2. Age of Respondents

Ethnic Identification

Homeowners were asked to specify their ethnic identification. Figure 3 shows the ethnic identification of the homeowners who responded to the survey. Ninety-three percent of the respondents to this survey indicated they were white.

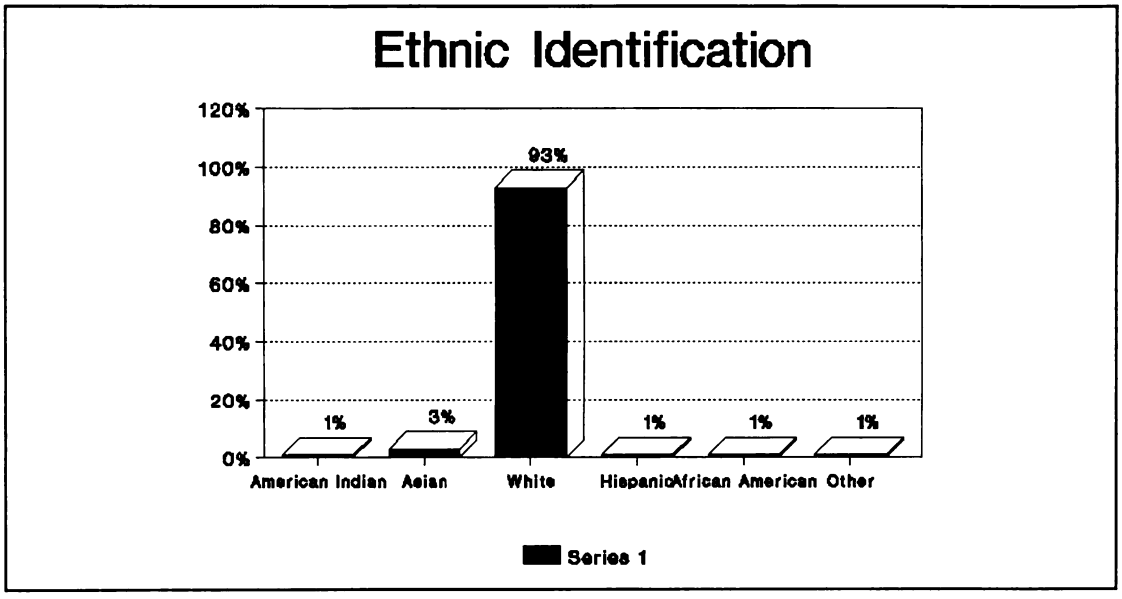


Figure 3. Ethnic Identification

Place of Residence

Homeowners were asked how they would characterize the place in which they live. Figure 4 shows the percentages for each category.

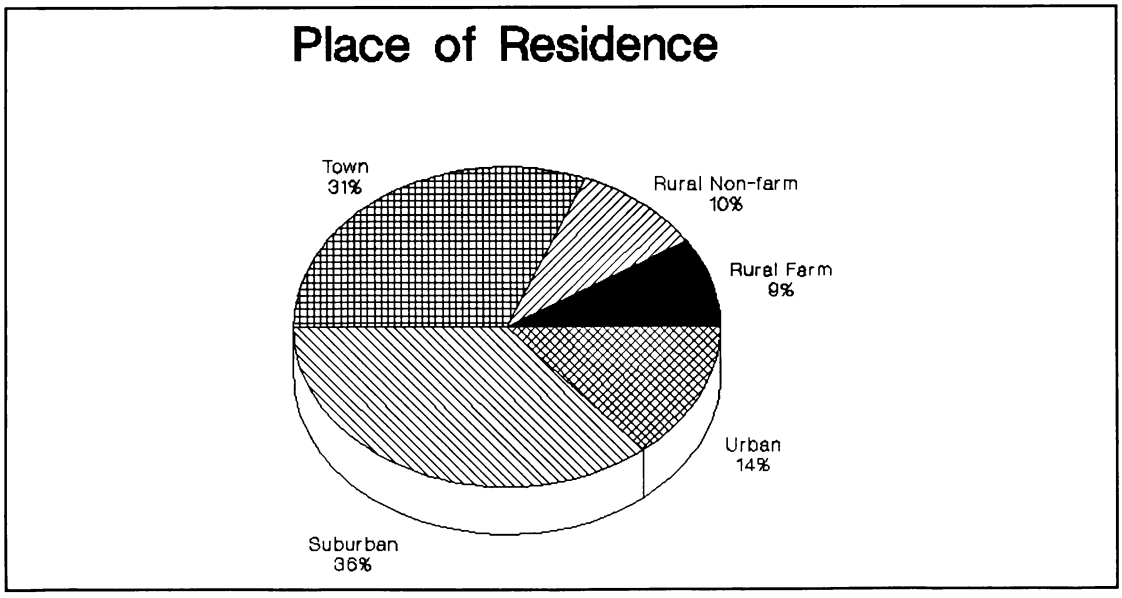


Figure 4. Place of Residence

Education Level

Homeowners were asked to identify their highest level of education. Thirty percent of the respondents had attended some college. Twenty-eight percent of the sample population had completed high school. Figure 5 shows the educational distribution of the respondents.

