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THE UNIVERSITY OF ALBERTA

ATTITUDE AND BEHAVIOR OF FARMERS TOWARD DISPOSABLE PROTECTIVE CLOTHING: AN EXPERIMENTAL FIELD STUDY

by

HELENA M. PERKINS

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled ATTITUDE AND BEHAVIOR OF FARMERS TOWARD DISPOSABLE PROTECTIVE CLOTHING: AN EXPERIMENTAL FIELD STUDY submitted by Helena M. Perkins in partial fulfilment of the requirements for the degree of Master of Science in Clothing and Textiles.

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ABSTRACT

Attitudes and Behavior of Farmers Toward Disposable Protective Coveralls: An Experimental Field Study

by

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The purpose of this study was to understand the behavior of Alberta farmers with regards to wearing disposable protective clothing by measuring behavioral intention and actual behavior as a function of attitudes and beliefs. Protective clothing is often perceived as uncomfortable. Disposable clothing offers potential comfort as well as protection. Fishbein-Ajzen's Theory of Reasoned Action was utilized as a conceptual framework.

An experimental field study was conducted with 325 volunteer Alberta grain farmers. Experience and information were used as experimental treatments. Kimberly-Clark Kleenguard™ Extra-Protection coveralls were chosen as trial garments.

Self-administered questionnaires using the semantic differential type rating scale as suggested by Ajzen and

Fishbein (1980) were used to measure the components of the model, thermal comfort, and evaluation of coverall attributes. Data from 244 respondents were computer analyzed using frequencies, T-tests, analysis of variance, Pearson product-moment correlations and multiple regression analyses.

The findings indicated that most of the respondents had beliefs that wearing disposable coveralls would provide the best method of protection, and provide a more secure feeling about pesticide use. Positive attitudes, both personal and social, and behavioral intentions were indicated.

Attitude and subjective norm together provided considerable influence on behavioral intention, with attitude the stronger component. Behavior can be effectively predicted by measuring behavioral intention.

Information and/or experience positively affected beliefs about feeling wet from perspiration, feeling restricted in mobility, and taking time to put on and remove coveralls. Attitudes were positively affected; behavioral intention and behavior were unaffected.

Overall, thermal comfort assessment and evaluations of coverall attributes were positive, with no information effect. Higher thermal comfort levels and evaluations increased intentions to wear disposable coveralls.

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I. INTRODUCTION

Pesticides are a necessary part of agricultural production in today's ever-expanding world. Large-scale benefits such as high crop yields and affordable produce are gained by the use of pesticides by agricultural workers. These benefits result at the cost of risking human health. Health hazards range from acute toxicity with symptoms such as headaches and nausea, to long term and cumulative effects such as cancer and genetic mutations (Boraiko, 1980). The long term effects are not apparent to agriculture personnel and thus, pesticide application is often rated as a relatively acceptable risk (Vlek & Stallen 1981; Rucker, McGee, Chordas, 1986). No one knows for sure how many farm workers suffer pesticide poisoning: immediate adverse effects on health seldom result from spraying; flu-like symptoms are often attributed to something other than pesticide application; and not all poisonings are reported (Boraiko, 1980).

In the United States and Canada, farm workers could be seriously exposed to pesticides through poor enforcement procedures. In Alberta, many workers may be at risk due to the government resting the final responsibility for safe practices with the individual. The provincial government administers regulations under the Agricultural Chemicals Act, however, the Act is lenient and not adequately enforced. Under section 4 of the regulations it states that a person who applies pesticides on private land or premises owned, occupied or controlled by him does not need to obtain a license nor possess adequate knowledge concerning the proper and safe use, application, handling, disposal and hazards of pesticides (Government of the Province of Alberta, 1980).

Alberta Environment develops and administers legislation, stresses the need for awareness, and through educational programs, helps applicators develop an understanding of pesticide management (Alberta Environment, 1979). Alberta Agriculture has provided information to agricultural workers on the risks of pesticide use, safe handling of pesticides, and protective clothing.

Applicators, mixers and loaders have the highest risk of exposure to pesticides. Dermal exposure has been cited as the most likely cause of both acute and chronic adverse health effects. Eighty-seven to 90% of total human exposure to pesticides is from skin exposure (Durham & Wolfe, 1962; Maibach, Fieldman, Milby & Serat, 1971; Moraski & Neilson, 1985). Dermal absorption of pesticides can be enhanced by the high temperatures that prompt applicators to remove protective clothing. The potential for illness varies with the length of exposure and the toxicity level of the pesticide (Moraski & Neilson, 1985).

Ordinarily, field workers are protected from the effects of agricultural chemicals by restricting them from entering treated areas until after natural degradation of these chemicals has occurred and they are no longer hazardous. These "worker reentry intervals" remain unsubstantiated and are now considered educated guesses (Kilgore & Akesson, 1980). The use of protective clothing is considered essential for providing some measure of protection for those who work with and around pesticides.

Traditional protective clothing lacks thermal comfort and interferes with mobility. Most farmers still do not wear protective gear: everyday work clothes such as long-sleeved shirts, jeans, leather boots and baseball caps are worn instead (Rigakis, Martin-Scott, Crown, Kerr, & Eggertson, 1987; Rucker et al., 1986; Stone, Koehler, Kim, & Kadolph, 1986). "There is a need for protective clothing that offers comfort and acceptability as well as chemical protection to those individuals occupationally exposed to pesticides" (Branson, DeJonge, & Munson, 1986, p.27).

The use of protective clothing has emerged as a viable method of increasing the health and safety of a worker faced with a hazardous environment. Such clothing may also improve a worker's job efficiency. Creating protective clothing has become increasingly challenging as new technological developments create new hazards. New chemicals or infectious organisms create the need for new types of protective clothing for industrial, agricultural or medical personnel.

Despite the considerable effort given to the development of protective gear for the agricultural worker, what is now available has not been widely accepted by many workers at risk. Emphasis has been placed on finding a suitable fabric for use with pesticides. Unfortunately, less consideration has been [illegible] the exploration of user acceptance.

In the past, many farmers refused to wear protective clothing [illegible] to the lack of thermal comfort of available garments (Henry, 1980). Comfort has been established as one of the most important spray garment characteristics. Thus, a problem has been created because the requirements for both protection and comfort tend to be in contradiction.

Use of protective apparel would increase if comfortable, affordable prototypes were readily available. Nonwoven, disposable fabrics for use in protective garments are a potential alternative. Recently, "breathable", disposable, protective garments have appeared on the market. The term "breathability" has not been defined in scientific terms but implies they are comfortable. However, perceived lack of thermal comfort of disposable garments may be the primary reason for their rejection. Perceptions of the comfort of coverall attributes will have to change in order to motivate workers to wear them.

Statement of the Problem

The main purpose of this study is to understand and predict the behavior of Alberta farmers with regards to the wearing of disposable protective clothing by measuring behavioral intention and actual behavior as a function of their attitudes and beliefs. In doing so, it will be determined whether actual experience with the garment and information will be effective in changing the farmers' behavioral intention or behavior with regards to wearing protective clothing. New beliefs, attitudes and evaluations of the garments' attributes and wearing outcomes must be formed in order to change actual behavior.

Justification

Recently, attention has been focused upon the use of disposable garments for work with pesticides. There are many reasons for the interest in disposable garments. The garments are lighter in weight, and hence more comfortable and functional than traditional impermeable protective clothing. They also exhibit a high degree of resistance to chemical penetration, are economically priced and disposable, thus eliminating the need to decontaminate them (Moraski & Nielson, 1985). The researcher used Kleenguard® Extra-Protection (EP) disposable coveralls manufactured by Kimberly-Clark that are sucessfully entering into the Canadian Market for use in several occupations, including assembly line workers and painters (Kleen Guard coveralls campaign, 1986). Farmer reaction and intentions toward adopting these disposable protective garments is a vital area of concern. A clearer understanding of why farmers are not using protective clothing, and what will affect their behavior will be useful for manufacturers as they can adapt their mode of advertising or designs and sizing of the garments. As well, educators of agricultural workers (i.e. agriculture extension personnel) will be interested in increasing their understanding of farmers actions toward wearing protective clothing and knowledge of newly developed practices in the area of health and safety of agricultural workers. Families will benefit from the adoption of disposable protective garments by decreasing the contamination of family washing. Contaminated garments are often added with the regular wash; however, disposable garments will help reduce this possibility.

An exploration into the adoption behavior of an individual user of protective clothing must also examine variables that affect behavior. Behavior is often consistent with an individual's beliefs, personal and social attitudes and behavioral intentions. In order to accurately determine the effect of these variables toward performing a behavior, an accurate device must be developed and tested under a variety of conditions.

One of the most popular and well accepted measuring devices of behavioral intention is the Fishbein-Ajzen theory of reasoned action which attempts to predict a specific behavior under a given set of conditions. The controversy and discussion surrounding the validity of the Fishbein-Ajzen theory suggests the need for further research and clarification.

The need to measure beliefs, attitudes and intentions regarding the wearing of disposable protective clothing is an important step in developing a greater understanding of the attitude-behavior relationship. This research will attempt to determine the applicability of this model as a conceptual framework for studying the behavior of wearing protective clothing.

Objectives

The objectives of this study were as follows:

1. To measure the variables in the Fishbein-Ajzen model with regards to wearing disposable protective coveralls.
2. To determine relationships among the variables in the Fishbein-Ajzen model and their predictive power on behavioral intention.
3. To determine whether experience with the garment will have a significant effect on respondents' beliefs, attitudes and behavioral intention with regards to wearing disposable protective coveralls.
4. To determine the effect of information about disposable protective clothing on the respondents' beliefs,

attitudes, behavioral intention and overt behavior with regards to wearing disposable protective coveralls.

5. To determine whether a combination of experience and information will have a significant effect on respondents' beliefs, attitudes and behavioral intention with regards to wearing these garments.
6. To measure the subjects' thermal comfort level and evaluation of the coveralls after wearing them.
7. To determine whether a significant relationship exists between either the respondents' thermal comfort level or evaluation of garment attributes and behavioral intention.
8. To determine whether information will have a significant effect on either the respondents' thermal comfort level or evaluation of the attributes of disposable protective clothing.

Null Hypotheses

The following null hypotheses will be tested to meet objective 2.

1. There will be no significant relationship between the product of beliefs about and evaluations of the outcomes of performing the behavior and measured attitude towards performing the behavior.
2. There will be no significant relationship between the product of normative beliefs and motivation to comply and

measured subjective norm for the behavior of wearing disposable protective coveralls.

3. There will be no significant relationships among intention of performing the behavior, attitude toward performing the behavior, and subjective norm.

4. There will be no significant relationship between behavior and intention of performing the behavior.

The following null hypothesis will be tested to meet objectives three, four and five:

5. There will be no significant differences among treatment groups with or without experience and/or information in their:

(a) beliefs about wearing these coveralls

(b) attitudes towards wearing these coveralls

(c) intentions to wear these coveralls

(d) behavior of wearing the coveralls

The following null hypothesis will be tested to meet objective 7.

6. There will be no significant relationship between either thermal comfort or evaluation of garment attributes and behavioral intention.

The following null hypothesis will be tested to meet objective 8.

7. There will be no significant differences between treatment groups with and without information in their thermal comfort level and evaluations of the attributes of disposable protective coveralls.

Definitions

Pesticides- chemicals including insecticides, herbicides and fungicides that are intentionally introduced into the environment for the control or destruction of pests, weeds and other hazardous organisms.

Disposable protective clothing- nonwoven structures, chemically resistant to penetration, lighter in weight than traditional protective clothing, and economically priced; they do not require decontamination (Moraski & Nielson, 1985).

Kleenguard® EP coveralls- a three layer product made of nonwoven, spunbonded polypropylene fabric; it has an extra protection (EP) finish recommended for use with pesticides; a porous structure allows "breathing"; it comes with washing instructions and is launderable in some cases, although this procedure is not recommended by the researcher for pesticide protection purposes; it is manufactured by Kimberly-Clark.

Field Trial (wear test)- a period of controlled wearing and evaluation of disposable coveralls to determine consumer attitudes toward their use in terms of comfort, protection and convenience.

Physical comfort- (with respect to clothing) "is a mental state of physical well-being expressive of satisfaction with physical attributes of a garment such as air, moisture and heat transfer properties and mechanical properties such as elasticity and flexibility, bulk, weight, texture and construction" (Sontag, 1985, p.10).

Thermal comfort- defined by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) as "that state of mind which expresses satisfaction with the thermal environment" (American Society of Heating, Refrigeration, and Air Conditioning Engineers, 1981, p.2).

Physical comfort is operationally defined as the individual senses or personal thoughts regarding thermal satisfaction, garment fit, style and tactile properties as measured by the rating scales in Appendix F, Parts 1 & 2.

Theoretical Definitions Related to the Fishbein-Ajzen Model

Beliefs- refer to a person's conviction, or acceptance that certain things are true or real; opinions, expectations, or judgements (Webster's New World Dictionary, 1974, New York: World Publishing).

(a) behavioral beliefs-refer to a person's perceived likelihood that performing a behavior will result in a given outcome (Ajzen & Fishbein, 1980, p.66). Beliefs about the outcome of wearing disposable protective coveralls (b_i) are measured by questions 1-11, Part E, Appendix C.

(b) normative beliefs- refer to a person's belief that a specific referent or group of referents think(s) he should (or should not) perform a particular behavior (Ajzen & Fishbein, 1980, p.73). Normative beliefs (NB) about spouse, family, Alberta Agriculture, Agricultural Service Board, and members of farm organizations regarding the use of disposable protective coveralls are measured by questions 2-8, Part F, Appendix C.

Evaluation of consequence or outcome- refers to a person's positive or negative evaluation of the outcome of performing a given behavior (Ajzen & Fishbein, 1980, pp.64-65). Evaluations of the outcomes associated with wearing work clothes (e_i) are measured by questions 1-11, Part A, Appendix C.

Motivation to comply- refers to a person's desire to comply with the expectations of another individual referent or group of referents (Ajzen & Fishbein, 1980, p.75). Motivation to comply (MC) with spouse, family, neighbors, friends, Alberta Agriculture, Agricultural Service Board, and members of farm organizations are measured by questions 1-7, Part B, Appendix C.

Attitude toward a behavior- a person's judgement that performing the behavior is good or bad, that he is in favor of or against performing that behavior (Ajzen & Fishbein, 1980, p.56). Attitude toward wearing disposable protective coveralls (Att) is measured using semantic differential scales in Part D, Appendix C.

Subjective Norm- refers to a person's perception that important others collectively think he/she should (or should not) perform a particular behavior (Ajzen & Fishbein, 1980, p.57). Subjective norm (SN) regarding the wearing of disposable protective coveralls is measured by question 1, Part F, Appendix C.

Behavioral Intention- a measure of the likelihood that a person will engage in a given behavior (Ajzen & Fishbein, 1980, p.42). Behavioral intention (BI) toward wearing disposable protective coveralls is measured by questions 1-5, Part C, Appendix C.

Overt behavior- the actual wearing of disposable protective coveralls and/or gloves while spraying field with pesticides. Overt behavior (B) is measured using a self-administered questionnaire, Appendix D.

II. REVIEW OF LITERATURE

The review of literature which follows includes five main sections. The first section describes the use of protective clothing for agricultural workers exposed to the hazards of pesticides. The second section describes attitudes and behavior toward the use of protective clothing and focuses on recent studies in this area. The third section describes literature on the concept of comfort as it relates to protective clothing, focusing on problems and misconceptions of thermal comfort. Measurement of comfort is discussed in the fourth section. The fifth, and last section, describes the development of the Theory of Reasoned Action.

A. THE USE OF CLOTHING FOR PESTICIDE PROTECTION

Studies measuring pesticide deposition on the skin have detected between 718 and 1,755 milligrams of pesticide residue deposited per hour (Hanson, Schneider, Olive & Bates, 1978; Nigg, 1980). Areas of high deposition include the front upper arm and back upper torso. An area of moderate deposition is the front upper leg. The hands often receive the highest exposure to pesticides (Wolfe, 1976). These areas need maximum protection. Variation in levels of deposition and amount of penetration is dependent upon the method of pesticide application used and the prevailing weather conditions.

The use of protective clothing is extremely important for providing some protection for those who work with pesticides. In 1973, U.S. Federal legislation proposed an amendment on protective clothing. For reentry within 24 hours after application of highly toxic pesticides, protective clothing was to include "a garment or garments of impermeable material to cover the entire body, hat, natural rubber gloves, impermeable shoe coverings, and goggles or face shields and a respirator" (Federal Register, July 31, 1973). This proposed standard was opposed by state regulatory agencies, research and extension agencies, growers and their organizations, pesticide manufacturers, and public interest groups. The debate focused on the high risk of heat stress with impermeable clothing.

On May 10, 1974, the Federal Register recorded the adoption of the final protective clothing standard. Protective clothing was defined as "at least a hat or other suitable head covering, a long sleeved shirt and long legged trousers or a coverall type garment (all of closely woven fabric covering the body, including arms and legs), shoes and socks".

"In contrast to what is demanded by the Federal Register, previous studies have found that the more closely woven fabrics permitted the greatest degree of penetration"

(Orlando, Branson, Ayers, & Leavitt, 1981, p.619). Long smooth yarns "wick" more quickly and easily than a fabric with either randomly arranged fibers in its yarns, or in its structures. However, with fabrics providing high penetration protection, the problem of human thermal comfort arises (i.e., low moisture vapour transfer).

Recently, attention has been focused upon the use of disposable protective garments for work with pesticides. There are many reasons for the interest in disposable garments as already mentioned in chapter 1. Spunbonded disposables are nonwoven structures that wick less because of their fabrication; those that have been treated to resist liquid penetration provide the best barrier. Non-coated disposables allow the transmission of moisture vapour through the fabric to the outside surface by diffusion and therefore facilitate evaporative cooling. The process of evaporation exchanges heat produced by the body with the environment to maintain thermal comfort (Tanner, 1979). Cooling by evaporation is extremely important with protective clothing because the garments cannot be designed with ventilation features that allow further contamination.

In a laboratory study by Orlando et al. (1981), two spunbonded samples gave 25 times more protection than cotton shirt-weight fabric. The level of protection also differs depending on the chemical and formulation of the pesticide. There are variations in types of disposable fabrics as well.

Kleenguard® EP disposable coveralls manufactured by

Kimberly-Clark will be used in the proposed research. This product is constructed of a spunbonded and meltblown polypropylene fabric that is specially treated to resist liquid penetration. It has been claimed by manufacturers that this fabric "breathes", looks and feels like cloth, and hence, must be comfortable (Business to Business Marketing, 1986). A coverall material, manufactured by E. I. DuPont de Nemours, called Tyvek®, is 100% spunbonded olefin and constructed into limited use coveralls by several manufacturers. Disposable coveralls are cut large to accomodate body movements and the above mentioned coveralls are inexpensive to produce. Some people object to the bulky look and limited colour choice.