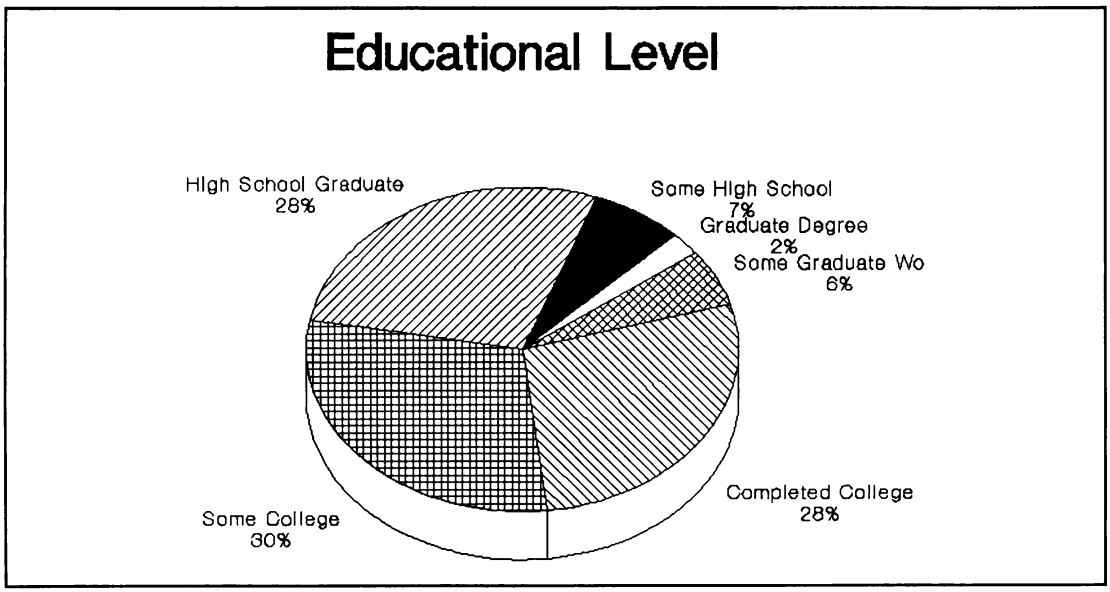


Figure 5. Educational Level

Household Income

Over 27 percent of the respondents indicated their yearly household income was between $20,000 and $39,000. Only 11% of the homeowners who responded to the questionnaire indicated they earned over $80,000 in yearly household income. Figure 6 shows the percentages of each category.

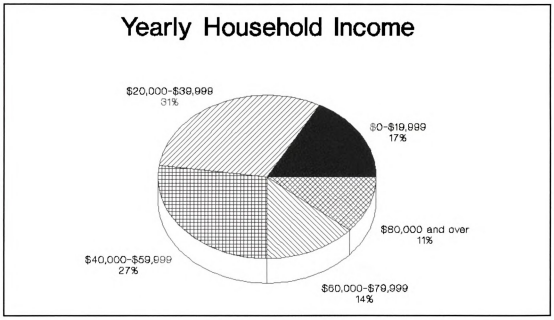


Figure 6. Yearly Household Income

Analysis

Hypothesis Test 1

The hypothesis test relating to Objective #1 was as follows:

H_0 There are no differences in homeowner attitudes when compared to demographic data. Using the research hypothesis as a guide, an alternative directional hypothesis, H_1, was developed.

H_1 There will be differences in homeowner attitudes when compared to demographic data.

For testing purposes, the hypothesis were diagramed as follows,

$H_o \quad u_2 \geq u_1$

$H_1 \quad u_1 \geq u_2$

T-test

A T-test was performed to determine if differences existed between the gender of the homeowner and their attitude toward lawn chemicals. No significant differences were found between men and women and their respective attitudes towards the use of lawn chemicals.

Analysis of Variance

An analysis of variance was performed to determine if differences existed between the ages of homeowners and their attitudes about proposed restrictions on lawn chemical use. The ANOVA found that there were significant differences between the age of homeowners and their attitudes toward proposed restrictions on lawn chemical use. Table 1 contains ANOVA results.

A post-hoc Tukey test was conducted to determine the ages of homeowners which differed significantly. The Tukey test found that homeowners between the ages of 26-35 years of age are significantly differed from those homeowners between the ages of 56-65. This indicates that homeowners between the ages of 56-65 have a more positive attitude

toward the use of lawn chemicals than those in the 26-35 age group. Table 2 shows the results of the Tukey test. Therefore, the null hypothesis is deemed tenable.

Table 1

Analysis of Variance for ages of homeowners and their attitudes toward the use of lawn chemicals.

Source of Variation	Mean Square	D.F.	F	Signif. of F
Between Groups	.8832	4	2.642	.037
Within Groups	9.2927	128	2.642	.037
Total	10.1759	132		

* p<.05

Table 2

Tukey Test for significant differences between ages of homeowners and their attitude towards the use of lawn chemicals.

Age of Respondents	Under 25 Years	26-35 Years	36-45 Years	46-55 Years	56-65 Years	Over 65 Years
Mean		3.1971	3.1354	3.0259	2.963	3.0487
Under 25						
26-35 Years					*	
36-45 Years						
46-55 Years						
56-65 Years						
Over 65 Years						

* p<.05

Analysis of variance tests were conducted for differences in yearly household income of homeowners and their attitudes about the use of lawn chemicals. No significant differences were found.

Analysis of variance tests were conducted for differences in where the homeowners lived and their attitudes about lawn chemical use. No significant differences were found.

Analysis of variance tests were conducted for differences in education level of homeowners and their attitudes about the use of lawn chemicals. No significant differences were found.

Analysis of variance tests were conducted for differences in what region of the United States homeowners lived and their attitudes about lawn chemical use. No significant differences were found between the region of the country homeowners live and their attitudes toward lawn chemical use.

Regression Analysis

A multiple regression analysis was conducted on the variables related to Objective 1. A multiple regression analysis was conducted to determine which independent variables were associated significantly to the attitudes of homeowners about lawn chemical use. The beta value indicates the amount of change associated with the intercept for each unit of the variable being measured. The age

group, 56-65 was the significant variable in the regression. Table 3 contains the data from the regression analysis.

Table 3

Multiple regression of homeowners' attitudes on the independent variables

Independent Variables	Beta (B)	t Value
Demographic Variables		
Income Level		
$0-$19,999	-.082784	.4396
$20,000-$39,999	.044737	.6185
$40,000-59,999	.018584	.8358
$60,000-$79,999	.190793	.0641
Over $80,000	.053337	.6258
Education Level		
Some high school	-.050164	.7112
Completed high school	-.124010	.0852
Some college	-.034889	.5960
A graduate degree	-.085174	.4308
Gender		
Female	.032340	.5717
Ethnic Identification		
White	-.1755191	.0526
Age		
26-35 years	.044737	.5960
46-55 years	-.126797	.0641
56-65 years	-.172147	.0244*
Over 66 years	-.051805	.5381
Where you live		
Rural non-farm	-.155038	.1646
Town	.045191	.6160
Suburban	-.078961	.3583
Urban		

*p<.05

R^2 =.25022

Objective 2

Objective 2 was to determine possible differences in homeowners' attitudes about proposed restrictions on lawn chemicals and demographic data. The independent variables for Objective 2 were geographic region gender, age, ethnic identification, place of residence, education level and household income. The dependant variable was homeowners' attitudes about proposed restrictions on lawn chemicals.

Analysis

T-test

A T-test was performed to determine if differences existed between the gender of the homeowner and their attitude about proposed restrictions on lawn chemicals. The T-test found that women were significantly more concerned about lawn chemical use than men. Table 4 shows the mean and standard deviation of the two groups and Table 5 contains the 2-tailed probability that shows the significant difference. Therefore, the null hypothesis is deemed tenable.

Table 4

Means and Standard Deviation of Gender and their attitudes towards proposed restrictions on lawn chemical use.

Gender	Mean	Standard Deviation
Males	3.2	.768
Females	3.5	.815

Table 5

Pooled variance estimate of gender and their respective attitudes towards proposed restrictions on lawn chemicals.

F-Value	2-Tail Probability	T-Value	Degrees of Freedom	2-Tail Prob.
1.13	.601	-2.08	155	.039

Hypothesis Test

The hypothesis test relating to Objective #2 was as follows:

H_0 There will be no significant attitudinal differences between homeowners about proposed restrictions when compared to demographic data.

H_1 There will be significant attitudinal differences between homeowners about proposed restrictions when compared to demographic data.

For testing purposes, the hypothesis was diagramed as follows,

$H_o \quad Y_1 \quad = \quad Y_2$

$H_1 \quad Y_1 \quad \neq \quad Y_2$

A T-test was performed to determine if differences existed between the homeowners who have pets and those who do not and their attitude about proposed restrictions on lawn chemicals. The T-test found that homeowners who have pets were significantly more concerned about proposed restrictions on lawn chemical use than those who do not have pets. Table 6 shows the mean and standard deviation of the two groups and Table 7 contains the 2-tailed probability that shows the significant difference.

Table 6

Means and Standard Deviation of homeowners who have pets and those who do not and their attitudes towards proposed restrictions on lawn chemicals.

Pets	Mean	Standard Deviation
Pets	3.1	.095
Without Pets	3.4	.082

Table 7

Pooled variance estimate of homeowners who have pets and those who do not and their respective attitudes towards proposed restrictions on lawn chemicals.

F-Value	2-Tail Probability	T-Value	Degrees of Freedom	2-Tail Prob.
1.14	.576	-2.19	155	.030

A T-test was performed to determine if differences existed between homeowners who have children and those who do not and their attitude about proposed restrictions on lawn chemicals. The T-test found that homeowners who have children were significantly more concerned about proposed restrictions on lawn chemical use than men. Table 8 shows the mean and standard deviation of the two groups and Table 9 contains the 2-tailed probability that shows the significant difference.

Table 8

Means and Standard Deviation of homeowners who have children and those who do not and their attitudes towards proposed restrictions on lawn chemicals.

Children	Mean	Standard Deviation
Children	3.1	.810
Without Children	3.4	.721

Table 9

Pooled variance estimate of homeowners who have children and those who do not and their respective attitudes towards proposed restrictions on lawn chemicals.

F-Value	2-Tail Probability	T-Value	Degrees of Freedom	2-Tail Prob.
1.26	.311	-3.01	151	.003

Analysis of Variance

An analysis of variance was performed to determine if differences existed between the ages of homeowners and their attitudes about proposed restrictions on lawn chemical use. The ANOVA found that there were significant differences between the age of homeowners and their attitudes toward proposed restrictions on lawn chemical use. Table 10 contains ANOVA results.

A post-hoc Tukey test was conducted to determine the ages of homeowners which differed significantly. The Tukey test found that homeowners between the ages of 26-35 years of age are significantly differed from those homeowners between the ages of 56-65. This indicates that homeowners between the ages of 56-65 are much less concerned about proposed restrictions on lawn chemicals than those in the 26-35 age group. Table 11 shows the results of the Tukey test. Therefore, the null hypothesis is tenable.

Table 10

Analysis of Variance for ages of homeowners and their attitudes about proposed restrictions on lawn chemicals.

Source of Variation	Sum of Squares	DF	F	Sig. of F
Between Groups	8.7376	5	2.9685	.0138
Within Groups	88.8914	151		
Total	97.6290	156		

* $p<.05$

Table 11

Tukey Test for significant differences between ages of homeownersand their attitude towards the use of lawn chemicals.