Polyethylene coated Tyvek®, called Saranex®, is a better protector but is more expensive and not as comfortable in hot weather. Saranex® fabric is coated with Saranex®, a saran film produced by Dow Chemical and is impermeable and chemically resistant. This coverall could be used for short periods of time while mixing, loading, or cleaning, or while spraying in cooler weather.

The Kimberly-Clark coveralls designed as boiler suits were used for spray operators in a study by Lloyd, Bell, Howarth, and Samuels (1985). They were determined to be potentially adequate for the protection of operators against predominantly aqueous spray particles. Gore-Tex® was used as a "reference" garment since previous studies had established its effectiveness and comfort for the protection of spray operators. The study led to the conclusion that the disposable garments are suitable as a short-life protective garment for spray operators provided: a)an impermeable cover (eg. disposable plastic apron) is supplied and worn for additional protection when opening pesticide containers of liquid pesticides, dispensing and mixing the contents; b)it is not used as a coverall for protection when spraying undiluted, highly toxic or corrosive products; and c)the service life for spray operators is stated and instructions supplied on how to wash, dry, store, and dispose of the suit, and under what circumstances it should never be worn again (e.g. when torn, saturated with spray etc.) (p.10).

B. ATTITUDE AND BEHAVIOR TOWARDS PROTECTIVE CLOTHING USE

There has been an increased emphasis on research in the area of protective apparel for pesticide users for the past eight years. The primary focus of this research has been on the ability of fabric to prevent penetration (DeJonge, Ayers, Branson, 1985; Orlando et al., 1981). Although the pesticide protection attribute is extremely important, the clothing may still be considered unacceptable in terms of comfort, durability, or protection effectiveness, and thus not worn.

Recent studies have looked at attitudes and behavior toward wearing pesticide protective apparel to determine the most acceptable type of garment (DeJonge, Vredegood, Henry, 1983-84; Murray, 1982; Carlson, 1982). Currently available spray garments do not enjoy overwhelming acceptance by the users for which they are designed. Individuals may tend to discount future risks since the results of pesticide exposure are often long term and cumulative with no immediate adverse effect on the health of the applicator except for direct spills. With the knowledge that pesticides are harmful to one's health and the belief in the benefit of their use, cognitive dissonance results. The farmer may rationalize not using protective clothing by believing that 'most applicators are tough enough to take pesticide exposure' (Shern, 1986).

Motivating workers to wear special clothing often depends on their perception of comfort and durability, as well as their attitudes toward the hazards present and the effectiveness of the clothing in protecting against these hazards. Murray (1982) studied the reasons behind fruit farmer's garment evaluations. These reasons were explored through the participant's attitudes, perception of health risk, uncontrolled variables, demographic variables and the likelihood of future wear.

Murray (1982) found that farmers do perceive and admit that a need exists for protective garments. There was no significant relationship between the evaluators' perceptions of health risk and their garment evaluations. Sixty-eight percent of the participants expressed the intention to continue to wear a majority of the garments evaluated (Tyvek®, Storm Shed®, and GoreTex®), therefore it seemed as if thermal comfort was maintained. Although only 54.2% were willing to buy them, Tyvek® was the preferred choice in the area of cost. Sixty percent expressed the willingness to cope with the inconvenience of a special spray garment. The users established comfort, mobility and durability as the most important spray garment characteristics. Comfort and mobility were important before and after the wear test. Durability, resistance to tearing, and light-weight characteristics were also deemed extremely important after the wear test. Garment and fabric appearance, colour and disposable aspects were not considered important after the wear test. There appeared to be an increasingly positive response to the garments the more they were worn. All respondents showed concern over the health risks of pesticide exposure and agreed that regular work clothing was not adequate to protect pesticide applicators.

Several studies have included an investigation of differences in the perceptions of repondents by type of farm, size of farm, age, and education (DeJonge et al., 1983-84; Henry, 1980; Murray, 1982). DeJonge et al. (1983-84) and Murray (1982) found that neither age, education level, nor size of farm had significantly affected beliefs or actions. Fruit growers are more likely than non-fruit growers to adopt protective apparel since their risk is more obvious to them because of application technique (more body contact).

Henry (1980) found significant differences in the respondents' perceptions of the attributes of functional apparel by type of farm, age, acreage, and education as determined by chi-square analysis. Fruit farmers and field and/or vegetable farmers perceived the comfort and protection attribute of a functionally designed garment for pesticide users in a significantly more positive way than did dairy and/or livestock farmers. Fruit farmers also perceived a greater need for protective clothing. They understood that clothing can be contaminated and that protective clothing can be comfortable in a significantly more positive way. They were also more willing to try new ideas in pesticide protection. They were already taking precautions, held high beliefs regarding necessity of protection, were less likely to choose comfort over protection, and were desirous of expert information regarding new innovations.

Those with smaller acreages perceived protection as more positive and had a greater perception of the need for protective clothing. Those older than 65 years had more positive perceptions of need to be covered and protected; older farmers were less likely to choose comfort over protection and had positive attitudes toward trying the protective apparel if it was easily available to them.

Those with the least education held the strongest beliefs regarding protection. High school graduates had more positive perceptions of the attributes of functional apparel than college graduates except in their perception of availability of comfortable and protective functional apparel for pesticide users. The interactive effect of type of farm, mainly fruit farmers, was responsible for many of the differences in the respondents.

Carlson (1982) tested the effectiveness of fear appeals as a measure of persuasion in the acceptance of pesticide protective garments. The degree of persuasive ability of the fear appeal strategy was measured by changes in attitudes, intentions for future use, and reported behavior. Carlson's (1982) results showed that fear appeals significantly and positively changed perceptions of hazard, perceived benefits of protective clothing and intentions for future use, but not reported behavior. Past research has suggested that more time is necessary to alter behavior than attitude (Rogers and Shoemaker, 1971).

Rucker et al. (1986) and Stone et al. (1986) asked farmers questions on selection of work clothing. Very few reported wearing disposable protective clothing and respirators were worn a little more frequently. The reasons most often given for not wearing an item were "not necessary" and "not comfortable". Aspects such as thermal discomfort, cost, lack of durabilty, and loss of dexterity, often influence the sprayers' use of protective clothing. Staiff, Davis, and Stevens (1982) indicated that Pacific N. W. spraymen tended to wear waterproof hats, jackets, trousers, and boots only when temperatures were low enough so as not to cause discomfort. Some of these same individuals used outerwear consisting only of a cap, short-sleeved shirt, light trousers, and canvas sneakers when temperatures became high enough to cause extreme discomfort if they were to wear conventional protective clothing.

C. COMFORT AND PROTECTIVE CLOTHING

As mentioned previously, comfort is one of the most important pesticide protective garment characteristics. Traditional protective clothing has been unacceptable because of poor heat dissipation through the fabric, a critical factor affecting subject's thermal response.

Branson et al. (1986) evaluated the thermal response associated with prototype pesticide protective clothing in a controlled environmental chamber. Special features were designed for convenience and thermal comfort. However, the design did not influence subjects' thermal response to the extent that fabric did. The types of fabrics used that were good penetration barriers were Tyvek®, Gore-Tex®, and Neoprene®. Subjects wearing Tyvek® fabrics had higher skin temperature than all other fabrics. Those wearing Gore-Tex® had similar skin temperatures to those wearing chambray (typical fabric of farmers' clothing). Perceptual measures of thermal sensation and thermal comfort correlated well with the physiological tests.

Staiff et al. (1982) also assessed the effects of colour on wearers' comfort. Colour was probably the factor which most affected inside surface temperature when these orchard applicators evaluated several types of protective clothing. The white garments produced the lowest inside airspace temperature and inside garment surface temperature. Dark garments, such as grey coveralls and black or dark green rubberized cotton raincoats, produced higher interior temperatures than other garments. Whiter clothing, used as a radiation screen, will unlikely benefit the wearer unless there is also free circulation of air underneath the clothing (Kerslake, 1966). Some of the Pacific N. W. spraymen with high inside garment temperatures felt cooler than those with lower temperatures, possibly due to the lightweight properties of the garments. One suspects, however, that even lightweight garments might be unacceptable under conditions of high temperature accompanied by high relative humidity. High humidity decreases the possibility of evaporative cooling by the body. Skin may become wet with sweat, thus resulting in subjective discomfort (Kerslake, 1966; Watkins, 1984).

Vanderpoorten (1981) concluded in her study on the use of clothing and perception of comfort in the home environment, that attitudes may affect both actions and perceptions related to thermal comfort. Attitudes toward the risks and benefits involved in pesticide application also differ and may affect current practices as well as receptivity to educational efforts (Rucker et al., 1986).

The concept of thermal comfort is complex and little is understood about some of the subjective factors which may affect feelings of comfort. Many consumers believe that natural fibers are comfortable and synthetics are somewhat uncomfortable. Psychological comfort factors, resulting from fiber sensations, can change as a result of training (Fourt & Hollies, 1970).

> Clothing made from filament yarns has been highly unacceptable to men, but not noticeably uncomfortable for women...This relates to the fact that most men normally highly uncomfortable in filament underwear while women are quite accustomed to its definitely cool feel (Fourt & Hollies, 1970, p.178).

Perceptions of comfort with particular fabrics can change with experience, however slow the process may seem. Taggart and Hester (1985) studied consumer's perceptions of polypropylene apparel and reported that the consumers studied showed an increase of perceptions of polypropylene garments from prepurchase to after wear suggesting that awareness of the fabric's properties increases with wear. However, introduction of polypropylene into the mass consumer market was cautioned against due to consumers' misunderstandings of particular perceptions of the attributes of polypropylene apparel and limited awareness of the uses of polypropylene in active sportswear.

The dimension of physical comfort has a differential impact on a person's overall garment evaluation prior to and after wearing. Sontag's results (1985) showed that physical comfort and psychological comfort were both highly correlated with overall evaluation before wearing the garment. Experience of wearing the insulative clothing modified perceptions of physical comfort, psychological comfort and overall evaluation. As well as changing perceptions of clothing comfort through experience, researchers have also suggested increasing consumer education in the area of clothing comfort (Slater, 1985; Sontag, 1985; Taggart & Hester, 1986).

Many variables influence comfort, the garment being one of them. Others include the environment and level of activity of the wearer (physical variables), psychological variables, and stored modifiers such as past experiences and expectations. The physical and subjective differences in clothing materials are also responsible for differences in comfort when the clothing is worn (Fourt & Hollies, 1970). While studying the effect of changes in temperature and humidity on thermal sensations, Nevins, Gondalez, Nishi, and Gagge (1975) found significant differences among individual subjects' sensitivity to thermal sensations and humidity level.

D. COMFORT AND MEASUREMENT

Most of the studies mentioned above utilize wear tests to study the acceptability of particular garments. Although there are certain limitations in conducting a wear test, such as expense, the effects of participants' cooperation, time constraints, and seasonal limitations, they are effective for evaluating consumer satisfaction with the garments in terms of comfort, convenience, and protection. Another objective for conducting a wear test, that applies to this research, is to assess a user's subjective evaluation of the garment's design and fabric effectiveness with respect to its intended end use (Murray, 1982). In some ways it resembles a test market of a new product.

As well as determining attitudes toward use and overall acceptability of the test garment, wear tests can obtain information on thermal acceptance levels, physical changes in the garment fabric, and any dangerous effects from wearing them. "Although specific properties related to comfort can be studied in the laboratory, only wear tests provide a practical measurement of garment comfort under actual wearing conditions" (Latta, 1977, p.48).

Many test methods have been developed for assessing the physical and subjective properties of clothing and the clothing fabric. Some of the physical properties can be measured with great precision. However, they cannot substitute for actual measurement of comfort on people.

The laboratory measures of comfort include the thermal and moisture properties of the fabric, fabric and fiber characteristics, air permeability, and water-vapor transport properties (Fourt & Hollies, 1970, pp. 45-48; Slater, 1985). Moisture and air-transport properties of fabrics and the geometry of the fabric construction are particularly important for comfort in a hot environment.

Evaporation of perspiration is the most powerful means of cooling the body and is extremely important for protective clothing that omits ventilated areas that could enhance pesticide poisoning, thus reducing cooling by convection. Clothing that is vapour permeable will assist the evaporation of moisture from the skin. If the resistance to moisture transmission is too high, the relative humidity next to the skin increases to 100% and discomfort results.

The subjective assessment of comfort is dynamic as people adapt to different conditions of environment, fiber, and fabric (Fuzek & Ammons, 1977). Subjective measures of comfort include psychological scales, such as the McGinnis Thermal Scale (Hollies, Custer, Morin, & Howard, 1979), the Bedford (Chrenko, 1974) and ASHRAE scales for determining thermal sensation responses (Tables 1 and 2).

Psychological scaling is the process of making judgements from our own perceptions. Many of the methods for applying psychological scaling to comfort problems are fairly well-established (Hollies, 1977). As well as measuring thermal comfort, they can be used for clothing appearance factors of style and fit and for the effect of clothing colour on comfort acceptance. "Rating scales are the only way we have to assess an individual's impression of the environment and his feelings of comfort, or discomfort or warmth or coldness" (Rohles, 1978, p.727).

The scales are of ordinal and interval level of measurement and vary from three to thirteen points. The McGinnis Thermal Scale, shown in Table 1, is a thirteen-point scale used for thermal sensation responses. According to Hollies et al. (1979) it is reliable for both thermal stress assessment and as a check on subject safety in severe climates.

Table 1

McGinnis Thermal Scale

I am:

1. So cold I am helpless
2. Numb with cold
3. Very cold
4. Cold
5. Uncomfortably cool
6. Cool but fairly comfortable
7. Comfortable
8. Warm but fairly comfortable
9. Uncomfortably warm
10. Hot
11. Very hot
12. Almost as hot as I can stand
13. So hot I am sick and nauseated

Seven-point scales remain the most frequently used. The choice of seven is supported by research evidence, which suggests that the number of separate estimates that a person can unambiguously assign to a one-dimensional stimulus is rather small. On this basis, many researchers have concluded that subjects will be unable to distinguish more than seven levels of thermal sensation (McIntyre, 1976, cited in

Branson, 1982). The Bedford and ASHRAE scales, shown in Table 2, are two commonly used seven-point scales.

Table 2

Bedford and ASHRAE Thermal Comfort Rating Scales

Bedford Scale	ASHRAE Scale
Much to warm	Hot
Too warm	Warm
Comfortably warm	Slightly warm
Comfortable	Neutral
Comfortably cool	Slightly cool
Too cool	Cool
Much too cool	Cold

Examination of the scales shows that the ASHRAE scale refers only to thermal sensation, whereas the Bedford scale combines sensation and comfort. Rohles (1978) has supported the validity and reliability of the ASHRAE scale using earlier comfort studies.

Although Rohles has supported the use of the seven-point ASHRAE scale he also proposed a nine-point scale to measure thermal sensation by adding the categories very hot and very cold to the extremes of the scale. There was an existing tendency for subjects not to use the end points, thus effectively reducing a seven-point scale to five points. If a researcher wants to increase variability and end up with seven points, a nine-point scale is recommended (Rohles, 1974).

The semantic differential scale originally developed by Osgood, Suci and Tannenbaum (1957) has been used in studies measuring the comfort of wearing clothing (Huck & McCullough, 1986; Rohles, Konz, McCullough, & Milliken, 1983; Winakor, Kim, Wolins, 1980). Such scales consist of a series of adjective pairs such as comfortable-uncomfortable and hot-cold, which are separated by seven or nine distinct spaces and which require the rater to place a check mark in one of the spaces that describes his feeling. The semantic differential scale, which has been used in this study (Appendix C, Part D and Appendix F) appears to be a valid and reliable instrument (Rohles, 1978). Osgood et al. (1957) have reported relatively high reliabilities for single seven-point bipolar scales used in the semantic differential. Branson et al. (1986) asessed thermal comfort using a nine-point semantic rating scale developed by Rohles in an effort to refine the rating of thermal comfort.

E. THE THEORY OF REASONED ACTION

In an effort to measure consumer behavior with regards to wearing disposable protective garments, it is important to identify a theoretical framework of consumer behavior. Several models have been tested to study attitude and its relationship to behavior. The Fishbein-Ajzen theory of reasoned action, also called the Fishbein behavioral intentions model, or the "extended" model, is a popular and well accepted model of behavioral intention and forms the conceptual framework for this study. The Fishbein and Ajzen model has received much attention in psychology and applied fields like consumer studies.

Attitude has become a very important construct in the research area of human behavior and is presumed to be an influential factor on behavior. Several definitions of attitude have been addressed and the general agreement is that a person's attitude toward some object constitutes a predisposition on his part to respond favorably or unfavorably to the object.

The assumption of a strong relationship between attitude and behavior has been questioned by an increasing number of researchers. As a result, several different theoretical models have attempted to explain this relationship. Much of the discussion and issues involved in the controversy surrounding these models results from int rest in the Fishbein attitude models. These models explained attitudes toward objects not behavior. The Fishbein-Ajzen theory of reasoned action is an adaptation of Dulany's theory of propositional control (Ryan & Bonfield, 1975b) and thus addresses attitudes toward behavior.

Fishbein's theory has received widespread attention and examination. He has been credited with being the first to combine several factors into a systematic formulation. This model integrates attitude and normative influences relative to behavior. The model has had empirical support despite its limitations.

The Development of the Theory of Reasoned Action

This section begins by outlining the basic components in Dulany's theory of propositional control as Dulany's concepts were later incorporated into Fishbein's modified theory. The extended Fishbein-Ajzen theory will then be detailed including discussion of various assumptions of the model, external variables, supporting evidence and criticisms.

Dulany's theory proposed to predict and explain behavioral intention based upon two major hypotheses. The first, the response hypothesis, is the individual's hypothesis concerning the expectation of a reinforcement (eg., the degree to which the subject thinks a particular response will result in reinforcement or reward). Fishbein's behavioral beliefs approximate Dulany's response hypothesis. Associated with the response hypothesis is the subjective value of the reinforcer which is the value the subject places on the reward. Fishbein termed this component "evaluations".

The second, or behavioral hypothesis, is the individual's hypothesis concerning the congruence of a response with group norms (e.g., the degree to which the subject believes that a specific behavior is expected from the subject by one or more referents). Fishbein's normative beliefs approximates Dulany's behavioral hypothesis.

Associated with the behavioral response is an evaluative feeling termed the motivation to comply. This is the degree of the subject's desire to conform to the expectations of the referent(s). Fishbein also termed this component "motivation to comply". These variables reflect specific actions and situations and are proposed to predict and explain behavioral intention and further predict overt behavior.

According to Dulany's tests of the model, the independent variables are additive and behavioral intention must be included as a moderator. Dulany (1968) claimed that the independent variables accounted for 50% to 77% of the variance in behavioral intention and that behavioral intention accounted for 80% to 88% of the variance in behavior.

Fishbein basically extended the laboratory work of Dulany to a social psychological framework. He modified Dulany's theory and took it out of the laboratory and into more realistic settings.

The ultimate goal of the theory of reasoned action is to understand and predict an individual's behavior by identifying and measuring the behavior of interest and what determines the behavior. According to Ajzen and Fishbein,

> the theory is based on the assumption that human beings are usually quite rational and make systematic use of the information available to them. People consider the implications of their actions before they decide to engage or not engage in a given behavior (1980, p.5).

The theory views a person's intention to perform a behavior as the immediate determinant of the overt behavior. An individual's intention to perform a specific behavior in a given situation (and thus his actual performance of the behavior) is a function of 1) his attitude toward performing that behavior (Att), and 2) his beliefs about what others expect him to do in that situation (NB). This latter component, normative beliefs, functions together with the individual's motivation to comply with the norms (MC). The relative importance of the normative and attitudinal components depends in part on the behavioral intention under investigation, conditions under which the behavior is to be performed, and individual differences among subjects. The two components are assigned weights (w_1 and w_2) to determine the relative importance of each.

Fishbein proposes attitude toward the behavior to be a function of the act's perceived consequences and of their values to the individual. Fishbein's attitude toward the behavior model differs from his original attitude toward an object model. The latter is often described in the marketing literature. In the attitude toward the object model, belief statements refer to concept objects and in the attitude toward the behavior model they refer to behavioral outcomes.

Fishbein's second component deals with the influence of the social environment on an individual's behavior, that is, the person's perception of the social pressures put on him to perform or not perform the specific behavior. This conceptualization is a general expansion of Dulany's work since he conceived this variable in terms of pressure exerted by the experimenter (Ajzen & Fishbein, 1980).

A factor of the social environment that has a strong influence on behavior is a reference group. The potential reference groups vary with the specific situation. Frequently, the expectations of more than one reference group have to be considered. Thus, it is necessary to measure the individual's motivation to comply with each of the reference groups.

The symbolic form of the Fishbein model states that the variables combine additively. Conceptually, these constructs may have separable effects on behavioral intention. They may also not be completely independent (Ryan & Bonfield, 1975a). The model was further revised to include a general normative concept which has been defined as a "subjective norm".

> Just as beliefs and their evaluative aspects are seen as contributing to a more general attitudinal concept, it was assumed that normative beliefs and motivations to comply contribute to a more general normative concept (Fishbein, 1976, p.493).

Beliefs of an individual are the primary determinants in the model. The beliefs that underlie an individual's attitude toward a behavior are called behavioral beliefs and the beliefs underlying the normative component are called normative beliefs. The Fishbein-Ajzen theory begins with these personal beliefs which influence attitudes, both personal and social, resulting in the formation of behavioral intentions.

The Fishbein-Ajzen theory examines the relative importance of the attitudinal and normative factors in determining behavioral intentions. The relative importance of the two components is likely to vary with the type of behavior, with the situation, and with individual differences between subjects. The task of capturing the relative importance of the two components has been assigned to the weights (w_1 and w_2).

Ajzen and Fishbein (1972) noted that behavioral intention is highly situation-specific. Conditions under which behavioral intention is measured must be maximally conducive to a high correlation between behavioral intention and behavior and the time interval between the measurement of these two constructs must be small to obtain high correlation. Unanticipated behavioral consequences and/or normative expectations may also lower the correlations between behavioral intention and behavior.

Ajzen and Fishbein (1980) recommended that prior to measuring the constructs salient outcomes, consequences, relevant others, and reference groups be determined using an elicitation technique. They should be elicited from the same population being studied. Subjects are asked to give different associations to the same stimulus words in a free association situation (Ryan & Bonfield, 1975b). Mazis, Ahtola, and Klippel (1975) have demonstrated that prediction of behavioral intention is enhanced when elicited rather than predetermined beliefs are employed.

Overt behavior has generally been operationalized as the direct observation of an individual's choice in a specific situation. To measure the magnitude of a behavior, multiple choice questions are often used. Absolute and relative frequencies of a behavior also employ multiple choice sets among alternatives. Each alternative represents a single frequency or range of frequencies. Many behaviors are not directly accessible to an observer. In these cases, self-reports are used to measure the behavioral outcome. They require less effort, time, and money (Ajzen & Fishbein, 1980).

Variables External to the Model

Ajzen and Fishbein (1980) have recognized the potential importance of factors such as attitudes toward targets, personality traits, and demographic characteristics but they do not constitute an integral part of their theory. They are considered instead to be "external variables". In a review of research by Ajzen and Fishbein (1973), situational characteristics were shown to influence the relative weights of the attitudinal and normative components. Norms were clearly more important under cooperative situations while attitude toward the act was more important under competitive situations. Thus, any "external" factor such as demographic, personality characteristics, variables related to the behavior or situational variables can affect intentions and overt behavior only if they influence the components of the model or their relative weights.

The validity of the theory does not depend on support for relationships between external variables and components of the model but rather on relationships within the model. The results of a study on marijuana use, by Bearden and Woodside (1978), support the premise that the influence of most external variables on intentions to behave may be accounted for through influences on either beliefs about outcomes of the behavior or normative beliefs about what others think the behavior should be.

Supporting Evidence

There is a large body of empirical research, as reviewed by Ajzen and Fishbein (1973), Fishbein and Ajzen (1975) and Ryan and Bonfield (1975a) supporting the validity of this model. Ajzen and Fishbein (1973) examined several studies ranging from strategy choices in Prisoner's Dilemma games to sexual attitudes among undergraduates to predict behavior. Evidence strongly supports the theory of reasoned action by showing the high multiple correlations between each of the two components, attitude and subjective norm, and behavioral intentions.

Certain unresolved validity issues were researched by

Ryan, and Bonfield (1980). Their study added correlational evidence in support of external validity. Through their method, response set bias was lowered using a personal interview (instead of pencil and paper procedures that tend to upwardly bias the results) and the model was applied in a real world setting to reduce artificiality of the testing situation. Associations among the variables in the model were supported. The individual and joint relative contributions of the attitudinal and normative components to the explanation of variations in behavioral intentions were also demonstrated.

The model has been applied in studies as varied as toothpaste purchase behavior (Wilson, Mathews, & Harvey, 1975) and family planning (Fisher, 1984; McCarty, 1981). Many issues which have been examined are very controversial in nature, such as use of drugs and alcohol, or use of nuclear power. Other studies have looked at product choices among competing alternatives where preferences are part of daily life and consumption patterns. Even a mundane and relatively trivial act such as coupon usage can be partially accounted for by this theory (Shimp & Kavas, 1984).

Ryan and Bonfield (1980) demonstrated measurement reliability. Cronbach's coefficient alpha index of internal consistency was used as an estimate of reliability. The magnitude of these reliability estimates ranged from .76 to .93. This indicates that each three-item instrument measured a single source of variance, primarily systematic. This also supports the appropriateness of summing the scale items.

Criticisms

Several authors have criticized elements or relationships of the model. Fishbein and Ajzen attempt to refute these criticisms by clarifying their intentions for the model's function. A few examined criticisms that follow are those questioning the conceptualization and operationalization of certain elements of the model, external variable effects, and the interdependency of the two major components, subjective norm and attitude toward the behavior.

The manner in which Fishbein and Ajzen define and operationalize the concepts of their model appears to be inappropriate for those seeking to distinguish between personal and social reasons for engaging in a behavior.

> It is necessary to establish the degree to which the attitudinal and normative measures tap the particular constructs they are intended to reflect, permitting accurate separation of the two sources of influence (Miniard & Cohen, 1983, p.312).

As the model stands now, there seems to be lack of clear conceptual separation of the two major components.

Fishbein has never explicitly claimed that the components were independent. The mathematical expression of the model and interpretation of the regression coefficients imply a separation. Supporting evidence shows that attitudes and subjective norms are highly predictive of intentions and they correlate more strongly with the criterion than with each other (Bowman & Fishbein, 1978). Designing situations where the attitudinal and normative factors are separate is not an easy task in view of the distinct but related connection that often exists between them. For the present study on behavioral intentions toward the use of disposable protective clothing, an exacting separation of the attitudinal and normative influences is not essential.

Ahtola (1976) presents his concerns over the attitude factor, or attitude toward the behavior. This factor is often measured in terms of the individual's attitude toward the behavior and not in terms of the individual's attitude toward he himself performing the behavior, the latter preferred by Ahtola. Fishbein (1976) does not feel the distinction is always necessary. "In most cases, a person's attitude toward "performing" a given behavior and his attitude toward "my performing" a given behavior are very highly correlated. If however there is reason to suspect these attitudes are different, then the appropriate attitude is the subject's attitude toward his or her performing the behavior.

Another criticism has been directed toward the subjective norm which is a component of the normative factor. In measuring the subjective norm, respondents are asked if those people who are most important to them think they should or should not perform a particular behavior. Ahtola (1976) questioned whether people really perceive any collective others in normal circumstances. He argued that the opinions of different referents may vary and conflict making it difficult for the subject to accurately rate the expectation of a group of referents. Fishbein (1976) responded to this problem by stating that through his experience with the subjective norm, the respondents have had no difficulty in responding to questions regarding most important others.

Some researchers criticize the model for omitting external variables as a direct link to behavior or behavioral intentions (Bentler & Speckart, 1979; Crosby & Muehling, 1982; Fredricks & Dossett, 1983). Bentler and Speckart (1979) hypothesized that prior behavior has a direct effect on both behavioral intention and overt behavior. In their study on the use of alcohol, marijuana, and hard drugs as taught behaviors, behavioral intentions seemed to be an insufficient mediator of hard drug use when prior behavior was included in the model. When the behavior tends to be habitual and/or low in arousal quality, such as alcohol or drug use, behavorial intention is reduced or eliminated.

Crosby and Muehling (1982) examined the effects of external variables on arts attendance behavior. All classes of external variables, including past behavior, age, awareness, trial and interest, were found to have direct effects on behavioral intention and were only partially mediated by the attitudinal and normative factors. They claimed they were able to predict intentions to attend arts events not only by attitudinal and normative factors, but also by the external variables mentioned above. They pointed out that further theoretical refinement was needed to specify when behavior is primarily under attitude/normative control or when other variables are more important.

There are limitations involved when studying human behaviors that cannot be explained by a theory of reasoned actions. There is concern with the generalizability and the possibility of demand artifacts inherent in a tightly controlled artificial setting. Also, the capacity to predict behavior decreases as the time interval between measurement of predictors and behavior increases (Ajzen & Fishbein, 1980). Ryan and Bonfield (1980) found that the applications of the model are only useful when promoting non-competive behaviors where brand or product positioning is not of primary importance.

In this study of the behavior of wearing disposable protective garments, a field setting will be used to assess the behavioral intention of wearing these garments in the future, not an artificial setting. The measurements of behavioral intention and behavior will be close in time. Also, by examining only one product, brand positioning will not be of importance in this study. Thus, several limiting factors will not have an effect on this proposed study.

F. SUMMARY

The use of protective clothing for agricultural workers is essential to limit dermal exposure from pesticide application. The recent introduction of disposable protective garments has afforded the farmer increased thermal comfort. However, motivating agricultural workers to wear disposable garments may depend on their attitudes toward salient outcomes of wearing disposable protective clothing, such as protection from hazards, as well as their perception of comfort and durability of these garments.

Researchers suggest the need for consumer education in the area of clothing comfort and actual experience of wearing protective clothing to change attitudes and behavior. The Fishbein-Ajzen theory of reasoned action is a well-accepted and supported model to study human attitudes and behavior despite its weaknesses. This model needs further refinement in conceptualizing and operationalizing the elements, assignment of external variables, and the interdependency of the two major components, attitude toward the behavior and subjective norm. The model will be used in an attempt to explain the attitude-behavior relationship in an investigation of the wearing of disposable protective clothing.

III. METHODS AND PROCEDURES

This chapter describes the conceptual framework, selection of subjects, research design, description of the instruments, treatments and methods of data analysis.

A. CONCEPTUAL FRAMEWORK

The conceptual framework used in this study was the Fishbein-Ajzen model of behavioral intentions (Ajzen & Fishbein, 1980). The intention to wear disposable protective clothing was measured by this model. The development of the model and propositions contained therein are outlined in Chapter 2. The Fishbein-Ajzen model is represented by the following equation:

$$B \sim BI = w_1(Att) + w_2(SN)$$

where:

B = behavior
BI = behavioral intention
Att = attitude toward the outcome of performing the behavior
SN = subjective norm
and w_1, w_2 = empirically determined weights

Attitude toward the outcome (Att) can be measured directly or broken down into two components for an additional measurement:

$$Att = \sum_{i=1}^{n} B_i e_i$$

where:

B_i = belief that the behavior will lead to consequence i
e_i = evaluation of consequence i
n = number of beliefs

Subjective norm can also be measured directly or broken down into components for an additional measurement:

$$SN = \sum_{j=1}^{n} NB_j MC_j$$

where:

NB_j = normative belief (a person's belief that reference group j or individual j thinks he should or should not perform the behavior)
MC_j = motivation to comply with referent j
j = the number of relevant reference groups or individuals

Following the Fishbein-Ajzen model, the attitude toward wearing disposable protective coveralls (Att) was measured directly and by the product of B_i and e_i, beliefs about the outcome of performing the behavior and the evaluation of the outcomes, respectively. Subjective norm (SN) was measured directly by the product of NB_j (the normative beliefs that referents expect the subject to perform the behavior) and MC_j (the subject's motivation to comply with the referents' expectations).

Variables external to the model were examined for their direct and indirect effect on behavior and behavioral intention. The influences of these variables are indicated by broken lines in Figure 1.

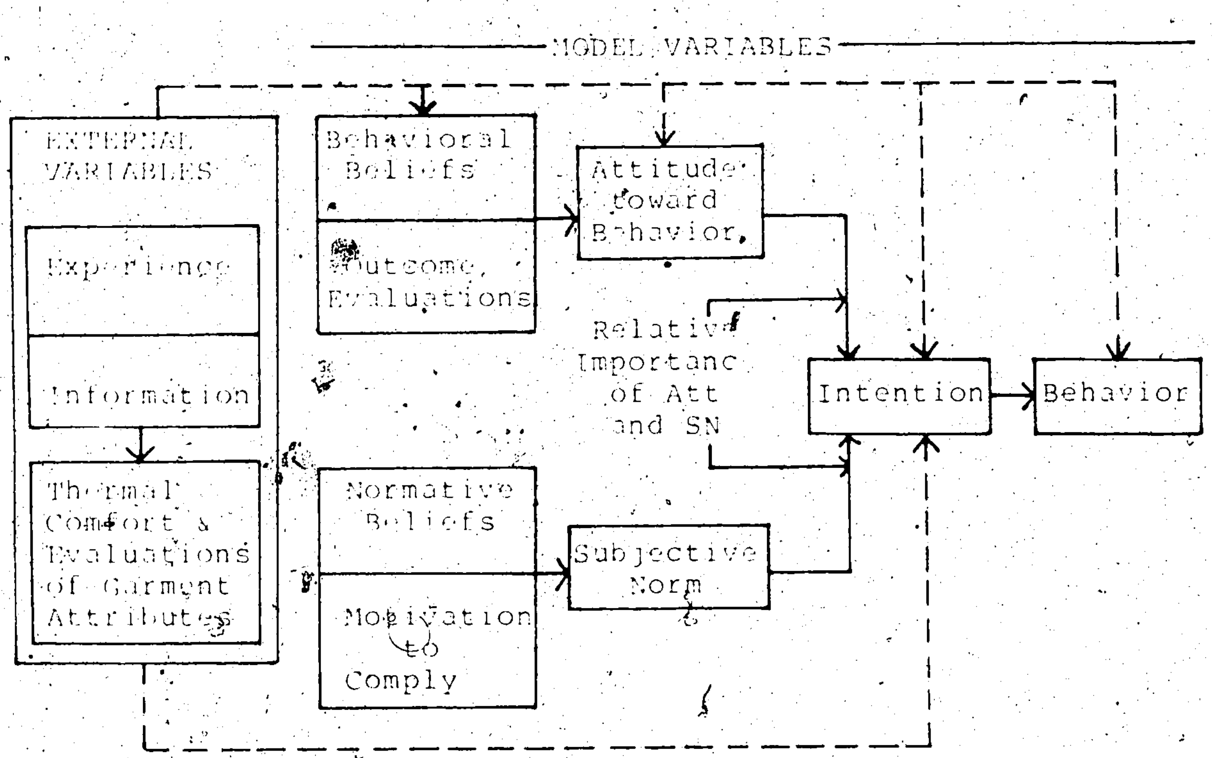

Figure 1. SCHEMATIC DIAGRAM OF CONCEPTUAL FRAMEWORK (Adapted from Ajzen and Fishbein 1980)

B. SELECTION OF SAMPLE

Approximately 320 volunteer farmers were solicited through cooperating District Home Economists. Farmers in ten randomly selected areas of the province were asked to volunteer (letters and consent forms in Appendix A).

To avoid bias in the results, care was taken to ensure that the farmers knew the research was being done by a

University of Alberta graduate student and not Alberta Agriculture. Although the District Home Economists helped to distribute and collect garments, the farmers were assured of the anonymity of their individual responses.

C. RESEARCH DESIGN

The design of this study was based on the Experimental Group--Control Group design (Figure 2). Randomization enhanced the probability of statistical equivalence of the groups (Kerlinger, 1986). The experimental group together with a control group satisfied the demand for comparison.

R	T	O_1	(experimental group)
R		O_2	(control)

R = random assignment of treatments to subjects
O_n = Observations (Dependent variable measurement, where n is the number of the observation)
T = Treatment (Manipulation of the independent variable)

Figure 2. Experimental Group--Control Group Design: Randomized Subjects (Kerlinger, 1986, p.306)

The basic design was modified to include three treatment groups within the experimental group. The result was a design with four groups, each with approximately 80 randomly assigned farmers (Table 3).

Table 3

Modified research design

Group	# subjects	Treatment	Post-Tests[a]	
			May	June
1	80	1	-	Att,SN,BI,C
2	82	2	Att,SN,BI	B
3	80	3	-	Att,SN,BI,C
4	83	-	Att,SN,BI	B

[a]Att=Measurement of attitude (towards wearing the garment)
SN =Measurement of subjective norm
BI =Measurement of behavioral intention (with regards to wearing the garment)
C =Comfort questionnaire
B =Measurement of overt behavior (wearing the garment)

Treatment 1 was the experience of actually wearing disposable protective coveralls. Treatment 2 was exposure to information about disposable protective coveralls. Treatment 3 was experience and information. The control group had no treatment. All four groups completed a post-test questionnaire following the treatment. This consisted of the attitude-behavioral intention and background questionnaire.

Groups 1 and 3 also completed a short questionnaire to assess their physical comfort while wearing the coveralls and to measure their evaluations of garment attributes. Groups 2 and 4 (those not asked to wear the garments) completed a short questionnaire to measure voluntary behavior with regards to wearing disposable protective clothing. Table 3 shows the time frame and selection of questionnaires for the post-tests.