Age of Respondents	Under 25 Years	26-35 Years	36-45 Years	46-55 Years	56-65 Years	Over 65 Years
Mean	3.6875	3.6641	3.3581	3.2578	2.9038	3.3214
Under 25						
26-35 Years					*	
36-45 Years						
46-55 Years						
56-65 Years						
Over 65 Years						

* $p<.05$

Analysis of variance tests were conducted for differences in yearly household income of homeowners and their attitudes about the use of lawn chemicals. No significant differences were found between the yearly household income of homeowners and their attitudes toward proposed restrictions of lawn chemical use.

Analysis of variance tests were conducted for differences in education level of homeowners and their attitudes about proposed restrictions of lawn chemicals. No significant differences were found between the educational level of homeowners and their attitudes toward lawn chemical use.

Analysis of variance tests were conducted for differences in homeowners place of residence and their attitudes about proposed restrictions on lawn chemical use. No significant differences were found.

Analysis of variance tests were conducted for differences in what region of the United States homeowners lived and their attitudes about proposed restrictions of lawn chemical use. No significant differences were found between the region of the country homeowners live and their attitudes toward lawn chemical use.

Regression Analysis

A multiple regression analysis was conducted on the variables related to Objective 2. A multiple regression analysis was conducted to determine which independent variables were associated significantly to the attitudes of homeowners about proposed restrictions on lawn chemical use. The beta value indicates the amount of change associated with the intercept for each unit of the variable being measured. The age group, 56-65 was the significant variable in the regression. Table 12 contains the data from the regression analysis.

Table 12

Multiple regression of homeowners' attitudes on the independent variables

Independent Variables	Beta (B)	t Value
Demographic Variables		
Income Level		
$0-$19,999	-.058384	.8268
$20,000-$39,999	.003487	.9884
$40,000-59,999	-.149584	.5399
$60,000-$79,999	-.202918	.4694
Over $80,000	.114097	.6948
Education Level		
Some high school	.207285	.5176
Completed high school	.185692	.3474
Some college	.220504	.2282
A graduate degree	.028779	.9278
Gender		
Female	.230901	.1053
Ethnic Identification		
White	.091551	.7225
Age		
Under 25 years	.291032	.6310
26-35 years	.358399	.0827
46-55 years	-.096414	.6251
56-65 years	-.458136	.0315*
Over 66 years	-.085326	.6999
Where you live		
Rural non-farm	-.121799	.6880
Town	.113445	.6542
Suburban	.108614	.6566
Urban	.219914	.5176

*$p<.05$
$R^2 = .25022$

Objective 3

Objective 3 sought to determine homeowners' attitude about the use of lawn chemicals.

Homeowners were asked to specify how much government regulation they felt there was in the area of lawn chemicals. Figure 7 represents the percentages of the responses to this question. Fifty-three percent of the respondents were not sure how much regulation existed. Twenty-five percent felt that there was not enough government regulation of lawn chemicals.

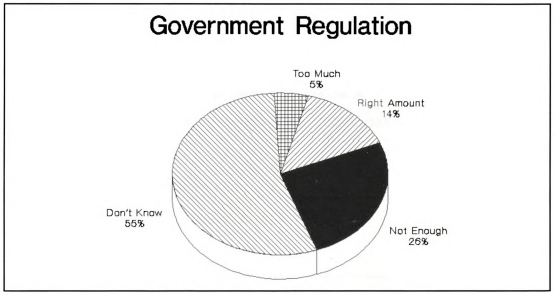


Figure 7. Government Regulation

Figure 8 shows how homeowners current use of lawn chemicals compares to the amount they used a year ago. Fifty-percent of the homeowners indicated that their use of chemicals remained the same as the previous year. Thirty percent used less than the previous year.

Homeowners who did use less chemicals on their lawns were asked why they were using less. Figure 9 shows the number of respondents who responded to each category.

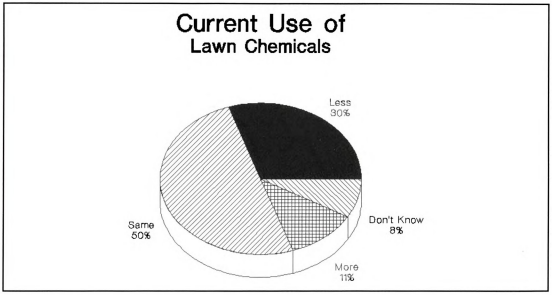


Figure 8 Current Use of Lawn Chemicals

Twenty-three respondents they indicated that they were using less lawn chemicals due to environmental concerns. Nineteen indicated they are using less because they worried about the safety of their family.

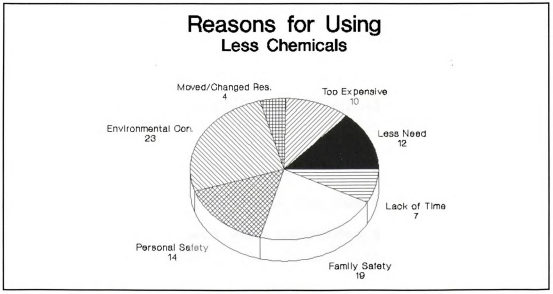


Figure 9. Reasons For Using Less Chemicals

Respondents were asked to specify whether they used a lawn care service. Figure 10 represents the percentages of those homeowners who used and did not use a lawn care service. Seventy-eight percent of the respondents indicated that they did not use a lawn care service.