D. DESCRIPTION OF THE INSTRUMENTS

The Attitude-Behavioral Intention Questionnaire

This self-administered questionnaire (Appendix C) was designed based on the procedures outlined by Ajzen and Fishbein (1980). It was first used in a pilot study conducted in June 1986. Forty volunteer subjects from the same population as the proposed research were used. They all wore disposable protective coveralls while spraying their fields. The questionnaire was completed after the field trial. The farmers also completed a telephone interview and a background questionnaire. The following is a description of how the various constructs were measured in the pilot study and any revisions made since.

Prior to measuring these constructs, salient outcomes, consequences, relevant others, and reference groups were determined from previous studies (Carlson, 1982; Murray, 1982). These salient items were further narrowed down after analyzing the results of the pilot study. Open-ended questions on likes and dislikes, as well as comments from the telephone interview gave further insight regarding salient outcomes of wearing disposable protective coveralls.

Behavioral intention is the immediate determinant of behavior. When an appropriate measure of intention is used, a more accurate prediction of behavior will be obtained. The measure of behavioral intention has to correspond to the behavioral criterion in action, target, context, and time (Ajzen & Fishbein, 1980). The behavioral action was the wearing of a garment; behavioral target was disposable protective coveralls; behavioral context was during the actual spraying of the fields; behavioral time was the next time the fields were sprayed. Thus, the resulting behavioral intention statement used in the pilot study was: "I intend to wear a disposable protective coverall next time I apply pesticides".

A revised measure of behavioral intention was used in the final study. Four other statements were added to the original statement after assessing the comments, beliefs and evaluations of farmers and comments of District Home Economists. These added statements included conditions for the behavior (eg. if the garments were provided free) that are often made when choosing to perform a certain behavior.

Measurement of the constructs in the questionnaire was based on the semantic differential technique, or the use of bipolar adjectives on either side of an intensity scale. According to Ajzen and Fishbein (1980) the adjective pairs likely-unlikely, probable-improbable, and possible-impossible may be used with behavioral intention measurements. The adjectives in a given pair are placed on opposite ends of a seven-place scale. Respondents evaluate the statement by rating it on the scale and responses are scored from -3 on the negative side to +3 on the positive side. The scales are then summed if there is more than one. These adjective scores, however, were not used to measure behavioral intention in this research (Appendix C). Instead, a scale similar to the one utilized for measuring overt behavior was used for behavioral intention. This consisted of a seven-point rating scale with all the time at the higher end of the scale and not at all at the lower end.

Ajzen and Fishbein (1980) suggested that attitudes also be measured on a bipolar evaluative scale. The common use of single-item measurements to operationalize these constructs is generally considered unreliable because there is no opportunity for random and specific errors to average out over a set of scales. Therefore multi-item scales have been developed to avoid bias resulting from adjective specificity and to obtain reliability estimates (Ryan, 1982). The bipolar adjectives that were used in this study to measure attitude were good idea-bad idea, beneficial-harmful, pleasant-unpleasant, necessary-unnecessary, sensible-foolish.

The semantic differential is also used to measure the components of the attitude construct; that is, beliefs about the outcome of the behavior and evaluation of the outcomes.

The set of bipolar adjective scales for the behavioral beliefs consists of likely-unlikely, probable-improbable, and possible-impossible. The questionnaire used only likely-unlikely to reduce the total length. One outcome statement was reworded after the pilot study in order to improve clarity.

The evaluation statements include either good-bad, beneficial-harmful, pleasant-unpleasant or sensible-foolish. In the pilot, two scales for each statement were used. The revised draft uses only the scale that obtained the highest correlation with the attitude measurement in the pilot. The score on each belief is multiplied by its corresponding evaluation score and then the products for all belief-consequence pairs are summed (Ajzen & Fishbein, 1980).

The subjective norm deals with the perception that most important others desire the performance or nonperformance of a specific behavior. This perception may or may not be what the most important others actually think. The subjective norm statement can use either "I should-I should not" or "likely-unlikely" terms to scale the perception. The questionnaire used likely-unlikely. This scale was also scored from +3 to -3.

The set of bipolar adjective scales for the normative belief component consists of the same adjective pairs as attitudinal beliefs. The questionnaire employed only the pair likely-unlikely. The normative belief measurement uses a direct question concerning the perceived expectations of other people.

The motivation to comply measurement used a direct question concerning the likelihood of the respondent complying with important others in regards to the wearing of disposable protective coveralls. It was measured on a seven-point unipolar scale from very likely to not at all. The estimate of the subjective norm was calculated by multiplying the score of each normative belief by the corresponding motivation to comply and summing across referents. The number of referents was decreased from nine in the pilot to seven in the revised questionnaire.

Overt Behavior Measurement

Those subjects not given garments to wear as an experimental treatment were asked to complete a self-administered report to measure actual behavior of wearing/not wearing disposable protective garments (Appendix D). Statements related to various behaviors were followed by multiple choices: none of the time, 1/4 of the time, 1/2 of the time, 3/4 of the time, and all of the total spraying time.

Background Information

All respondents were asked to complete a short check-off questionnaire describing other types of protective gear worn, method of application, types of pesticides, wind velocity, temperature, symptoms of pesticide poisoning, age, and additional exposure to information (Appendix E). They were also asked to estimate the total number of hours they spent applying pesticides and wearing the garments.

Thermal Comfort and Evaluation of Garment Attributes

Those participants experiencing the wearing of the disposable protective garments were asked to complete a short assessment of thermal comfort and evaluation of the garment's attributes after they wore the garment (Appendix F). Semantic differential scales were used for both of these assessments. The participants were also asked what they liked and disliked about the disposable gloves they were asked to wear.

E. ADMINISTRATION OF QUESTIONNAIRES AND TREATMENTS

Experience as an Experimental Treatment

Kimberly-Clark's Kleenguard® EP disposable coveralls, with or without modifications, along with three pair of disposable PVC gloves were distributed to and worn by 160 volunteer pesticide applicators (groups 1 & 3). The field trials were conducted in the spring of 1987 during spraying season. Modifications made to the coveralls were based on the findings from a small pilot study conducted by Alberta Agriculture with the help of the researcher in the Spring of 1986. Five coveralls from each district were randomly selected and reinforced in the crotch area with Sew Fast, a fabric glue.

The volunteers were asked to wear the disposable coveralls and gloves for only one day while spraying their fields with pesticides, or until they tore, abraded or were exposed to a concentrated spill. The garments were collected and subjected to laboratory evaluation (i.e., visual inspection for abrasion and other wear factors). These results do not form part of this thesis research.

Information as an Experimental Treatment

Available literature on the subject of pesticides is generally informational in nature. Most literature points out the hazards of pesticides and suggest proper use of pesticides, equipment and clothing. Currently, few publications exist to educate users of pesticides on specific aspects of protective clothing, such as design features or fabric and fiber properties.

Information on the water-vapour transmission rate of protective clothing fabrics was generated through objective, physical tests done in the laboratory. Kleenguard® EP fabric resulted in a rate similar to a medium weight 100% cotton twill, 2 times faster than a Goretex fabric (Goretex®

laminated to 3oz. Nomex®), and 16 times faster than Saranex®. From a comfort standpoint, Kleenguard® would be expected to afford comfort with respect to perspiration evaporation during high physical activity or high temperatures. Two different methods were used: a modified ASTM method E96-80 (Annual Book of ASTM Standards, 1987) and the method outlined by Farnworth & Dolhan (1984); similar results were obtained for the samples in each of the tests.

Clear, concise, and positive information about this comfort aspect was used together with other information relating to attributes of disposable protective clothing, in a pamphlet form. The information on durability and protection effectiveness was from a related laboratory study (Martin-Scott, 1987). This pamphlet and another from Alberta Agriculture (Appendix G), were sent to 160 pesticide applicators (groups 2 and 3). They were sent to subjects in early May 1987 before completing the attitudinal questionnaire and before spraying.

Administration of Instruments

The instruments consisted of the attitude-behavioral intention questionnaire, behavior questionnaire, background information questionnaire, and scales to assess thermal comfort and evaluation of physical attributes of disposable protective clothing. For those farmers not exposed to experience as an experimental treatment (groups 2 and 4), administration of the attitude-behavioral intention questionnaire occurred in early May 1987 shortly after the pamphlets were sent out. These two groups also completed the background and behavior questionnaire in early July after allowing time for spraying and possible voluntary behavior of wearing disposable protective coveralls.

For those farmers who were exposed to experience as an experimental treatment (groups 1 and 3), administration of the questionnaires occurred immediately after they were finished spraying. These consisted of the attitude-behavioral intention, background and comfort questionnaires and were delivered along with the test garment with explicit instructions for wearing the garment and when and how to answer the questionnaires (Appendix B).

Reminder phonecalls were made by the District Home Economists (D.H.E.) in early June and early July to encourage response. Completed questionnaires and used coveralls were collected by the D.H.E.'s and forwarded to the researcher.

F. DATA ANALYSES

Data were coded and entered into the University of Alberta's computer. Data analyses were conducted using the SPSS^X package of programs (SPSS^X User's Guide, 1986). Background data about the sample were described using frequencies, means and standard deviations. The level of thermal comfort after wearing the garment and evaluation of coveralls and gloves for those exposed to experience as a treatment, was described using frequencies.

Null hypotheses 1, 2, 3, and 4: The measured values for the model's components were determined by responses to scale items and described using means, standard deviations and frequencies. Relationships among these components were determined through Pearson Product-Moment Correlation analyses. Multiple regression was used to explain and predict behavioral intention.

Null hypothesis 5: The differences among the treatments groups with or without experience and/or information in their beliefs, attitudes, and intentions were determined by using analysis of variance. The difference in the behavior of the group with information and the group without was determined using a T-test.

Null hypothesis 6: The existence of a relationship between either thermal comfort or evaluation of the attribu[illegible] disposable protective coveralls (variables external [illegible] the model) and behavioral intention was determined by using Pearson Product-Moment Correlation analyses.

Null hypothesis 7: The differences between treatment groups with and without information in their thermal comfort level and evaluation of the attributes of disposable protective coveralls were determined using T-tests.

G. ASSUMPTIONS

1. Subjects of the wear test were honest in reporting their pesticide attitudes and spray activities and in evaluating the garments that they wore.
2. The instruments used in this study gave valid and reliable results for analysis.

Research on the Fishbein-Ajzen model supports its validity and reliability as discussed in the review of literature section. A pilot study utilizing the instrument based on the model (previously discussed) also adds evidence in support of external and internal validity and reliability of the questions. Moderate relationships (r=.53 to r=.65) were found to exist between the major components in the model. Attitudes and subjective norms were highly related to behavioral intentions and correlated more strongly with their components than with each other. This supports the assumptions of the Fishbein-Ajzen model. Specific constructs were measured by two different questionnaires and showed similar positive results. Reliability measures were determined for the attitude construct, since all five items measured the same attitude. A significant measure of reliability was obtained (alpha =0.78).

H. LIMITATIONS & DELIMITATIONS

1. The garment used as the experimental treatment was limited to Kimberly-Clark's Kleenguard® EP disposable coveralls.
2. The time span for completing the wear study was limited by the spray season in Alberta.
3. The sample was limited to those Alberta farmers in randomly selected districts who volunteered for the study.
4. The length of time the coverall was worn on the test day was determined by the respondent's own spray schedule.
5. Attitude measurement is an indirect process. Responses to questionnaire items are easily influenced by uncontrolled circumstances, therefore, the data reflected only estimates of the participants' "true" feelings.
6. Self-report behavioral measures may introduce unknown sources of error. The behavioral categories may be highly arbitrary and subjective.
7. Many important external variables, such as past behavior or experience that may influence the components of the model, were not measured in the present study.

IV. FINDINGS

In this chapter a description of the sample and pesticide application, analysis of the Fishbein-Ajzen model's components, thermal comfort assessment, evaluation of the coveralls and gloves, and testing of the null hypotheses will be presented. An alpha of .05 was set as the level of significance to test the null hypotheses.

A. Description of the Sample

Of the 324 volunteers in the sample, 244 (75%) responded either fully or in part. One-hundred and ninety (59%) of the respondents completed both questionnaires. Treatment group 1 (experience) consisted of 67 respondents, all of whom completed both questionnaires. Treatment group 2 (information) consisted of 52 respondents, 30 (58%) of whom completed both questionnaires. Treatment group 3 (experience/information) consisted of 64 respondents, 62 (97%) of whom completed both questionnaires. In treatment group 4 (control), 31 out of 61 (51%) completed both questionnaires. Twelve (4%) of the non-respondents included farmers who did not spray due to dry conditions, retired from pesticide spraying, hired commercial sprayers or had already completed their spraying.

The age distribution ranged from 22 to 65 years. The mean age was 39 years, with a standard deviation of 10 years. Five female applicators participated in the study.

The background information questionnaire included a check list of information sources about disposable protective coveralls. The newspaper (58%), Alberta Agriculture displays (55%), and Alberta Agriculture handouts and brochures (60%) were the sources of information most often used by the applicators. The information pamphlet sent to selected groups in the experiment was read by 78 (40%) of those responding to the question (all were asked) and 56 (29%) of those responding had family members who read the pamphlet. Of this group of family members, the spouse (71%) was the family member most often stated as having read the pamphlet.

Of those groups <u>not</u> receiving the pamphlets, 14 (23%) applicators responding from treatment group 1 stated that they themselves and/or a family member read the pamphlet. Treatment group 4 included 13 (35%) applicators and/or a family member who read the pamphlet. Of those groups receiving the pamphlets, 22 (66.6%) applicators from treatment group 2 stated that they themselves and/or a family member read the pamphlet. Treatment group 3 included 39 (65%) applicators and/or a family member who read the pamphlet.

Due to the method of subjects acquiring the information (i.e. mailed pamphlet), it was also important to group those particpants who actually read the pamphlet and those who did not. The four 'reading' groups created were: 1. Only respondent read; 2. Respondent and family member(s) read; 3. Only family member(s) read; 4. No one (in respondent's household) read. There was a statistically significant difference among the four treatment groups in the number of respondents and/or families reading the pamphlet (p<.001). More respondent households read the pamphlet from groups 2 and 3 (who were intended to read it) than from groups 1 and 4.

B. Description of pesticide application

Table 4 indicates the total number of hours of pesticide application and number of hours of application while wearing a disposable coverall. The mean number of hours spent in pesticide application during the 1987 Spring/Summer spraying season was 38. The number of hours ranged from 0 to 200. The range in hours of application while wearing a disposable coverall was much narrower. Ten hours was the average length of time coveralls were worn for groups 1 and 3 (asked to wear given coverall for one day only). Twenty-four hours was the average length of time for those few respondents in groups 2 and 4 who actually wore a disposable coverall.

Neoprene or rubber gloves were the most often cited item of extra protective gear worn during mixing of pesticides (Table 5), followed by a respirator, rubber boots and goggles. Aprons, cotton masks, and leather boots were worn by only a few during mixing and application.

Table 4

Mean Hours of Application

Application Hrs.	Groups	n	Mean	Std.Dev.	Range
Total	all	194	38	33	1-200
While coverall worn:					
	1 & 3	127	10	8	1-60
	2 & 4	18	24	23	2-80

Table 5

Other Protective Gear Worn

	Frequencies (Percentages)					
Gear	mixing		loading		both	
goggles	39	(20.1)	2	(1.0)	10	(5.2)
respirator	21	(10.8)	11	(5.7)	25	(12.9)
apron	15	(7.7)	5	(2.6)	3	(1.5)
neoprene/rubber gloves	112	(57.7)	2	(1.0)	43	(22.2)
neoprene/rubber boots	25	(12.9)	7	(3.6)	53	(27.3)
other (cotton mask, cotton coveralls, leather boots)	1	(0.5)	6	(3.1)	9	(4.6)

Table 6 indicates the methods of application used while wearing a disposable coverall. Boom spraying was the most common method of spraying pesticides. Forty-eight percent of the respondents used tractors with cabs; 34% with air-conditioned cabs.

Table 6

Method of Application While Wearing a Disposable Coverall

Method		n	%
boom sprayer		134	93.7
handsprayer		10	7.0
other		4	2.8
	total	143	*103.5

* some used more than one method

Several different brands of pesticides were used. Those frequently used were all herbicides: Glean, Banvel, Buctril M, MCPA Amine, Target, and Avenge. Almost all brands were used in liquid form.

Particulars of the application day during which the disposable coverall was worn were asked of those subjects in groups 1 and 3. June was the most common month for spraying pesticides (92%). The respondents' spraying season stretched from May 18 to July 14, 1987. The temperature ranged from

5°C to 32°C. The modal temperature category was 18°C to 25°C. Ninety-five percent of the applicators experienced 'no wind' to 'medium wind' conditions.

All applicators were asked whether they experienced symptoms of pesticide poisoning during the current spraying season. Ninety-one percent stated 'no' or 'not sure' of any poison symptoms. Of the 9% (18) who stated 'yes', 6 reported headaches and 3 nausea in response to an open-ended question.

C. Analysis of the Model's Components

Components of the Fishbein-Ajzen Model were measured by responses to scale items on self-administered questionnaires (Appendices C and D). The behavior of wearing various items of protective clothing for groups 2 and 4 was reported at the end of the spraying season. A multiple-choice type questionnaire was employed. The choices ranged from <u>none of the total spraying time</u> to <u>all of the spraying time</u>.

Seventy-nine percent of the respondents did not wear disposable coveralls during any of the spraying time, while 16% wore them all of the time. A slightly higher percentage (28%) of farmers wore disposable gloves all of the time, similar to the percentage (27%) wearing regular cotton or cotton/polyester coveralls. The majority (56-59%) wore none of these items while spraying. Most (80%) wore at least a long sleeved shirt and long pants all the time while applying pesticides. Of those few (n=18) who chose to wear a disposable garment, 72% (13) wore a coverall not recommended for pesticide use. Four participants wore the same type as the experimental garment.

Behavioral Intention (BI) and Motivation to Comply (MC) components were coded from 1 to 7, at 7 indicating <u>all of the time</u> and <u>very much</u> respectively. All other components are coded from -3, indicating an extremely negative response, to 3, indicating an extremely positive response to the statement. Table 7 indicates the means and standard deviations for all the model components except behavior.

Ninety-three percent of respondents intended to wear disposable protective coveralls at least some of the time and 27%, all of the time, the next time they applied pesticides. When asked their intentions to wear them if improved disposable coveralls were available, more respondents (44%) intended to wear them all of the time. The <u>all of the time</u> response increased for intention statements with conditions of convenience (58%) and perceived comfort of the coveralls (57%). Even more farmers (65%) stated they would wear them all the time if they were provided free. The means for all of the conditional behavioral intentions (BI2 to BI5) were thus higher than for BI1 (Table 7).

Overall, a positive attitude (Att) was indicated toward wearing disposable protective coveralls (average of attitude scales = 2.2). The majority of respondents (92-99%) felt it was a good idea, sensible, beneficial, and necessary.

Table 7

Responses to the Components of the Fishbein-Ajzen Model: Wearing of Disposable Protective Coveralls

Component	Mean	Std.Dev.	Range
Behavioral Intention (BI)			
BI 1	5.1	1.8	1 to 7
BI 2 (if improved)	6.0	1.2	2 to 7
BI 3 (if free)	6.5	1.0	1 to 7
BI 4 (if convenient)	6.3	1.0	1 to 7
BI 5 (if convinced of comfort)	6.4	0.9	1 to 7
Attitude Toward the Act (Att)			
Att1 (good/bad)	2.7	0.6	0 to 3
Att2 (sensible/foolish)	2.7	0.6	0 to 3
Att3 (pleasant/unpleasant)	0.9	1.6	-3 to 3
Att4 (beneficial/harmful)	2.6	0.6	0 to 3
Att5 (necessary/unnecessary)	2.2	1.1	-3 to 3
Beliefs			
Be1 better protection	2.1	[illegible]	-3 to 3
Be2 best protection method	1.8	1.2	-3 to 3
Be3 feel more secure	1.8	1.2	-3 to 3
Be4 feeling hot	0.5	1.6	-3 to 3
Be5 feeling wet	0.3	1.6	-3 to 3
Be6 restrict mobility	-0.1	1.6	-3 to 3
Be7 taking time to put on/off	-0.6	1.6	-3 to 3
Be8 taking time to find	0.2	1.8	-3 to 3
Be9 a lot of money to purchase	0.4	1.6	-3 to 3
Be10 feeling conspicuous	-1.1	1.5	-3 to 3
Be11 eliminating care of clothes	0.7	2.1	-3 to 3
Evaluations			
Eval 1 (good/bad)	2.0	1.0	-3 to 3
Eval 2 (good/bad)	2.4	0.9	-2 to 3
Eval 3 (good/bad)	2.2	1.0	-3 to 3
Eval 4 (pleasant/unpleasant)	-1.3	1.5	-3 to 3
Eval 5 (pleasant/unpleasant)	-1.4	1.4	-3 to 3
Eval 6 (good/bad)	-1.2	1.7	-3 to 3
Eval 7 (beneficial/harmful)	0.0	1.6	-3 to 3
Eval 8 (beneficial/harmful)	-0.2	1.6	-3 to 3
Eval 9 (good/bad)	-0.9	1.5	-3 to 3
Eval 10 (good/bad)	0.2	1.0	-3 to 3
Eval 11 (beneficial/harmful)	1.9	1.4	-3 to 3
Subjective Norm	1.8	1.3	-3 to 3

Table 7 (cont'd.)

Component	Mean	Std.Dev.	Range
Normative Belief (NB)			
NB 1 (spouse)	2.1	1.2	-3 to 3
NB 2 (family)	1.8	1.2	-3 to 3
NB 3 (neighbors)	0.4	1.5	-3 to 3
NB 4 (friends)	0.6	1.5	-3 to 3
NB 5 (Alberta Agriculture)	2.3	0.7	-2 to 3
NB 6 (Agricultural Service Board)	2.2	0.8	-3 to 3
NB 7 (farm organization members)	2.0	1.0	-3 to 3
Motivation to Comply (MC)			
MC 1 (spouse)	5.2	1.4	1 to 7
MC 2 (family)	5.0	1.3	1 to 7
MC 3 (neighbors)	3.0	1.5	1 to 6
MC 4 (friends)	3.3	1.5	1 to 7
MC 5 (Alberta Agriculture)	5.1	1.2	1 to 7
MC 6 (Agricultural Service Board)	5.0	1.3	1 to 7
MC 7 (farm organization members)	4.6	1.3	1 to 7

Fewer farmers (60%) felt that wearing these coveralls was pleasant, with the mean being closer to neutral (Table 7).

Results indicated that most farmers believed that wearing disposable coveralls would likely provide better protection than everyday work coveralls while applying pesticides (93%), would provide the best method of protection (89%), and would feel more secure about the use of pesticides if they wore disposable protective coveralls (91%). Only 52% to 65% of the respondents were slightly to extremely likely to believe that wearing these coveralls would make them feel hot and wet from perspiration, would take time to find and a lot of money to purchase, and would eliminate the need to specially care for contaminated work clothes. The average response to the belief that wearing these coveralls will restrict their mobility was neutral. About half (47% and 56%) of the respondents believed that the coveralls would take a lot of time to put on and take off and that they would feel conspicuous while wearing disposable protective coveralls, thus the negative means for these beliefs reported in Table 7.

Corresponding evaluations were given for each of the above salient outcomes of wearing disposable protective coveralls. Most respondents felt that the following outcomes of wearing protective clothing were quite to extremely good: providing better protection than everyday work coveralls (86%); providing the best method of protection (91%); and feeling more secure about pesticide use (86%). Eliminating the need to specially care for contaminated work coveralls was quite to extremely beneficial to most respondents (82%). Feeling hot and feeling wet from perspiration was evaluated by most as slightly to extremely unpleasant (78% and 81% respectively). Restricting mobility was seen as slightly to extremely bad by 77% of the farmers. Both taking a lot of time to put on/take off and to find work coveralls were neither beneficial nor harmful to approximately 30% of the respondents and slightly to extremely harmful for 40%. Feeling conspicuous was neither good nor bad (65%) and spending a lot of money on work coveralls was seen as slightly to extremely bad for 64% of the respondents.

The mean response to the subjective norm (SN) statement was positive. For 73% of the farmers, it was quite to extremely likely that most people who were important to them think they should wear disposable protective coverall while applying pesticides. Respondents believed that spouses (84%), family (71%), Alberta Agriculture (92%), the Agricultural Service Board (90%), and members of their farm organizations (79%) would quite likely to extremely likely suggest that they should wear disposable protective coveralls. Many respondents were neutral in their belief that neighbors (43%) and friends (33%) would likely suggest that they wear disposable protective coveralls.

In general situations, most farmers (approximately 90%) were likely to comply with their spouses, family, Alberta Agriculture, the Agricultural Service Board, and members of their farm organizations. They were less likely to comply with neighbors and friends (approximately 50%), thus the lower means for these referents in Table 7.

D. Thermal Comfort Evaluation

Most of the participants who wore the experimental garments rated themselves as comfortable with respect to thermal comfort. Eighty-four percent were comfortable to extremely comfortable. Almost half (43%) were neither hot nor cold. A majority (81%) rated positively on the satisfaction-dissatisfaction scale. Approximately forty-six percent felt dry while 27% were indifferent on the wet-dry scale.

E. Evaluation of Physical Attributes

Results of participant evaluations indicated positive beliefs about the attributes of disposable protective coveralls. Responses to the heavy-light scale ranged from 4 to 9 (1=extremely heavy); eighty-seven percent rated the garment as very light to extremely light. Responses to the stiff-flexible scale ranged from 3 to 9 (1=extremely stiff); eighty-three percent rated the garment as very flexible to extremely flexible. The majority rated the coveralls as breathable (52%), water/liquid repellent (64%), and loose (58%). Most respondents also viewed the hood and elastic as comfortable (49% and 80% respectively). The durability rating of the coveralls was divided, with 47% at each of the durable and nondurable ends of the scale.

F. Evaluation of Disposable Gloves

Three pairs of disposable PVC gloves were distributed to the farmers with their coveralls (groups 1 and 3). They were asked to state reasons why they liked or disliked the gloves after wearing them. Thirty-six percent of those returning the questionnaire liked the flexibility of the gloves, 26% liked the chemical protection they provided, and 16% liked the tightness and the ease of putting them on and taking them off. Features of the gloves respondents disliked were the lack of durability (45%), fit (too short) (32%), poor breathability (26%), and difficult removeability (19%).

G. Testing of Null Hypotheses

Null Hypothesis 1: There will be no significant relationship between the product of beliefs about and evaluations of the outcomes of performing the behavior (calculated attitude) and measured attitude towards performing the behavior.

A Pearson correlation analysis between these two independent variables indicated a moderate and significant relationship between the two measures of attitude ($r=.30$, $p<.05$). Five individual belief/evaluation products were found to be significantly related to the measured attitude score ($p<.05$). These included attitudes toward the behavior as being better protection ($r=.38$), the best protection method ($r=.32$), feeling more secure (.35), and the more weakly related attitudes of feeling slightly wet ($r=.18$) and not being restricted in mobility ($r=.11$). Null hypothesis 1 can be rejected based on these results.

Null Hypothesis 2: There will be no significant relationship between the product of normative beliefs and motivation to comply (calculated subjective norm) and measured subjective norm for the behavior.

A significant, strong relationship was found to exist between these two measures of the subjective norm (r=.60, p=.00). All individually calculated products were found to be significantly related to the measured subjective norm. The respondents' spouses and families, as referents, were most strongly related to the overall measure of the variable (r=.70 and .53 respectively). The results of the Pearson's r tests show that null hypothesis 2 can be rejected.

Null Hypothesis 3: There will be no significant relationships among intention of performing the behavior, attitude toward performing the behavior, and subjective norm.

Table 8 indicates the Pearson correlations among these variables. Significant and moderate relationships were found to exist among intentions, attitude and subjective norm. The fourth and fifth BI statements only weakly correlated wih Att and the fourth BI also had a weak relationship with SN.

Weighted measures of behavioral intention and attitude were computed using a factor analysis procedure to determine component weights. A slightly stronger relationship was found to exist using a weighted behavioral intention measure with a weighted attitude measure. The relationship between SN and the weighted BI measure was also slightly stronger

Table 8

Pearson Correlations Among Behavioral Intentions (BI), Attitude (Att) and Subjective Norm (SN)[a]

BI	Att (ave.)	SN	Att (weighted)
1	.42	.34	---
2	.43	.37	---
3	.36	.38	---
4	.29	.24	---
5	.25	.34	---
ave.	.46	.43	---
weighted BI	---	.47	.50

[a]all correlations have $p < .001$

than between SN and the unweighted BI measure.

A weak but significant relationship was also found to exist between the subjective norm and the attitude measure ($r=.32$, $p=.00$). The weighted attitude measure also had a significant relationship with SN ($r=.31$, $p=.001$).

Several multiple regression analyses were also performed to test this hypothesis. In the first set of regressions (Table 9), the dependent variables were the five behavioral intention measures and the average BI measure. The independent variables were the five direct attitudinal

Table 9

Regression of Behavioral Intention (BI) on Subjective Norm (SN) and Individual Attitude (Att) Scales

Dependent variable	Independent variable (in order of entry into eq.)	R	R^2	Significance of change in R^2
BI1	Att3	.39	.15	.00
	SN	.48	.23	.00
	Att5	.49	.24	.05
	*Att4,Att1,Att2	.50	.25	.69
BI2	Att3	.39	.14	.00
	SN	.48	.23	.00
	Att5	.51	.26	.01
	*Att4,Att1,Att2	.51	.26	.78
BI3	SN	.39	.15	.00
	Att3	.45	.20	.00
	Att1	.47	.22	.03
	*Att5,Att4,Att2	.47	.22	.83
BI4	Att2	.30	.09	.00
	SN	.34	.12	.01
	*Att3,Att5,Att4, Att1	.36	.13	.72
BI5	SN	.34	.12	.00
	Att2	.41	.17	.00
	*Att3,Att5,Att4, Att1	.42	.18	.53
BI(average)	SN	.42	.18	.00
	Att2	.50	.25	.00
	Att3	.54	.29	.01
	*Att5,Att4,Att1	.55	.30	.40

*forced to enter after Stepwise procedure terminated measures and the measure of the subjective norm. Variables were entered into the equation using the Stepwise procedure. All remaining variables that did not meet the criteria for entry were forced to enter after the stepwise procedure was terminated.

The independent variables (Table 9) contributed the largest percentage of explained variance (30%) for the average behavioral intention measure. Attitude was an important contributor in all equations. Att3 entered first for BI1 (no conditions) and BI2 (wear if improved). Att2 entered first for BI4 (wear if convenient). The subjective norm was also an important contributor in all equations and entered first for BI3 (wear if free), BI5 (wear if comfortable) and the average measure.

In the next set of regressions (Table 10), the dependent variables remained the same, but the independent variables were the subjective norm and the average of the attitude scales. Forced entry was used in these analyses: attitude first and then the subjective norm first for each BI measure. Using the average attitude measure resulted in lower percentages of explained variance than in the first set of regression analyses, for all equations. As in the first set, the average of behavioral intention had the largest amount of explained variance (29%). Comparing the two analyses for each BI variable, SN seemed to account for more of the variance than did attitude for BI3 (wear if free) and BI5 (wear if comfortable). For the other BI variables, attitude measures and the measure of the subjective norm. Variables were entered into the equation using the Stepwise procedure. All remaining variables that did not meet the criteria for entry were forced to enter after the stepwise procedure was terminated.

The independent variables (Table 9) contributed the largest percentage of explained variance (30%) for the average behavioral intention measure. Attitude was an important contributor in all equations. Att3 entered first for BI1 (no conditions) and BI2 (wear if improved). Att2 entered first for BI4 (wear if convenient). The subjective norm was also an important contributor in all equations and entered first for BI3 (wear if free), BI5 (wear if comfortable) and the average measure.

In the next set of regressions (Table 10), the dependent variables remained the same, but the independent variables were the subjective norm and the average of the attitude scales. Forced entry was used in these analyses: attitude first and then the subjective norm first for each BI measure. Using the average attitude measure resulted in lower percentages of explained variance than in the first set of regression analyses, for all equations. As in the first set, the average of behavioral intention had the largest amount of explained variance (29%). Comparing the two analyses for each BI variable, SN seemed to account for more of the variance than did attitude for BI3 (wear if free) and BI5 (wear if comfortable). For the other BI variables, attitude

Table 10

Regression of Behavioral Intention (BI) on Attitude (Att) Average and Subjective Norm (SN)

Dependent variable	Independent variable (in order of entry into eq.)	Untransformed data		Transformed data	
		R	R^2	R	R^2
BI1	Att(ave.)	.42	.18	.49	.24
	SN	.48	.22	.57	.33
BI1	SN	.35	.12	.44	.19
	Att(ave.)	.48	.22	.57	.33
BI2	Att(ave.)	.43	.19	.52	.27
	SN	.49	.24	.59	.34
BI2	SN	.36	.13	.43	.19
	Att(ave.)	.49	.24	.59	.34
BI3	Att(ave.)	.36	.13	.43	.18
	SN	.46	.21	.53	.28
BI3	SN	.39	.15	.42	.17
	Att(ave.)	.46	.21	.53	.28
BI4	Att(ave.)	.28	.08	.42	.18
	SN	.32	.11	.48	.23
BI4	SN	.24	.06	.27	.07
	Att(ave.)	.32	.11	.48	.23
BI5	Att(ave.)	.24	.06	.39	.15
	SN	.37	.14	.48	.23
BI5	SN	.34	.12	.38	.14
	Att(ave.)	.37	.14	.48	.23
BI(average)	Att(ave.)	.46	.21	.55	.30
	SN	.54	.29	.63	.39
BI(average)	SN	.42	.18	.45	.20
	Att(ave.)	.54	.29	.63	.39
BI(weighted)	Att(wt.)	.44	.20	.54	.30
	SN	.53	.29	.62	.39

seemed to account for more of the variance.

A correlation between Att and SN was apparent upon examining the results of the second set of regression analyses. Att and SN provided differing amounts of explained variance depending on their position in the equation.

In a third set of regressions, SN and Att(average) were allowed to enter the regression equation freely. SN entered first in the equations using BI3 (wear if free) and BI5 (wear if comfortable) as the dependent variables, while the attitude measure entered first in the equations using BI1 (no conditions), BI2 (if improved), BI4 (wear if convenient), and BI (average) as the dependent variables. The results of these regressions thus confirm those of the second set.

Another regression used a weighted measure (using factor analysis loadings) of behavioral intention as the dependent variable and the subjective norm and a weighted measure of attitude as the independent variables. The variables entered the equation freely using the Forward procedure. The attitude measure entered the equation first explaining 20% of the variance in BI; SN added 9% to the total variance (Table 10). Therefore, 29% of the total variance in the weighted behavioral intention measure was explained by the weighted attitude measure and the subjective norm.

Examining the residuals from the above regression analyses indicated the existence of a curvilinear relationship, thus underestimating the regression correlations. Therefore, a transformation of the data was performed using the ACE procedure in SPSS^X (Breiman & Friedman, 1985). This procedure determines the optimal transformation using simple iterative algorithms.

The last set of regression analyses (Table 10) used the same procedure and variables as the second set, using the transformed data. In these analyses, Att and SN explained more of the variance in BI. For example, using BI4 as the dependent variable, an increase of 12% explained variance resulted from using the transformed data. All equations significantly improved (7%-12% more explained variance). On the basis of both the Pearson correlations and regression analyses, null hypothesis 3 was rejected.

Null Hypothesis 4: There will be no significant relationship between behavior and intention to perform the behavior.

The relationship between the first behavioral intention statement and behavior was tested because the target behavior of these variables, wearing a disposable coverall (i.e. without conditions) was the same. A moderate and significant relationship was found to exist between these variables ($r=.31$, $p=.01$). Null hypothesis four was thus rejected.

Null Hypothesis 5: There will be no significant differences between treatment groups with or without experience and/or information in their beliefs, attitudes, intentions and behavior.

Oneway analysis of variance in beliefs, attitudes and intentions among the four treatment groups proved significant at $p<.05$ for three of the belief statements and one attitude scale. Table 11 indicates the means and F-probabilities for the belief, attitude, and intention statements.

Respondents' beliefs about feeling wet from perspiration while wearing the coveralls were significantly different among treatment groups ($p=.03$). Scheffe's Multiple Range test, with a significance level set at $p<.10$, was used to determine where the differences between the groups occurred. A combination of experience and information affected the belief about feeling wet. Those subjects in this treatment group were less likely to believe they would feel wet while wearing disposable coveralls.

Responses to the belief statement about restricting mobility also differed significantly ($p=.05$) among the four groups. Scheffe's test did not indicate where the differences occur. The Least Significant Difference post-hoc test indicated significant differences at the .05 level between groups 3 (experience/information) and 4 (control). Those subjects with both experience and information believed that the behavior was less likely to result in restriction of their mobility.

A significant difference among treatments was also found in the belief about time to put on and take off the coveralls ($p=.02$). Scheffe's test indicated that experience alone as a

Table 11

Oneway Analysis of Variance (Mean Beliefs, Attitudes and Intentions of Treatment Groups)

Component	Group	Mean	Probability of F
Belief 1 -protect better	1	2.0	
	2	2.2	
	3	2.2	.36
	4	1.9	
Belief 2 -best method	1	1.7	
	2	1.8	
	3	1.8	.89
	4	1.7	
Belief 3 -more secure	1	1.7	
	2	1.9	
	3	1.9	.67
	4	1.9	
Belief 4 -feel hot	1	0.5	
	2	0.5	
	3	0.2	.65
	4	0.6	
Belief 5 -feel wet	1	0.3	
	2	0.4	
	3	-0.1	.03*
	4	0.8	
Belief 6 -restrict mobility	1	-0.3	
	2	0.2	
	3	-0.4	.05*
	4	0.3	
Belief 7 -time on/off	1	-1.0	
	2	-0.1	
	3	-0.8	.02*
	4	-0.3	
Belief 8 -time to find	1	0.0	
	2	0.5	
	3	0.2	.47
	4	0.3	

Table 11 (cont'd.)