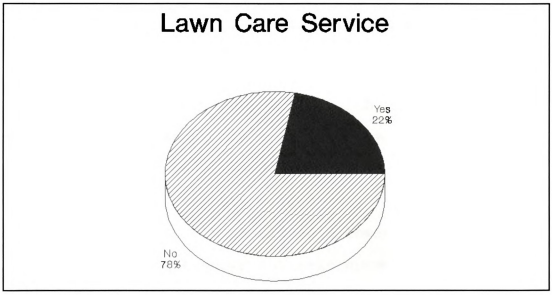


Figure 10. Lawn Care Service

Research Question: What will be the overall attitude of homeowners about the sue of lawn chemicals?

Homeowners responded to statements that were designed to measure their attitude about the use of lawn chemicals. A majority of homeowners were undecided about these statements. This indicates their knowledge of lawn chemicals is limited. Homeowners did indicate they disagreed with the statement that "lawn chemical

manufacturers do not sell lawn chemicals which would harm the environment."

However, homeowners agreed with the statement that "a healthy lawn provides a safe area for people in public parks," and "the benefits of a healthy lawn justify the use of lawn chemicals." Homeowners are concerned that manufactures are selling chemicals that are harmful, but are willing to take the risk of using them to keep their lawn in proper condition.

In addition, homeowners agreed with the statements that "homeowners are responsible for lawn chemical misuse" and "homeowners should be allowed to apply lawn chemicals." Homeowners believe they are responsible for lawn chemical misuse, but believe they should be allowed to apply them. Table 13 and Table 14 shows the mean scores for homeowners.

Confidence intervals were calculated for each likert-type question to determine where the population mean was relative to the sample mean (See Appendix A).

Table 13 Mean scores of homeowners' attitudes.

Question	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Q.1 Lawn chemicals applied by homeowners are safe for the environment.			2.68		
Q.2 Lawn chemicals applied by professional lawn care companies are safe for the environment.			2.60		
Q.3 I am concerned about possible contamination of my water supply because of lawn chemicals applied in my neighborhood.			3.1		
Q.4 I am concerned about my personal safety when lawn chemicals are applied in my neighborhood.			3.1		
Q.5 I am concerned about the safety of my children when lawn chemicals are applied in my neighborhood.			3.4		
Q.6 If you spend enough time taking care of your lawn, lawn chemicals are not necessary.			3.0		
Q.7 If you use the lawn chemical as directed for a problem, lawn chemicals are not harmful.			2.9		
Q.8 If you use the recommended rate of lawn chemicals and follow directions on the label, they are not harmful.			2.8		
Q.9 The Environmental Protection Agency (EPA) does not allow the use of lawn chemicals in a way that would harm the environment.			2.6		
Q.10 Lawn chemical manufacturers do not sell lawn chemicals which would harm the environment.		2.1			
Q.11 I am concerned about the health of my pets when lawn chemicals are applied in my neighborhood.			3.4		
Q.12 When used as directed, lawn chemicals are harmful to the human body.			2.9		
Q.13 A healthy lawn provides a safe area for people in public parks.				3.9	
Q.14 A healthy lawn provides a safe area for children to play.			3.4		
Q.15 The benefits of a healthy lawn justify the use of lawn chemicals.				3.5	
Q.16 When used as directed, lawn chemicals cause cancer.			2.8		
Q.17 When used as directed, lawn chemicals harm wildlife.			2.8		

Table 14 Mean scores of homeowners' attitudes.

Question	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Q.18 When used as directed, lawn chemicals harm wildlife.			3.0		
Q.19 I am concerned enough about lawn chemicals to quit using them.			2.8		
Q.20 Lawn chemical manufacturers are not concerned about the effects of their products.			2.9		
Q.21 The Environmental Protection Agency (EPA) is not concerned about the effects of lawn chemicals.			2.7		
Q.22 I have a good knowledge of how to apply lawn chemicals.			3.2		
Q.23 Professional lawn care companies are responsible for the misuse of lawn chemicals.			3.3		
Q.24 Lawn chemical manufacturers are responsible for lawn chemical misuse.			2.7		
Q.25 Homeowners are responsible for lawn chemical misuse.				3.6	
Q.26 Professional lawn care companies should be allowed to apply a lawn chemical.			3.4		
Q.27 Homeowners should be allowed to apply lawn chemicals.				3.5	

When homeowners were asked about their attitudes towards proposed restrictions on lawn chemicals they agreed with the statements that "professional applicators who do lawn chemical spraying should be licensed" and "professional applicators should post signs after lawn chemical application until the chemical is dry or 24 hours after application." However, they disagree with the statement that "homeowners who do lawn chemical spraying should be licensed." Means scores of homeowner attitudes about proposed restrictions on lawn chemicals are reported in Table 15.

Table 15

Homeowners attitudes about proposed restrictions on lawn chemicals.

Questions	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
Q.1 Professional applicators should notify surrounding neighbors at least 48 hours before pesticides are applied.			3.3		
Q.2 Professional applicators should obtain a town permit for application of lawn chemicals.			3.4		
Q.3 Professional applicators who do lawn chemical spraying should be licensed.				4.1	
Q.4 Professional applicators should post signs after lawn chemical application until the chemical is dry or 24 hours after application.				4.0	
Q.5 Homeowners should notify surrounding neighbors at least 48 hours before pesticides are applied.			3.1		
Q.6 Homeowners should obtain a town permit before application of lawn chemicals.			2.5		
Q.7 Homeowners who do lawn chemical spraying should be licensed.		2.4			
Q.8 Homeowners should post signs after lawn chemical application until the chemical is dry or 24 hours after application.			3.4		

Objective 4

Objective 4 sought to determine which media sources or other sources of information homeowners get their information from about lawn chemicals. The independent variable in this objective were the media sources of homeowners. The dependant variable were homeowners'

attitudes.