Component	Group	Mean	Probability of F
Belief [illegible] -a lot of money	1	0.4	
	2	0.3	
	3	0.3	.98
	4	0.4	
Belief 10 -feel conspicuous	1	-1.1	
	2	-1.2	
	3	-0.9	.69
	4	-1.2	
Belief 11 -no washing	1	0.7	
	2	0.2	
	3	0.7	.25
	4	1.1	
Attitude 1 -good-bad idea	1	2.7	
	2	2.8	
	3	2.8	.72
	4	2.8	
Attitude 2 -sensible-foolish	1	2.7	
	2	2.7	
	3	2.8	.72
	4	2.8	
Attitude 3 -pleasant-unpleasant	1	1.0	
	2	0.6	
	3	1.4	.02*
	4	0.6	
Attitude 4 -beneficial-harmful	1	2.6	
	2	2.6	
	3	2.6	.80
	4	2.7	
Attitude 5 -necessary-unnecessary	1	2.1	
	2	2.1	
	3	2.3	.72
	4	2.2	
Attitude -average	1	2.2	
	2	2.2	
	3	2.4	.41
	4	2.2	

Table 11 (cont'd.)

Component	Group	Mean	Probability of F
Intention 1 -no condition	1	4.9	
	2	5.0	
	3	5.2	.79
	4	5.2	
Intention 2 -wear if improved	1	6.0	
	2	6.1	
	3	6.0	.91
	4	6.0	
Intention 3 -wear if free	1	6.4	
	2	6.6	
	3	6.5	.56
	4	6.3	
Intention 4 -wear if convenient	1	6.4	
	2	6.5	
	3	6.3	.67
	4	6.3	
Intention 5 -wear if comfortable	1	6.4	
	2	6.4	
	3	6.3	.58
	4	6.5	
Intention -average	1	6.0	
	2	6.1	
	3	6.0	.97
	4	6.0	

*$p \leq .05$

treatment affected this belief. After experience, the subjects believed it was less likely to take a lot of time to put on and take off the coveralls.

There was a significant difference among treatment groups in only one of the five scales measuring attitude (Att3, p=.02). In this scale, the bipolar adjectives used to measure attitude toward the behavior were pleasant-unpleasant. The Scheffe test indicated that differences occurred between groups 2 and 3 and also between 3 and 4. Experience and information together affected attitudes in terms of the behavior being pleasant or unpleasant. Those with this treatment (3) feel the behavior is more likely to be pleasant. There were no significant differences between the groups in their behavioral intention.

A T-test revealed no significant difference between the groups with no experience (2 and 4) in their actual behavior (Table 12). Therefore, for these respondents information had no affect on behavior. A crosstab analysis using the chi-square statistic was also performed on the four 'reading' groups within groups 2 and 4 with respect to behavior. Results indicated no significant differences (χ^2, p=.09) among the four 'reading' groups with regards to whether they wore a disposable protective coverall on their own accord. This confirmed that information had no effect on actual behavior for those farmers in groups 2 and 4.

As a result of the preceeding statistical procedures, null hypothesis five can be rejected regarding a small number of beliefs and one attitude scale, but is not rejected for behavioral intention and behavior.

Null Hypothesis 6: There will be no significant relationship between either thermal comfort level or evaluation of physical attributes and behavioral intention.

Table 12

Effect of Information on Overt Behavior

Group	Mean Behavior (range=1 to 5)	Probability of t
2	1.7	.72
4	1.8	

Pearson correlations between individual and summed scales of both thermal comfort and behavioral intention indicated the majority were significant with both moderate and weak relationships (Table 13). All of the thermal comfort scales were significantly correlated with the behavioral intention statement having no conditions (BI1). The sum of the thermal comfort scales had a stronger relationship than individual comfort scales with BI1 and BI(average).

A few significant relationships were found to exist between garment evaluations and behavioral intention statements. Evaluation of hand (stiff-flexible) was significantly and weakly related to the first two behavioral intention statements and the average of the five BI statements (r=.20, .29, and .17 respectively). Evaluation of water-repellency was significantly and weakly related to all behavioral intention scales (r=.28, .24, .19, .26, .18, .30;

Table 13

Correlation Coefficients (r) of Thermal Comfort and Behavioral Intention

Thermal Comfort	Behavioral Intention 1	2	3	4	5	ave.
1	.27**	.32***	.23**	.23**	.07	.29**
2	.28***	.23**	.06	.06	-.06	.18*
3	.34***	.28***	.22**	.26**	.08	.32***
4	.17**	.06	.03	-.04	-.03	.07
sum	.38***	.31***	.19*	.18*	.02	.31***

* $p < .05$
** $p < .01$
*** $p < .001$

BI1 to BIav respectively). The sum of garment evaluation scales had a significant but weak relationship with the average of the behavioral intention scales (r=.23, p=.008). On the basis of these results, null hypothesis 6 was rejected.

Null Hypothesis 7: There will be no significant differences between treatment groups with or without information in their thermal comfort level and evaluations of physical attributes of disposable protective clothing.

T-tests between group 1 (experience) and group 3 (experience/information) indicated no significant differences at the set alpha level of .05. Individual and summed thermal comfort and evaluation scales were used in the analyses. Neither the individual nor summed scales were significantly different, thus null hypothesis 7 was not rejected.

V. DISCUSSION

This chapter will first examine the background information outlined in Chapter 4 as it pertains to the experimental design and the purpose of the study. Further findings will be examined in relation to the purpose and objectives of the study, the literature review, and the conceptual framework of the study which is the Fishbein-Ajzen Model of Behavioral Intention.

The purpose of this study was to understand and predict the behavior of Alberta farmers with regards to the wearing of disposable protective clothing by measuring behavioral intention and actual behavior as a function of their attitudes and beliefs. It was then determined whether information or experience had an effect on intentions or behavior.

A. Applicator Response Rate and Background Information

The response rate from the farmers was high for returning one of the two questionnaires. The lower response rate for returning two questionnaires may possibly be because the time between completing the first and second questionnaire for groups 2 and 4 was long or it may have been due to other agricultural problems. The questionnaire may not have been a top priority; several commented they did not understand the questionnaire; or they may have been upset they were not chosen to wear a coverall.

Respondents in each group had been exposed to similar amounts of extra information on protective clothing. The majority obtained information from similar sources. Several farmers in groups 2 and 4 who were not intended to read the experimental pamphlet, responded 'yes' to the question, "Have you read the information pamphlet put out by the University of Alberta about disposable protective coveralls?". Respondents may have answered this question positively believing that they should have read it. However, even if they truly did read the information, creating new groups (for statistical analysis) of those who read, did not read and/or family members read, resulted in a statistically significant difference in the number of respondents and/or family members reading the pamphlet. As intended, groups 1 and 3 had more information than groups 2 and 4. More subjects may have read the pamphlet if one had been sent out earlier, followed by another, one week before spraying; however, time pressures due to unusually early warm spring weather stepped up schedules.

Although only a few farmers wore a disposable coverall on their own, several of those who did wore them for many hours (up to 80). This indicates that the experience may have been good and prompted them to wear them for a longer period. The greatest number of hours coveralls were worn by those in groups 1 and 3 was lower. This was to be expected since they were asked to wear them for only one day. Obviously, a few did not follow wearing instructions.

Most farmers wore rubber or neoprene gloves while mixing. Only a few other items of protective gear were worn. This indicates that they possibly have poor attitudes toward protecting themselves from the hazards. Other researchers have also found farmers not adequately protecting themselves (Rucker et al., 1986; Shern, 1986; Stone et al., 1986). Murray (1982) found respondents in her study were aware of the need for protective clothing. Albrecht and Norton (1987) reported 60% of their sample of farmers believed pesticides rarely or never get on their clothing. In another study, many believed they had been poisoned, yet they still had negative feelings of the value of protective clothing (Keeble, 1987).

B. The Fishbein-Ajzen Model of Behavioral Intention

The first objective of this study was to measure the variables in the Fishbein-Ajzen model in terms of wearing disposable protective coveralls. Examining the measure of behavior revealed similar results to another Alberta study by Rigakis et al. (1987). In this survey, 75% wore long pants, 80% long-sleeved shirts and 48% cotton coveralls, while spraying pesticides. In the present study, 80% wore long-sleeved shirts and long pants 'all of the time', and fewer (40%) wore cotton coveralls at least some of the time.

Approximately 30% wore disposable gloves (groups 2 and 4) and groups 1 and 3 indicated a positive response to wearing the given disposable gloves.

The majority of those who wore a disposable protective coverall on their own (13 out of 18) wore coveralls not recommended for pesticide use which may not have been as effective as others such as the Kleenguard® EP coverall. Four individuals wore the Kleenguard® EP coverall which was used as an experimental treatment.

Intentions toward wearing the coveralls were stronger with conditions added to the intended behavior. On the average, farmers intended to wear the coveralls almost all the time if they were provided free and only slightly less often if convinced of comfort, if convenient, or improved. Thus, convenience, comfort, and possibly durability (seen as an improvement) may be areas that need researching in order to increase intentions to wear the garment. Spending money on these limited use items may be a strong concern for farmers, keeping them back from wearing the garment.

Four of the five attitude scales were responded to very positively showing little variance in response. Att3 (pleasant-unpleasant) showed greatest variance in response and helped to explain the variance in behavioral intentions. Fishbein and Ajzen (1975) have found the good-bad scale to have a consistently [illegible] loading on the evaluative factor and this particular [illegible] almost always tends to be highly correlated with attitude. It has also been used as a direct measure of attitude (Sperber, Fishbein, & Ajzen, 1974). In the present study, good-bad scale used in the direct and all but one indirect measure of attitude (ie. evaluations) produced the lowest variance in response to the scale items.

Beliefs about providing better protection, providing the best method of protection, and feeling more secure about pesticide use if disposable coveralls were worn were the strongest held beliefs of the respondents. Beliefs about feeling hot, feeling wet, restricting mobility, finding disposables, specially caring for disposable coveralls, and cost of coveralls may be close to neutrality as an average response because many farmers may not have formed beliefs, due to the lack of prior experience with the product. They may have general beliefs about the garment's protection effectiveness but not about other attributes such as comfort, durability, or price.

The semantic differential does not allow for 'no opinion' or 'no belief' with a particular statement. As indicated by comments from respondents, many farmers had difficulties completing questionnaires and therefore may have used <u>neither</u> as a 'no response' answer.

The first three beliefs previously refered to, with the strongest responses, also correlate more strongly with the direct measure of attitude and had the lowest variance. Individuals may hold large numbers of salient beliefs at any one time. However, more time and incentive may be needed to hold a much larger set of beliefs. Ajzen and Fishbein (1980) suggest that under most circumstances, a small number of beliefs serve as the determinant of a person's attitude. Thus, due to the possible unfamiliarity with the behavior under question, a smaller set of beliefs should have been used.

According to the theory of reasoned action, both attitude toward the behavior (Att) and the subjective norm (SN) are measured twice. First, both concepts are measured <u>directly</u> and second, each concept is broken down into its components for a <u>calculated</u> measurement. The components used for calculating Att are beliefs and evaluations while the components used for calculating SN are normative beliefs and motivation to comply.

To understand the attitude of farmers toward protective clothing, we first have to know how individuals evaluate each of the outcomes. The first three evaluations that corresponded to the first three belief statements were positive. Therefore, the calculated measure of attitude towards these outcomes (by multiplying belief score with evaluation score) was also positive. Although some of the other evaluation statements were scored negatively and multiplied with a positive belief, ultimately producing a negative attitude, these products were close to neutral, thus having only slight overall effect on attitude. Negative evaluations of feeling hot and feeling wet contributed to negative attitudes about performing the behavior. Attitudes toward spending money to perform the behavior and feeling conspicuous were also slightly negative. When all belief/evaluation products are summed, it was seen that attitude toward wearing disposable protective coveralls was predicted to be slightly positive.

Examination of the subjective norm indicated that farmers felt most important others would quite likely think they should wear disposable coveralls. Referents that surfaced as being most important were the spouse, family, Alberta Agriculture, Agricultural Service Board and members of their farm organizations. Respondents indicated they believed these referents would feel they should wear disposable protective clothing and they also wanted to comply with these referents. Thus the subjective norm was predicted to be quite positive when using normative beliefs and motivation to comply with important referents. Neighbors and friends may not have been included in their set of 'important others'. The nature of this study may also have influenced stated compliance with Alberta Agriculture.

Objective two of this study addressed the relationships within the model and their predictive power. The calculated measures of both Att and SN were significantly related to the direct measures of these components. Calculated Att was only moderately related to measured Att. This finding might suggest that attitude toward the outcome of a behavior may not only comprise beliefs and evaluations as claimed by Fishbein and Ajzen. A more likely explanation may be that not all of the beliefs were salient (ie. attitude may consist of a smaller set of beliefs).

Assumptions are often made when we relate a set of beliefs with attitudes or subjective norm: that we have identified and measured all of the person's salient beliefs and only their salient beliefs; that these beliefs correspond to the attitude in target, action, context and time (Ajzen & Fishbein, 1980). Also, the variance in measured attitude may not have been large enough to result in a strong relationship with its components; however, only those beliefs and evaluations with the lowest variance were moderately related to measured attitude. Components of the subjective norm may have been more accurately measured, thus resulting in a stronger relationship between the calculated and measured subjective norm. These variables also showed greater variance than those measuring attitude.

The relationships among Att, SN, and BI were all significant. Behavioral intention was measured with and without conditions. The unconditional statement and the statement with the condition of coverall improvements were highest in their variance and strongest in their relationships with attitude and subjective norm. Although the other conditional behavioral intention statements had higher means, the variances were low. Perhaps there was not enough variance in these variables to detect relationships.

Multiple regression analyses were performed to explain and predict behavioral intention from attitude and subjective norm. The method of entry of the variables into the regression equations was controlled by the researcher. Several different analyses were done in order to determine whether a relationship existed between Att and SN and whether separate attitude scales or the average measure better explained the variance in behavioral intention.

The attitude component provided the larger influence on BI1 (no conditions), BI2 (if improved), and BI5 (if convinced of comfort) with some contribution from the subjective norm component. These findings are consistent with other research discussed in Chapter 2, where it was found that the attitudinal component generally provided a greater influence on BI than did the normative compliance component. SN had a slightly larger influence on BI3 (wear if free) and BI4 (wear if convenient) than did Att. Some attitudes may play a lesser role if coveralls were provided free or easily obtained. Attitudes toward the outcome of wearing these coveralls may have a more important role in behavioral intention if the coverall has to be purchased. Aspects such as comfort and durability influence one's attitude toward performing the behavior more than one's normative compliance and beliefs about referent expectations.

Behavioral intention may also be influenced more by attitude if respondents are less sure of the referents' expectations when it comes to more specific types of behavior (Jennings, 1984). In this study, where the behavior being investigated is not familiar (ie. wearing disposable coveralls), respondents may have difficulty determining their referents' expectations regarding the use of disposable protective coveralls. However, this was reflected only in their beliefs about expectations of neighbors and friends (ie. majority were neutral responses).

As suggested by Ajzen and Fishbein (1980), the two components are 'distinct but related' as the subjective norm likely affects behavioral intention through attitude. In other words, if a farmer believes his spouse expects him to wear disposable protective coveralls, this may not only affect his subjective norm, but may also result in the formation of a more positive attitude toward wearing protective coveralls while spraying pesticides. In such cases, there should be a relationship between the attitude and subjective norm components. The findings in this study support this theory. A definite relationship existed between the attitude and the subjective norm components.

For this study, the measured attitude toward the outcome of performing a behavior (Att) was measured on five scales using different adjectives. Using the separate attitude scales resulted in slightly more explained variance in behavioral intention (BI). Those equations with the highest percentage of explained variance of BI, had entered those attitude scales with the most variance in their scores. It is to be expected that variables with little variance can not be used to explain variance in other variables. The first set of regression analyses showed that after one or two attitude scales were added to the equation, the remaining scales did not account for more than 3% of the variance in BI. Therefore, it appears that the five scales were basically measuring the same concept. The weighted attitude measure did not add to the explained variance in BI.

Thus, behavioral intention can be explained and predicted successfully using direct and calculated measures of attitude. Although the average measure of attitude scales significantly related to behavioral intention, using only one scale to measure attitude would be sufficient.

Intentions can also be used to predict behavior. A moderate correlation existed between behavioral intention (no conditions) and overt behavior. Using intentions to predict behavior depends on intention corresponding to behavior in action, target, context, and time. Therefore only the first behavioral intention statement was examined for the prediction of behavior. A measure of intention will predict behavior more accurately only if the intention does not change before the behavior is observed. Intentions must be assessed just prior to behavior in order to be less influenced by other factors, and if not feasible, intentions conditional upon the occurence of certain events should be measured. Unanticipated events such as illness, loss of job, elimination of pesticide spraying, and normative expectations may have lowered the correlations between these two components.

C. Effect of Information and Experience on Components of the Model

Objectives 3, 4, and 5 were to determine the effects of information and/or experience on the subjects' beliefs, attitudes, behavioral intention and behavior. Experience and information treatments had effects on three salient beliefs and one scale of the direct attitude measure. The average attitude measure and behavioral intention were not affected by either the information pamphlet nor the experience of wearing a coverall. Behavior was unaffected by information.

Experience and information together as a treatment affected beliefs about restriction of mobility and feeling wet. Both of these outcomes were mentioned in the pamphlet and would be expected to affect the wearers' beliefs, along with actual experience, if the beliefs had been salient. Impersonal information sources are most important at the awareness stage. These individuals may not have developed their beliefs about disposable coveralls until reading the pamphlet.

Belief about taking time to put on and take off coveralls was affected by experience only. The information pamphlet would not likely have had an effect because it did not include information about this outcome.

The attitude scales not affected by experience and information were rated highly positive by almost all respondents. Their attitude may not have changed but was merely reinforced. The pleasant-unpleasant scale was affected by experience together with information. This scale was the lowest rated scale with the most variance.

Information had no affect on the behavior of those not wearing an experimental coverall. The message of the pamphlet may have affected a few of their salient beliefs yet without the added experience to reinforce these beliefs, attitude and ultimately behavior was unaffected. Behavior can also be affected by many outside variables such as coveralls not being readily available or coveralls being too expensive. The time interval between the communication of information and assessment of beliefs and attitudes must be short in order to incur greater retention of information.

According to the theory of reasoned action, attitude and behavioral change is ultimately the result of changes in beliefs. Those persons attempting to produce attitude change often fail to recognize that changing one belief through information and/or experiential treatments may also produce changes in other beliefs, leaving the attitude unchanged (Ajzen & Fishbein, 1980). In this study, there were too few belief changes to create a substantial change in attitude. As well, attitude was scored very high, thus not leaving much room for change. However, by examining changes in beliefs, we can obtain valuable information about the possible reasons for differences in behavior among individuals.

D. Thermal Comfort and Evaluation of Disposable Protective Coveralls

The sixth objective was to measure the subjects' thermal comfort level and their evaluation of the coveralls after wearing them while spraying pesticides. Most of the respondents who wore the experimental coverall assessed thermal comfort positively or neutrally. It has been shown in the literature that more farmers are positively evaluating recent protective clothing as being comfortable (Branson et al. 1986; Henry, 1980; Murray, 1982) unlike the traditional clothing of the past.

Neutrality has been viewed as a term implying a lack of discomfort. Comfort is also described in many disciplines as a lack of discomfort. Therefore, neutrality can be expressed as being comfortable, especially with the scales hot-cold and moist-dry (Dr. T. Nelson, University of Alberta, personal communication, 1987).

It was observed from individual thermal comfort assessments that those respondents reporting a comfortable feeling were also neutral to slightly warm. This observation differs from that of Rohles (1974) that subjects reporting a thermal sensation of 'slightly cool' are quite likely to report a feeling of comfortable. This contrasting finding may be the result of perceptions of thermal comfort of protective clothing. The resulting cooler than average but still warm feeling may have been acceptable in terms of thermal comfort for this traditionally uncomfortable type of garment. Either way, further evidence supports the use of two separate scales for thermal sensation and thermal comfort. Although the scales used in this research are labelled as a thermal comfort measurement, the use of hot-cold adds a thermal sensation measurement.

Positive beliefs are held about the garment's attributes. Durability was the only attribute divided equally on opposite sides of the scale. Experience with rips and tears while wearing the coverall may have affected this belief.

Objective 7 was to determine whether a significant relationship exists between either the respondents' level of thermal comfort or evaluation of the garment attributes and behavioral intention. Thermal comfort was related most significantly to behavioral intention with no conditions and behavioral intention under improved conditions. It was not expected that intention to wear the garment if the comfort was improved would be significantly related to thermal comfort level. Respondents feeling either comfortable or uncomfortable with respect to body temperature would most likely intend to wear the coveralls more often if convinced the coveralls were comfortable. It has been stated in the literature discussed in Chapter 2, that thermal comfort is a main reason farmers do not wear protective clothing.

The last objective was to determine whether information would have a significant effect on the respondents' thermal comfort and evaluation of the attributes of disposable protective clothing. The information pamphlet on disposable protective coveralls had no significant effect on thermal comfort and evaluation of the coveralls. The content of the information may have been too much of a contrast from their salient beliefs and evaluations. A subject employs his own attitude as an anchor to judge other attitudinal positions. When a communicator presents a position that is similar, his statements are more likely to be assimilated; when they are different, the subject may experience contrast and hence reject the information as "unreasonable" (Triandis, 1971). As with the effects of information on beliefs and attitudes, changes in evaluations may occur only if the individual is in an awareness stage and evaluations have not yet been formed.

VI. SUMMARY, CONCLUSIONS & RECOMMENDATIONS

A. SUMMARY

The main purpose of this study was to understand and predict the behavior of Alberta farmers with regards to the wearing of disposable protective clothing. The development of nonwoven disposable fabrics for use in protective garments is a potential alternative to the more traditional and uncomfortable protective garments. These limited use, protective garments are lighter in weight, resistant to chemical penetration, economically priced and disposable.

Fishbein-Ajzen's theory of reasoned action was utilized as the conceptual framework. The ultimate goal of the theory is to understand and predict behavior by measuring behavioral intention and overt behavior as a function of attitudes, beliefs, and evaluations, both personal and social.

An experimental field trial was designed to determine whether actual experience with the garment and/or information would be effective in changing the farmers' behavior with regards to wearing disposable protective clothing. The experimental design consisted of three treatment groups and a control group.

Self-administered attitude-behavioral intention questionnaites, developed following the procedures outlined by Ajzen and Fishbein (1980) were responded to by 244 volunteer grain farmers. Thermal comfort and evaluation of garment attributes were rated by groups receiving an experimental coverall. Overt behavior was self-reported at the end of the spraying season by those groups not receiving a coverall.

Sixteen percent of those reporting behavior stated they wore a disposable coverall. Most wore long-sleeved shirts and long pants. A majority of respondents intended to wear disposable coveralls at least some of the time the next time they applied pesticides. The measurement of behavioral intention included statements with conditions for the behavior (eg. if garments were improved) that are often made when choosing to perform a certain behavior. Allowing for certain conditions improved intentions to wear the coveralls in the future.

Within the model of behavioral intention are two components, attitude (Att) and subjective norm (SN). These components are both measured twice: they are measured directly as well as being separated into two further components which are first measured, then multiplied together, and then summed. The two components used to calculate attitude are beliefs about the outcomes of performing a behavior and the evaluations of the outcomes. The two components used to calculate subjective norm are normative beliefs and motivation to comply with important referents. Overall, a positive attitude was indicated toward wearing disposable protective coveralls. Outcomes of providing better protection than everyday work clothes, providing the best method of protection, and feeling more secure about pesticide use while wearing a disposable coverall had the strongest held beliefs about and evaluations of them. The measured attitudes were moderately related to calculated attitude (r=.30).

Most farmers stated it was very likely that most people who are important to them would think they should wear disposable protective coveralls. Important referents were the farmers' spouse, Alberta Agriculture, the Agricultural Service Board and members of their farm organizations. Respondents were likely to comply with these referents and believe they would likely suggest that disposable coveralls should be worn while the respondent sprays pesticides. A strong relationship existed between the measured and calculated subjective norm (r=.60).

Att and SN were both moderately related to behavioral intention. A weighted measure of Att increased correlations with a weighted measure of the five BI statements. The relative contributions of Att and SN to BI were measured using several multiple regression analyses. Using individual attitude scales rather than the attitude average slightly improved explained variance in BI. SN seemed to account for more of the variance than did Att for BI3 (wear if free) and BI5 (wear if convinced of comfort) while for the other BI variables Att seemed to account for more of the variance.

Att and SN explained 39% of the variance in the average BI measure. A moderate relation was found to exist between BI (no conditions) and overt behavior (r=.31).

Respondents with both experience and information had more positive beliefs about feeling wet from perspiration and restricting in mobility, as well as a more positive attitude (response to pleasant-unpleasant scale). There were no differences in behavioral intention. Those with experience only had more positive beliefs about taking time to put on and remove coveralls. Information alone had no affect on overt behavior.

Variables external to the model were expected to contribute to the understanding of BI. Evaluation of coverall attributes and thermal comfort level were rated positively. There was no differences between the groups with and without information in their reported thermal comfort level and evaluation of the coverall attibutes. There was a moderate relationship between the sum of the thermal comfort scales and BI1, BI2 (wear if improved) and BI(average).

B. CONCLUSIONS

Our understanding of Alberta farmers with regards to the wearing of disposable protective clothing has greatly improved. Behavioral intentions and actual behavior can be determined by examining attitudes and beliefs. The Fishbein-

Ajzen model can thus be applied to the behavior of wearing disposable protective coveralls. Significant relationships were found among all components of the model.

Both attitudes and subjective norm were positive. Positive attitudes and beliefs, which were shown to be significantly affected by experience and information, will most likely increase farmers willingness to wear disposable coveralls in the future.

The attitude scales correlated strongly with each other, however, using more than one scale provides a greater chance for variance in response. If only the first scale (good-bad idea) had been used, the belief-evaluation products could not have explained the low variance in this attitude response.

The calculated attitude was significantly related to measured attitude; however, fewer beliefs and evaluations need to be used to calculate attitude. Those appearing to be most salient for this sample were beliefs about protection effectiveness, security, and comfort. Since respondents appear to be entering into an awareness stage relating to the behavior of wearing disposable coveralls, more time and incentive may be needed to hold a larger set of beliefs. Experience affected some of these beliefs.

Calculating SN from normative beliefs and motivation to comply could substitute for the direct measure of SN. Neighbors and friends, however, did not seem to be important referents for the behavior under question.

According to the model, attitude generally provides a greater influence on behavioral intention than does subjective norm. In this study, important others play a significant role for behavioral intention statements with conditions not involving personal beliefs. For those intentions involving comfort, improvements and no conditions, Att plays the strongest role. Individuals will wear disposable protective coveralls if these personal beliefs are positive and salient.

Many respondents indicated wearing very few items of protective clothing. Through experience and information, an awareness of the hazards of pesticides and the need for protective clothing can be increased. Beliefs will also be formed or strengthened through experience and information.

The literature has indicated that many farmers are aware of the need for protective clothing yet they do not change their clothing behaviors. As shown through the use of conditional behavioral intention statements, perhaps individuals need to be convinced of the convenience and comfort of these disposable garments. Coveralls also need to be improved while maintaining their low price.

Comfort still seems to be chosen over protection by most farmers. Those experiencing the wearing of Kimberly-Clark's Kleenguard® EP disposable coverall, rated thermal comfort and evaluation of the coveralls very positively. These coveralls were rated as very comfortable and satisfying. They were evaluated as extremely light, flexible, and breathable, attributes implying comfort. Thermal comfort and evaluations were also significantly and positively related to behavioral intention. Therefore, a trial wearing period for disposable coveralls is necessary in order to form beliefs and perhaps eliminate perceptions of discomfort.

Although information had no affect on behavioral intention and behavior, it did influence a few beliefs as well as attitude. Information had greatest influence when accompanying experience. More information would most likely form more positive beliefs and strengthen present beliefs. Eventually, behavior will improve.

C. RECOMMENDATIONS

For Future Research

1. This study involved the behavior of wearing only one type of disposable coverall. A replication of this experimental study should be done using either another available disposable garment or an improved design.
2. Comfort and economics of wearing disposable protective coveralls by agricultural workers are important aspects that should be investigated more extensively.
3. A similar study should be conducted with the information supplied by a different source such as product manufacturers or agricultural organizations, to determine if the source of information affects the formation of beliefs, attitude and behavioral intention.

4. A follow-up study on those farmers receiving an experimental garment should be conducted during a future spraying season to measure overt behavior.

5. The effect that experience and/or information has on the effectiveness of the model could be examined by comparing the results of separate multiple regression equations between different treatment groups.

To the Manufacturers of Disposable Protective Coveralls

1. The attitude towards wearing these coveralls was extremely positive and many farmers wore the coveralls for a longer period than requested of them. Some also put on and took off the coveralls several times. Proper wearing instructions should be included on the packaging of garments. These instructions could include what signs to look for (i.e. abrasion) to indicate if coveralls are perhaps no longer as effective.

2. Experience with the garment was shown to change a few beliefs about wearing them. Providing a trial garment with perhaps the first purchase of pesticides, may increase the wearing behavior in future spraying seasons.

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APPENDIX A

Letters to District Home Economists (extension agents)

Consent form for volunteers

University of Alberta
Edmonton
Canada T6G 2N1

Department of Clothing and Textiles
Faculty of Home Economics
301 Printing Services Building, Telephone (403) 432-2479

To: (name of District Home Economist)

As you are aware from discussion with Bertha Eggertson, you have been randomly selected from a list of all District Home Economists to help with the disposable protective coverall research. We need your immediate participation in gathering volunteer farmers. Consenting volunteers will then be randomly assigned to one of four experimental groups.

The first group of farmers will be selected to experience the wearing of Kimberley Clark's Kleenguard disposable coveralls. The second group will be sent an information pamphlet concerned with disposable coveralls (farmers are not to be made aware of this treatment). The third group will have both information and experience, while the fourth group will have neither. All participants will be asked to complete a 5-page rating-type questionnaire either before or after the spring '87 spraying season. All information obtained will be kept confidential and overall results will be given to you after analysis.

Please place the enclosed advertisement in your district newspaper. Consent forms are included to be distributed to interested volunteers replying to the ad. We need 32-35 farmers from your district, so if not enough farmers reply, please make personal inquiries.

Please return completed forms back to us as soon as possible. We would like to have volunteers selected by early April. Also, enclose a list of the volunteers and their addresses.

Further assistance from you will include:
* distributing coveralls together with questionnaires in late May '87 to those farmers selected to wear them,
* collecting used coveralls and completed questionnaires after the spring '87 spraying season,
* telephoning farmers in early June and/or early July to encourage response from the farmers in completing the questionnaires.

You will be contacted again in early May regarding the above participation. Thank you for your assistance in this research project.

Sincerely,

Betty Crown
Betty Crown, Ph.D.
Professor and Chairperson
Department of Clothing & Textiles

Helena M. Perkins
Helena M. Perkins
Graduate Student

University of Alberta
Edmonton

Department of Clothing and Textiles
Faculty of Home Economics

Canada T6G 2N1

301 Printing Services Building, Telephone (403) 432-2479

To: (name of farmer)

We are seeking volunteers to participate in a field trial of disposable coveralls during the pesticide spraying season this year. Currently there is considerable interest in the use of such disposable garments because they offer an added layer of protection against dermal exposure to pesticides and also because, being disposable, the need to effectively launder these garments is eliminated. Before disposables can be recommended for use, however, we need your help to evaluate them for comfort, durability and acceptability.

If you volunteer, you will be randomly assigned to participate in one of the following:

(1) completion of a 5-page questionnaire before the spring '87 spraying season.

(2) wearing and evaluation of disposable coveralls during the spring '87 spraying season and completion of a 5-page questionnaire after the spring '87 spraying season.

All participants will be asked to complete a short check-off questionnaire regarding necessary background and spraying information after the spring '87 spraying season.

All questionnaire responses will be strictly confidential; no individual respondents will be identified. The summary of the results will be made available to you through your District Home Economist. Your participation in this project is strictly voluntary; you may withdraw at any time.

If you are willing to participate, please complete and return the form below to (name of District Home Economist) by March 31, 1987.

Thank you for your cooperation.

Sincerely,

Betty Crown, Ph.D.
Professor and Chairperson
Department of Clothing & Textiles

Helena M. Perkins
Graduate Student

Yes, I am willing to participate in a field trial of disposable coveralls and/or to complete a questionnaire on the same topic.

Name (please print) ______________________

Signature: ______________________

The following information is needed to aid us in selecting the proper size of coveralls if you are selected to wear them:

height ________ chest ________
weight ________ leg inseam ________

University of Alberta
Edmonton
Canada T6G 2N1

Department of Clothing and Textiles
Faculty of Home Economics
301 Printing Services Building, Telephone (403) 432-2479

May 18, 1987

To: (name of District Home Economist)

Spraying season for the volunteer farmers in our protective clothing study is quickly approaching. You have been sent disposable coveralls with accompanying questionnaires to be delivered to the randomly chosen volunteers from your district.

Each farmer has been given an ID number for data coding purposes and also to keep the results anonymous. The ID# is written on the back neck of the garment and at the top of each questionnaire.

Please pick up used coveralls along with completed questionnaires from these farmers. A white plastic bag has been provided to bundle contamiated coveralls. Those farmers who have not been given a garment to wear, have had a questionnaire mailed directly to them. They have been asked to return the completed questionnaire to you by May 26.

Along with this letter are the cover letters that are attached to the questionnaires. The first will be sent to farmers wearing the coverall and the second to farmers completing the questionnaire only. For your convenience we have included a list of the farmers coded into their respective groups.

Please make reminder phonecalls to all the farmers in early and/or late June to encourage response from them in completing the questionnaires.

Sincerely,

Betty Crown

Betty Crown, PhD.
Professor and Chairperson

Helena Perkins

Helena Perkins
MSc Candidate and
Research Assistant

APPENDIX B

Instructions for wearing coveralls and completing questionnaires

University of Alberta
Edmonton

Department of Clothing and Textiles
Faculty of Home Economics

Canada T6G 2N1

301 Printing Services Building, Telephone (403) 432-2479

May 18, 1987

Dear Participant,

Thank you for agreeing to participate in our field trial to evaluate disposable protective coveralls for pesticide applicators.

The coverall size given to you has been carefully chosen according to your measurements. Please wear this garment while mixing, loading and applying pesticides for 1 day only (to control wearing time for this study). If you must take them off, be very careful and hang them in a well-ventilated area. When squatting or climbing, raise the coverall leg at the thigh to prevent the crotch from tearing. Hood must be worn to protect head from exposure and also to keep the crotch at the proper height.

Do not wear garment if a rip, tear or hole occurs. After wearing, remove carefully and bundle in the white garbage bag provided. DO NOT THROW AWAY. DO NOT LAUNDER.

REMEMBER Extra-Protection Kleenguard coveralls are limited use garments and are not made to last as long as cloth coveralls. They do provide better protection due to their repellency properties.

Three pairs of disposable gloves have also been provided. Please use these and dispose of after each use adjusting spray nozzles, etc.

Please answer all questionnaires. The background questionnaire should be completed after all pesticide spraying is finished. The other two questionnaires should be completed immediately after wearing the garment. Successful evaluation of the use of these garments depends on completion of all the enclosed papers.

Return all questionnaires and used garments to your District Home Economist.

Thank you for your assistance,

Betty Crown   Helena Perkins

Betty Crown, PhD.
Professor and Chairperson

Helena Perkins
MSc Candidate and
Research Assistant

University of Alberta
Edmonton
Canada T6G 2N1

Department of Clothing and Textiles
Faculty of Home Economics
301 Printing Services Building, Telephone (403) 432-2479

May 18,1987

Dear Participant,

Thank you for agreeing to participate in our research to evaluate disposable protective coveralls for pesticide applicators.

You have been randomly chosen to complete our questionnaire on disposable protective coveralls without wearing the garments. Completing the questionnaire should take only 10 to 15 minutes of your time.

Please complete the questionnaire as soon as possible and return it by May 26 to your District Home Economist who will forward it to us. Successful completion of our study depends on your cooperation in completing this short check-off questionnaire.

Thank you for your assistance,

Betty Crown
Betty Crown, PhD.
Professor and Chairperson

Helena Perkins
Helena Perkins
MSc Candidate and
Research Assistant

APPENDIX C

Attitude-Behavioral Intention Questionnaire

GENERAL INSTRUCTIONS

Most of the questions which follow make use of rating scales with seven spaces; you are to make a check mark (✓) in the space that best describes your opinion. For example, if you were asked to rate "The postal service in Canada" on such a scale, the seven spaces would be interpreted as follows:

The postal service in Canada is:

good _____ : _____ : _____ : _____ : _____ : _____ : _____ bad
extremely quite slightly neither slightly quite extremely

If you think the postal service in Canada is quite good, then you would place your mark as follows:

The postal service in Canada is:

good _____ : __✓__ : _____ : _____ : _____ : _____ : _____ bad
extremely quite slightly neither slightly quite extremely

For questions containing more than one scale, please mark each scale. For example:

The postal service in Canada is:

good _____ : __✓__ : _____ : _____ : _____ : _____ : _____ bad

fast _____ : _____ : __✓__ : _____ : _____ : _____ : _____ slow

In making your ratings please remember the following points:

(1) Place marks in the middle of the space, not on the boundaries:

_____ : _____ : __✓__ : _____ : _____✓_____ : _____
this not this

(2) Be sure to answer all items - please do not omit any.

(3) Never put more than one check mark on a single scale.