Research Question: What media source will be the primary source of information for homeowners?

Homeowners were asked to specify which media sources they get their information from about lawn chemicals. Figure 13 shows the number of respondents who answered each category. Eighty-three homeowners indicated that there primary source of information was the newspaper. Eighty-one homeowners indicated that television was there second major source.

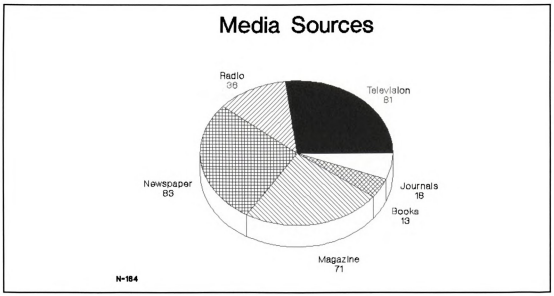


Figure 13. Media Sources

Research Question: What will the most prominent non-media source of information for homeowners?

Homeowners were asked to specify other sources from

which they get information about lawn chemicals. Figure 14 shows these various sources. Eighty-nine respondents indicated that they receive a majority of their information from a lawn and garden store and 42 respondents listed friends as another major source of information.

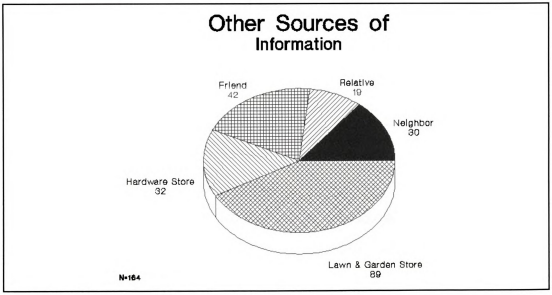


Figure 14. Other Sources of Information

Chapter V

Conclusions

Statements of major study conclusions reached from the findings are presented in the following sections. A brief discussion of support literature follows each statement.

Conclusion #1: Women have a greater level of concern about proposed restrictions on lawn chemical use than men.

A T-test was performed to determine if differences existed between the gender of the homeowner and their attitude toward lawn chemicals. The T-test found that women are much more concerned about lawn chemical use than men.

Conclusion #2: Homeowners between the ages of 56-65 years are less concerned about lawn chemical use than any other age group.

An analysis of variance and a regression analysis were performed to determine if differences existed between the ages of homeowners and their attitudes about the use of lawn chemicals. The ANOVA and regression found significant differences between the age of homeowners and their attitude about the use of lawn chemicals.

Conclusion #3: Homeowners between the ages of 56-65 are

less concerned about proposed restrictions on lawn chemical use than any other age group.

An analysis of variance and a regression analysis were performed to determine if differences existed between the ages of homeowners and their attitudes about proposed restrictions of lawn chemicals. The ANOVA and regression found significant differences between the age of homeowners and their attitude about proposed restrictions of lawn chemicals.

Conclusion #4: Homeowners attitudes about the lawn chemical use are neutral.

The descriptive survey found that the mean scores of likert-type questions relating to attitudes of homeowners supported this conclusion.

Conclusion #5: Homeowners are willing to accept the risk of lawn chemical use if they are personally applying the chemical.

The descriptive survey found that the mean scores of likert-type questions relating to attitudes of homeowners supported this conclusion.

Conclusion #6: The primary media channels homeowners get

their information about lawn chemicals from are newspapers and television.

Conclusion #7: Lawn and garden stores are homeowners' primary non-media information source for receiving information about lawn chemicals.

Conclusion #8: Homeowners who have pets are more concerned about proposed restrictions on lawn chemicals.

A T-test was performed to determine if differences existed between homeowners who have pets and homeowners who do not and their attitude toward lawn chemicals. The T-test found that homeowners who have pets are much more concerned about lawn chemical use than homeowners who do not have pets.

Conclusion #9: Homeowners who have children are more concerned about proposed restrictions on lawn chemicals.

A T-test was performed to determine if differences existed between the homeowners who have children and those who do not and their attitude toward lawn chemicals. The T-test found that homeowners who have children are much more concerned about lawn chemical use than those who do not have children.

Implications

A number of implications concerning homeowners' attitudes about the use of lawn chemicals can be drawn from this study. Each implication is followed by a specific recommendation.

Implications #1:

If chemical manufacturers do not develop an educational curriculum related to lawn chemical use that can be introduced in the educational setting, then chemical manufacturers run the risk of our youth being as uninformed about lawn chemicals as our adult population.

Recommendation #1:

The result of this study showed that homeowners are undecided about how they feel and think about lawn chemicals. This finding indicates that any group trying to convey messages about lawn chemical use has an opportunity to make an impact.

In order for manufacturers to educate youth about chemicals and their relationship to the environment, they must start at the lower grade levels. Furthermore, in order for teachers to fully accept a new curriculum, they must be included in each step of its development. Teachers' input allows them to take ownership of the project and to defend

the final document.

All teachers, whether they are involved in the development of curriculum or not, must be regularly advised of the progress and content of the curriculum materials. Teachers who are not aware of curriculum development activities will not support or adopt the new curriculum initiatives.

Implication #2:

If chemical manufacturers do not initiate proactive advertising strategies, then any group trying to convey messages about lawn chemical use has an opportunity to influence public attitude.