For each of the following eleven statements, please check (✓) the position on the scale that best respresents how you feel about the statement.

1. Providing better protection than everyday work coveralls is:

good _____:_____:_____:_____:_____:_____:_____ bad
extremely quite slightly neither slightly quite extremely

2. Providing the best method of protection from pesticides is:

good _____:_____:_____:_____:_____:_____:_____ bad
extremely quite slightly neither slightly quite extremely

3. Feeling more secure about pesticide use is:

good _____:_____:_____:_____:_____:_____:_____ bad
extremely quite slightly neither slightly quite extremely

4. Feeling hot is:

pleasant _____:_____:_____:_____:_____:_____:_____ unpleasant
extremely quite slightly neither slightly quite extremely

5. Feeling wet from perspiration is:

pleasant _____:_____:_____:_____:_____:_____:_____ unpleasant
extremely quite slightly neither slightly quite extremely

6. Restricting my mobility while working is:

good _____:_____:_____:_____:_____:_____:_____ bad
extremely quite slightly neither slightly quite extremely

7. Taking a lot of time to put on and take off work coveralls is:

beneficial _____:_____:_____:_____:_____:_____:_____ harmful
extremely quite slightly neither slightly quite extremely

8. Taking a lot of time to find work coveralls to purchase is:

beneficial _____:_____:_____:_____:_____:_____:_____ harmful
extremely quite slightly neither slightly quite extremely

9. Spending a lot of money on work coveralls is:

good _____:_____:_____:_____:_____:_____:_____ bad
extremely quite slightly neither slightly quite extremely

10. Feeling conspicuous in my coveralls is:

good _______:_______:_______:_______:_______:_______:_______ bad
extremely quite slightly neither slightly quite extremely

11. Eliminating the need to specially care for contaminated work coveralls is:

beneficial _______:_______:_______:_______:_______:_______:_______ harmful
extremely quite slightly neither slightly quite extremely

For each of the following seven statements, please check (√) the position on the scale that best represents your view.

<u>Generally speaking, with regards to wearing work coveralls:</u>

1. How much do you want to do what your wife thinks you should do?

very much _______:_______:_______:_______:_______:_______:_______ not at all

not applicable (no wife) _______

2. I want to follow the advice of other members of my family.

very much _______:_______:_______:_______:_______:_______:_______ not at all

3. I want to do what my neighbors think I should do.

very much _______:_______:_______:_______:_______:_______:_______ not at all

4. I want to do what my friends think I should do.

very much _______:_______:_______:_______:_______:_______:_______ not at all

5. I want to follow the advice given by Alberta Agriculture.

very much _______:_______:_______:_______:_______:_______:_______ not at all

6. I want to follow the advice given by the Agricultural Service Board.

very much _______:_______:_______:_______:_______:_______:_______ not at all

7. I want to follow the advice of the members of farm organizations to which I belong.

very much _______:_______:_______:_______:_______:_______:_______ not at all

- 3 -

C. For the following five statements, please check (√) the position on the scale that best represents your answer to the statement with regards to the next time you apply pesticides.

1. I intend to wear disposable protective coveralls:

none of the time ______:______:______:______:______:______:______ all of the time

2. If improved disposable protective coveralls are available, I will wear them:

none of the time ______:______:______:______:______:______:______ all of the time

3. If pesticide manufacturers were to provide free disposable protective coveralls, I will wear them:

none of the time ______:______:______:______:______:______:______ all of the time

4. If it is convenient for me, I will wear disposable protective coveralls:

none of the time ______:______:______:______:______:______:______ all of the time

5. If I am convinced they are comfortable, I will wear disposable protective coveralls:

none of the time ______:______:______:______:______:______:______ all of the time

D. For each of the following pairs of words, please check (√) the position on the scale that best represents your answer to the statement.

Wearing a disposable protective coverall while I apply pesticides is:

a good idea ______:______:______:______:______:______:______ a bad idea

sensible ______:______:______:______:______:______:______ foolish

pleasant ______:______:______:______:______:______:______ unpleasant

beneficial ______:______:______:______:______:______:______ harmful

necessary ______:______:______:______:______:______:______ unnecessary

- 4 -

E. For each of the following eleven statements about disposable protective coveralls, please check (✓) the position on the scale that best represents what you believe about the statement.

1. Wearing disposable protective coveralls will provide better protection than everyday work coveralls while applying pesticides.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

2. Wearing disposable protective coveralls will provide the best method of protection from pesticides.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

3. I would feel more secure about pesticide use if I wore disposable protective overalls.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

4. Wearing disposable protective coveralls will make me feel hot.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

5. Wearing disposable protective coveralls will make me feel wet from perspiration.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

6. My mobility will be restricted while working if I wear disposable protective clothing.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

7. Putting on and taking off disposable protective coveralls take a lot of time.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

8. Finding disposable protective coveralls to wear would take a lot of time.

likely ____:____:____:____:____:____:____ unlikely
extremely quite slightly neither slightly quite extremely

9. Purchasing disposable protective coveralls requires spending a lot of money.

likely _____:_____:_____:_____:_____:_____:_____ unlikely
extremely quite slightly neither slightly quite extremely

10. I would feel conspicuous if I wore disposable protective coveralls.

likely _____:_____:_____:_____:_____:_____:_____ unlikely
extremely quite slightly neither slightly quite extremely

11. Wearing disposable protective coveralls eliminates the need to specially care for contaminated work clothes.

likely _____:_____:_____:_____:_____:_____:_____ unlikely
extremely quite slightly neither slightly quite extremely

For each of the following eight statements, please check (✓) the position on the scale that best represents your view with regards to wearing disposable protective coveralls while applying pesticides.

1. Most people who are important to me think I sho[illegible] protective coveralls while applying pesticides.

likely _____:_____:_____:_____:_____:_____:_____ [illegible]
extremely quite slightly neither slightly quite extremely

2. My wife thinks I should wear disposable protective coveralls.

likely _____:_____:_____:_____:_____:_____:_____ unlikely
extremely quite slightly neither slightly quite extremely

not applicable (no wife) ________

3. How probable is it that other members of your family would want you to wear disposable protective coveralls?

likely _____:_____:_____:_____:_____:_____:_____ unlikely
extremely quite slightly neither slightly quite extremely

4. Is it likely that your neighbors would want you to wear disposable protective coveralls?

likely _____:_____:_____:_____:_____:_____:_____ unlikely
extremely quite slightly neither slightly quite extremely

5. My friends would suggest that I should wear disposable protective coveralls.

likely _______:_______:_______:_______:_______:_______:_______ unlikely
extremely quite slightly neither slightly quite extremely

6. Alberta Agriculture would suggest that I should wear disposable protective coveralls.

likely _______:_______:_______:_______:_______:_______:_______ unlikely
extremely quite slightly neither slightly quite extremely

7. The Agricultural Service Board would suggest that I should wear disposable protective coveralls.

likely _______:_______:_______:_______:_______:_______:_______ unlikely
extremely quite slightly neither slightly quite extremely

8. The members of farm organizations to which I belong would suggest that I should wear disposable protective coveralls.

likely _______:_______:_______:_______:_______:_______:_______ unlikely
extremely quite slightly neither slightly quite extremely

YOUR TIME AND EFFORT IN COMPLETING THIS QUESTIONNAIRE IS GREATLY APPRECIATED.

APPENDIX D

Behavior Questionnaire

<u>Check the response most similiar to your actions during the past spraying season, with regard to the following statements.</u>

1. I wore a disposable protective coverall.

- ____ none of the total spraying time
- ____ approximately 1/4 of the time
- ____ approximately 1/2 of the time
- ____ approximately 3/4 of the time
- ____ all of the spraying time.

2. I wore disposable gloves while applying pesticides.

- ____ none of the total spraying time
- ____ approximately 1/4 of the time
- ____ approximately 1/2 of the time
- ____ approximately 3/4 of the time
- ____ all of the spraying time.

3. I wore a long sleeved shirt and long pants while applying pesticides.

- ____ none of the total spraying time
- ____ approximately 1/4 of the time
- ____ approximately 1/2 of the time
- ____ approximately 3/4 of the time
- ____ all of the spraying time.

4. I wore a regular cotton or cotton/polyester coverall.

- ____ none of the total spraying time
- ____ approximately 1/4 of the time
- ____ approximately 1/2 of the time
- ____ approximately 3/4 of the time
- ____ all of the spraying time.

5. If you wore a disposable protective coverall, please check the type:

- ____ Kimberly-Clark Kleenguard (grey with blue stitching)
- ____ " (white with green stitching)
- ____ " (white with red stitching)
- ____ Tyvek (regular)
- ____ " (polyethylene-coated)
- ____ Saranex (Saran coated Tyvek)
- ____ Home Hardware/Home Decorator
- ____ other (specify: ____________________)

• note: not all of the above coveralls are recommended for use with pesticides.

APPENDIX E

Background Questionnaire

BACKGROUND INFORMATION FOR STUDY OF PROTECTIVE CLOTHING
(to be completed at the end of the day(s) of application)

1. Estimate total number of hours spent in pesticide application this season: ______ hrs

   Number of hours of application during which a disposable coverall was worn: ______ hrs

   Check either:
   _____ continuous wear
   _____ took on and off 1 2 3 4 times (circle one)

2. Check here if you quit wearing the coverall because:

   _____ it was torn (or developed a hole)
   _____ it was penetrated by pesticide
   _____ spilled concentrated pesticide on coverall
   _____ finished spraying
   _____ other (specify: ______________________________)

3. Other protective gear worn:

	during mixing	during application
goggles	________	________
respirator	________	________
apron	________	________
neoprene or rubber gloves	________	________
neoprene or rubber boots	________	________
other (specify: __________)	________	________

4. Method of application while wearing coverall (check all that are applicable)

   _____ boom sprayer
   _____ other (specify) ______________________________

5. Tractor used: _____ with cab _____ no cab _____ N/A
   Air conditioned cab? _____ yes _____ no _____ N/A

6. Pesticide(s) used while wearing coverall (brand name):

   Brand(s) __________________ liquid? _____ yes _____ no
   __________________ _____ yes _____ no
   __________________ _____ yes _____ no

7. Date of application and weather conditions during which coverall was worn:

Date ____________________
Temperature (°C or °F) ____________________
Wind (no wind, light, medium, strong) ____________________

8. During this year's spraying season did you experience what you believe to be the symptoms of pesticide poisoning?

____ yes (please describe) ______________________________
____ no ____ not sure

9. Your age (in years) __________

10. Please check which of the following sources of information about protective clothing you have been exposed to (check all which apply)

____ radio
____ T.V.
____ newspaper
____ meetings
____ neighbors
____ Alberta Agriculture protective clothing display
____ Alberta Agriculture handouts/brochures
____ relatives

11. Have you read the information pamphlet put out by the University of Alberta about disposable protective coveralls?

____ no ____ yes

12. Have any other members of your family read the above mentioned pamphlet?

____ no ____ yes: specify: ______________

Thank-you for taking the time to participate in our study.

APPENDIX F

Assessment of Thermal Comfort and

Evaluation of Garment Attributes

Please complete immediately after wearing the disposable coverall.

1. Thermal comfort assessment

Place a check between each pair of adjectives at the location that best describes how you feel:
(This is a nine-point scale; the middle space is a neutral feeling)

Comfortable ____:____:____:____:____:____:____:____:____ Uncomfortable

Cold ____:____:____:____:____:____:____:____:____ Hot

Satisfied ____:____:____:____:____:____:____:____:____ Dissatisfied

Moist ____:____:____:____:____:____:____:____:____ Dry

2. Evaluation of disposable protective coveralls:

Place a check between each pair of adjectives at the location that best describes the disposable coveralls you were asked to wear:

Heavy ____:____:____:____:____:____:____:____:____ Light

Stiff ____:____:____:____:____:____:____:____:____ Flexible

Non-breathable ____:____:____:____:____:____:____:____:____ Breathable

Rips/tears ____:____:____:____:____:____:____:____:____ Durable

Not repellent ____:____:____:____:____:____:____:____:____ Water/liquid repellent

Tight fit ____:____:____:____:____:____:____:____:____ Loose fit

Uncomfortable hood ____:____:____:____:____:____:____:____:____ Comfortable hood

Uncomfortable elastic ____:____:____:____:____:____:____:____:____ Comfortable elastic

3. Evaluation of disposable gloves

a. Please describe what you liked about wearing the disposable gloves:

b. Please describe what you disliked about wearing the disposable gloves:

APPENDIX G

Pamphlets

DISPOSABLE PROTECTIVE COVERALLS FOR PESTICIDE USE

What are they?

Disposable protective coveralls are "limited use" garments that provide an *extra layer of protection* to keep pesticide contact with the skin to a minimum.

Of the many disposable garments which are now marketed, Kimberly Clark Kleenguard Extra Protection (E.P.) coveralls and Dupont Saranex coveralls are advertised by the manufacturers as being suitable for use with pesticides.

Kleenguard coveralls are white and made of non-woven, spunbonded 100% polypropylene. The E.P. coveralls are specially treated to resist liquid penetration and cost approximately $7 - 10. Saranex coveralls are made of 100% spunbonded olefin (Tyvek). The garment is surfaced with Saranex, a Saran film made by Dow Chemical which provides extra protection. They cost about $38.00.

How effective are they in protecting against pesticide hazards?

- Disposables allow only an added layer of protection from pesticides
- work clothing may become contaminated after a direct spill; wear and tear from extended use may allow penetration
- many disposables have elastic at the wrists and ankles and also feature hoods
- Kleenguard coveralls are adequate for light sprays of pesticides; Saranex affords more protection

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Disposables may afford comfort

- some disposables look and feel like cloth
- white garments reflect sunlight and result in cooler surface temperatures
- a looser fit allows for ease of movement, air circulation and layering in cooler weather
- some disposables are highly breathable (i.e. Kleenguard)

What is meant by "breathable" disposable garments?

Breathability is the ability of clothing to allow perspiration from the body to evaporate into the atmosphere.

- comfort results when perspiration is evaporated more readily through clothing
- Kleenguard E.P. fabric was tested in our laboratory against Saranex, Goretex laminate, and 100% cotton twill.
  RESULT?

KLEENGUARD allowed the transmission of water-vapour at a rate of 2x more than Gore-tex fabric and 16x more than Saranex! KLEENGUARD obtained results similar to 100% cotton twill.

Two different methods of testing breathability were analyzed and similar results were obtained for the samples.

From a comfort standpoint, Kleenguard affords adequate comfort with respect to perspiration evaporation through the fabric during high physical activity or high temperatures. Saranex is less adequate from a comfort viewpoint.

Will I still need to specially care for my regular work coveralls if worn under disposables?

- YES. Wash work clothing according to recommended procedures from Alberta Agriculture, Home Economics Branch.

REMEMBER

- Make sure the purchased disposable is meant for pesticide use.
- If severe pilling, rips or holes occur, remove disposable coverall and replace with a new one for maximum protection.
- Changes to the disposable fabric will occur as a result of wear much quicker than regular fabric (i.e. Kleenguard).
- Saranex is a more durable fabric with its added coating.
- Although manufacturers provide washing instructions with some disposables, laundering is not recommended. This increases the material's ability to absorb chemicals.
- These coveralls are disposable and are meant to be disposed of after use.
- If wearing disposable coveralls for only a short time, take them off with care and store outdoors (or a well-ventilated area) until used again.
- Disposables should not be thrown out or burned like regular garbage. Wrap them in a plastic bag and bury or take to an approved pesticide container collection site.

When you wash and dry:

- wash pesticide-soiled clothing separately from regular family laundry
- avoid overcrowding clothes in the washing machine
- pre-treat pesticide-soiled clothing with a laundry stain removal product intended for oily stains when an oil-base (emulsifiable) formulation has been used
- pre-rinse pesticide-soiled clothing on pre-soak cycle of automatic washer
- use hot water setting
- use full water level
- use normal cycle
- use heavy duty detergent
- wash clothes twice or three times
- line dry clothes to prevent possible contamination of dryer and to increase the chemical breakdown of pesticide residues
- after use, run machine through full cycle with hot water and detergent to rinse washer
- wash hard hat, goggles, respirator (avoid getting charcoal filter wet, remove if possible), gloves and rubber or neoprene boots in hot soapy water daily

Try to limit clothing worn while handling pesticides for that use only. Some pesticides are difficult to remove from clothing.

For continuing safety, remember:

- wear correct protective clothing
- wear suitable safety equipment
- wash protective clothing after use

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Edmonton, Alberta T6H 5T6

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Protective Clothing for Pesticide Use

Alberta
AGRICULTURE
Home Economics Branch
Homedex 1353-90

Protective Clothing for Pesticide Use

Agricultural chemicals are potentially dangerous to handlers. Their use for crop production necessitates that handlers protect themselves.

What are pesticides?

Herbicides, insecticides and fungicides are all pesticides. They can enter the body through skin, nose and mouth. Exposure to pesticides during pouring, mixing or spraying can affect the users' health. Users can prevent harmful side effects by taking proper precautions.

Toxicity of pesticides varies depending upon the formulation. Use the symbols on pesticide labels as a guide. Those labels without a symbol indicate that the pesticides are non-toxic.

Danger (Highly toxic) Warning (Moderately toxic) Caution (Slightly toxic)

Be aware when pesticides are being used.
To ensure the least exposure:

* **wear correct protective clothing**
* **wear suitable safety equipment**
* **wash protective clothing after use**

What to wear for safety

Clothing acts as a barrier to prevent skin absorption of pesticides. Several articles of clothing are advisable during any handling of chemicals:

* **long-sleeved shirt**
* **full-length trousers**
* **coveralls**
* **neoprene or unlined rubber gloves**
* **neoprene overboots or long rubber boots**
* **wide-brimmed hard hat**

These standard protective garments leave almost no skin exposed to chemicals.

Wear a waterproof apron for added protection when handling very toxic pesticide concentrates.

* Remove contaminated clothing and equipment outdoors.
* Shower before putting on clean clothing. Remember to shampoo your hair.

What not to wear

* cloth or leather gloves
* leather shoes or sneakers
* baseball cap
* a wrist watch with a leather band

These materials absorb chemicals and prolong exposure to the wearer.

Protecting your face

Goggles or face shields are advisable to protect the eyes and face against pesticide vapors, dust and splashes.

A respirator is strongly recommended to prevent inhalation of dusts, powders and sprays. Covering both nose and mouth, it contains a charcoal cartridge and a pad to filter dust and spray particles. To reduce the health hazard, keep the respirator clean, and replace the cartridge or the entire respirator, if disposable, at the first sign of a chemical odor.

Keep it clean

Safe removal of pesticide demands **special care in** handling and washing contaminated clothes. The skin can absorb chemicals from inadequately laundered garments.

Take some precautions:

* handle soiled clothing with **rubber gloves**
* when applicable, remove pesticide granules from cuffs and pockets outdoors
* **discard any garment saturated with a full-**strength chemical concentrate
* **use disposable** plastic garbage bags for temporary storage of **pesticide-soiled** clothes before washing
* **wash protective clothing after you finish** spraying for the day