Recommendation #2:

In order for chemical manufacturers to capitalize on consumer indecisiveness, it is imperative they implement an advertising strategy that talks about their chemicals being environmentally friendly. Homeowners must be made aware of the benefits of a healthy lawn and the role of chemicals in keeping it healthy.

Implication #3:

If chemical manufacturers do not provide professional lawn care operators (PCO's) with media training, then when PCO's deal with the media they could exacerbate the pesticde

image problem.

Recommendation #3:

With increased pressure from environmental groups, professional lawn care operators (PCO's) must betrained in how to handle situations with the media when an accident occurs. Chemical manufacturers should develop a training program that field representatives can present to PCO's on how to handle the media.

In today's business environment, being successful requires many new skills. One of these skills is effectively handling the media in a crisis situation. Media reports can have a devastating effect on a company's image and business. Understanding how to properly provide information to the media is critical to every company's success.

Implication #4:

If chemical manufacturers do not support realistic regulation, then people will percieve manufacturers as only profit driven, and environmental activism will result in increased regulation on the chemical industry.

Recommendation #4:

Manufacturers must work closely with legislators to find new ways to pass legislation that will not only to

sustain our environment but will not inhibit the profitability of the chemical industry. Increased regulation threatens the manufacturers' ability to maintain existing profit margins.

Implication #5:

If chemical manufacturers, whose products are seen as causing environmental problems, do not stay in front of the issue, then consumers will percieve manufacturers products as an environmental problem.

Recommnedation #5:

Chemical manufacturers should build up environmental credits with the public by adopting changes before they are legislatively mandated. When chemical manufactures make proactive changes, they should aggresively commnunicate what they have done.

Recommendations for future research

Listed below is a recommendation, arising directly or indirectly from this study, that suggest future research in this area.

1. Conduct a study which stratifies homeowners into different population densities. The home interview technique should be used in this study.

APPENDIX A

CONFIDENCE INTERVALS

CONFIDENCE INTERVALS

Confidence intervals were calculated for each likert-type question to determine where the population mean was relative to the sample mean. Reliability was established for each individual likert-type question.

Confidence intervals were also calculated for each of the two major constructs. They can be found in the findings section under the analysis of variance tests and the T-test's that were run for each specific objective.

The underlined heading represents each of the two major constructs and the number preceding each confidence interval corresponds to its specific survey number.

Homeowners' Attitudes

7.) C(2.54<2.68<2.81)=.95

8.) C(2.45<2.60<2.74)=.95

9.) C(3.02,3.19,3.35)=.95

10.) C(3.02<3.19<3.34)=.95

11.) C(3.23<3.40<3.56)=.95

12.) C(2.84<3.0,3.15)=.95

13.) C(2.76<2.91<3.05)=.95

14.) C(2.75<2.89<3.02)=.95

15.) C(2.51<2.65<2.78)=.95

16.) C(2.05<2.18<2.30)=.95

17.) C(3.25<3.41<3.56)=.95

18.) C(2.80<2.94<3.07)=.95

19.) C(3.89<3.99<4.08)=.95

20.) C(3.33<3.47<3.60)=.95

21.) C(3.40<3.53<3.65)=.95

22.) C(2.70<2.85<2.99)=.95

23.) C(2.71<2.81<2.90)=.95

24.) C(2.94<3.08<3.21)=.95

25.) C(2.66<2.82<2.97)=.95

26.) C(2.81<2.96<3.10)=.95

27.) C(2.57<2.70<2.82)=.95

28.) C(3.0<3.24<3.37)=.95

29.) C(3.18<3.32<3.45)=.95

30.) C(2.61<2.75<2.88)=.95

31.) C(3.50<3.62<3.73)=.95

32.) C(3.35<3.48<3.60)=.95

33.) C(3.45<3.57<3.68)=.95

Proposed Restrictions

34.) C(3.20<3.36<3.51)=.95

35.) C(3.27<3.43<3.58)=.95

36.) C(4.04<4.15<4.25)=.95

37.) C(3.91<4.03<4.14)=.95

38.) C(3.01<3.16<3.30)=.95

39.) C(2.09<2.58<2.73)=.95

40.) C(2.28<2.42<2.55)=.95

41.) C(3.32<3.48<3.63)=.95

BIBLIOGRAPHY

Ary, D., Jacobs, L., & Razavieh, A. (1990). Introduction to Research in Education. New York: Holt, Rinehart & Winston.

Atkin, C. (1990). Consumer Attitudes About Food Issues in Michigan. Lansing, MI: Michigan Department of Agriculture.

Babbie E. (1983). The practice of social research. Belmont, California: Wadsworth Publishing Company.

Best, R. S., (1985). Pesticides: Meeting public concerns. Agrologist, 1985.

Borg, W.R. & Gall, M. D. (1983). Educational Research: An Introduction. New York: Longman.

Blair, D. (1989). Uncertainties in Pesticide Risk Estimation and Consumer Concern. Nutrition Today, Nov/Dec 1989.

Byrum, W. D. (1990). Chlorpyrifos, unpublished position paper, DowElanco, Indianapolis, IN.

Cambridge Research International, (1991). Environmentalism Update: The Greenhouse Effect, Air Pollution, and Pesticide Use. Cambridge, Mass.

Cambridge Reports, (1989). Product Safety Standards and Policies. Cambridge, Mass.

Campbell, D. T. & Stanely, J. C. (1963). Experimental and quasi-experimental designs for research. Houghton Mifflin Company.

Chou, M. (1991). Two Years After the Alar Crisis. Cereal Foods World. Vol. 36, p. 526-527.

Creason, J. R. & Runge, C. F. (1992). Use of Lawn Chemicals in the Twin Cities. St. Paul, MN.

Congressional Research Service Issue Brief, (1992). Food Safety: Issues and Concerns Facing Congress. Brief No. IB90096.

Davis, A. (1971). Elementary survey analysis, Englewood Cliffs, N.J.: Prentice-Hall.

Dillman, D. (1978). Mail and telephone surveys. New York: John Wiley & Son.

Dragna, J. & Cooper, J. F. (1990). "Setting the Scene For Big Green.' Agrichemical Age.

Elliot, J. H., (1985). Agricultural Chemicals: The importance of public perceptions. Agrologist, 1985.

EPA Journal, (1990). Pesticides and Food Safety. Office of Communications and Public Affairs.

Extension Bulletin, (1991). Commercial and Private Applicator Core Manual. Cooperative Extension Service, Michigan State University. E-2195.

Food Marketing Institute. Consumer Confidence in Food Safety, An Update. Washington, D.C.: Food Marketing Institute, September 28, 1989.

Gehring, P. J. (1990). Pest Control: Risk, Perceived Risk and the Future of Pest Control Technology. Unpublished material: Speech to the Midwest Plant Biotechnology Consortium.

Hamlin, G. H. (1991). 2,4-D, unpublished position paper, Dow Ag Products, Midland, MI.

Hamlin, et al. (1992). Manager of Corporate and Public Affairs, DowElanco. Personal Communication. November, 1992.)

Hammitt, J. K. (1986). Estimating Consumer Willingness to Pay to Reduce Food-Borne Risk. Santa Monica, CA: The Rand Corp. Report No. R-3447-EPA, 1986.

Kerlinger, F. (1956). The attitude structure of the individual: a Q-study of the educational attitudes of professors and laymen. Genetic Psychology Monograph, 53, 283-329.

Ketchum Public Relations, (1991). What Green Means To Your Customers.

Krejcie, R. F. & Morgan, D.W. (1970). Determining sample size for research activities. Educational and Psychological Measurement. 30: 607-610.

Lehnert, D. (1990). Unpublished material: Speech to Michigan Horticulture Society.

Likert, R. (1932, June). A technique for the measurement of attitudes. {Monograph} In R. S. Woodworth (Ed.). Archives of Psychology, 140, 5-55.

Matrixx Marketing Inc., (1991) Environmental Focus Groups. Unpublished material for DowElanco. Indianapolis, IN.

Medina, C. P. Pest Control Practices And Pesticide Perceptions in the Loo Valley. Management of Pests and Pesticides. Westview Press, Inc.

Minnesota Center for Survey Research (MCSR). 1990. Minnesota Farmers Survey, conducted for the Land Stewardship Project. Questionnaire and Results. Minneapolis: Minnesota Center for Survey Research.

Minnesota Center for Survey Research (MCSR). 1991. Lawn Care: A Survey of Metropolitan and Lake Area Homeowners. Results and Technical Report #91-24. Kay Schmitt, Project Manager.

Nagy, P. (1978). Subtest formulations by cluster analysis of the scientific attitude inventory. Journal of Research in Science Teaching, 7, 85-94.

National Gardening Association. 1987-8. National Gardening Survey. Burlington, Vermont.

Roberts, E.C. (ED). 1986. Harvests. The Lawn Institute. Pleasant Hill, Tennessee 32(4).

Roberts, E.C. (Ed). 1986. Harvests. The Lawn Institute. Pleasant Hill, Tennessee 34(1):16.

Roberts, E.C. (Ed). 1986. Harvests. The Lawn Institute. Pleasant Hill, Tennessee 34(2):19.

Sachs, C., Blair, D., Richter, C., (1987). Consumer Pesticide Concerns: A 1965 and 1984 Comparison. The Journal of Consumer Affairs, Vol. 21, No. 1, 1987.

Schmickle, Sharon. "City Folks Begin to Take Heat Over Lawn Chemicals." Star Tribune. July 22, 1991.

Shaink, M.R. (1985). A study of Michigan community college presidents' and trustees' perceptions about the application of marketing practices to community colleges. Unpublished doctoral dissertation, Michigan State University, East Lansing.

Triandis, H. C. (1971). Attitude and Attitude Change. New York: John Wiley & Sons.

SPSS Inc. (1987). Statistical package for the social sciences (SPSS/PC+). Chicago, Illinois.

U.S. General Accounting Office (1986). Nonagricultural Pesticides: Risks and Regulation. Report Number RCED-86-97.

U.S. General Accounting Office (1990). Lawn Care Pesticides: Risks Remain Uncertain While Prohibited Safety Claims Continue. Report Number RCED-90-134.

van Ravensway, E. & Hoehn, J. P. (1990). The Impact of Health Risk on Food Demand: A case study of Alar and Apples. Department of Agricultural Economics, Michigan State University.

van Ravensway, E. & Roberts, T. (1991). Food Safety Issues And Economic Analysis. Prepared for presentation at the XXI International Conference of Agricultural Economists. Tokyo, Japan.

van Ravenswaay, E. (1990). Consumer Perception Of Health Risks In Food. Department of Agricultural Economics, Michigan State University.

Winburn, J. N. (1962). A Dictionary of Agricultural and Allied Terminology. Michigan State University Press.

Yankelovich Clancy Schulman (1991). An Environmental Perspective on U.S. Crops Employees -1991. Green Action Monitor.

Zaidai, I. H. (1987). Farmer's Perceptions Of Pesticides As A Cotton Crop Protection Strategy. Management of Pests and Pesticides: Westview Press.