FARM SAFETY AND HEALTH NEEDS AMONG LIMITED RESOURCE FARMERS IN SELECTED COUNTIES OF NORTH CAROLINA

by

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(ABSTRACT)

The literature illustrates that agriculture continues to be the leader in the nation for accidents. The attitudes and behaviors of farmers and farm workers towards farm equipment and its safe use are major concerns. Farm safety education and research are strongly needed to prevent or reduce farm injuries. The primary purpose of this study was to investigate health and safety problems among limited resource farmers in selected counties of North Carolina. The survey method with a mailed questionnaire was used to collect the data. The sample for this study consisted of 297 limited resource farmers in North Carolina.

Selected conclusions drawn from the findings were:

1. The risks for limited resource farmers and their workers, associated with the use of tractors, machinery, and farm chemicals are very high.
2. Farmers between the ages of 36-50 have higher expected injuries compared to other age groups.
3. Training associated with the use of farm tractors, machinery, and personal protective equipment (PPE) is very essential for limited resource farmers.

4. The research suggested that hazards exposed by using tractors without rollover protection structures (ROPS) could result in higher injuries among limited resource farmers and workers.

Selected recommendations:

1. Federal and state governments should give incentives to farmers to encourage them to retrofit ROPS on their old tractors.
2. Mandatory training should be required for small scale or limited resource farmers on operation of farm equipment operation and personal protective equipment (PPE) utilization.
3. New designs of preventive guards and shields that can be easily removed or opened for maintenance and remounted or closed afterward are needed.

DEDICATION

To my father Ibrahim Ladan

Who died during my childhood

To my mother Mrs. Mariama Ibrahim

who started everything I have become today.

My Aunt Mrs. Marie Benjamin

whose untimely death occurred

while I was studying in Virginia Tech.

May her soul rest in perfect peace.

To my lovely wife Princella

who was very patience, and

unselfishly sacrificed her time

and pleasure to support me

spiritually, and morally throughout the journey

Finally, to my lovely God given daughter and

my best friend Mariama, who always gives

me her beautiful smile whenever I’m down.

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TABLE OF CONTENTS

Chapter 1

Introduction

American agriculture is extremely productive, but it has paid a price for that productivity. In the past, for example in 1940, 19 farmers produced food and fiber for 50 people. Today, however, each farmer produces food and fiber for 129 people (Farm Facts, 1995).

The emphasis on high production creates an environment of sophistication and intensity for farming practices. These practices consist of the use of machinery, computers, pesticides, and other means for obtaining high yields. Competition for high yields and quantity production strategies creates a hazardous work atmosphere for farmers. North Carolina agricultural workers suffer a large share of farm-related deaths, injuries, and illnesses compared to the overall American farm population (McLymore, 1992). The fatalities, injuries, and illnesses not only affect agricultural workers, but they pose an added burden for their families and communities. The fact that many owners/operators are not familiar with the proper use of agricultural machinery or current safety practices may contribute to the high rate of injuries and deaths caused by machinery and other agricultural activities. According to McLymore, (1992) the sources of agricultural income in North Carolina include the livestock industry; (Poultry, egg, hog, cattle and milk enterprises); special field crops (such as tobacco, peanuts, potatoes, cucumbers, and other vegetables); fruit (apples and peaches); aquaculture (trout and catfish); Turfgrass as well as traditional field crops (such as corn, soybeans, and cotton). It

is understandable that these commodities would have the most machinery and pesticide use.

The technical complexities of the machines used for farming require special information and/or training to be operated safely without posing a safety hazard to the operators or others. Health and safety information concerning agriculture is needed by agricultural workers and operators to provide for safer operation. The current agricultural health system can be expanded and integrated allowing agricultural professionals, producers, and workers in North Carolina to become better informed and to make it possible for all sectors of the agricultural community to access needed health and safety information from the many sources available.

Agricultural work poses many safety hazards related to the use of tractors, harvesters, loaders, irrigation, and other machinery. Health hazards include heat stress, bee stings, snake bites, dust, and airborne allergens.

Farm workers are frequently under pressure to perform hazardous jobs in the least amount of time possible. Sometimes, family members or employees are expected to perform these jobs with little or no experience or instruction on proper procedures.

Both limited educational background and economic factors have likely contributed to the high injury and fatality rates in agriculture. Occupational Safety and Health Administration (OSHA) regulations, which have been generally successful in reducing the injury and fatality rate in the industrial sector of the economy, have had less impact on agriculture largely because farms with fewer than 11 employees are exempted from these safety regulations (Purschwitz & Field, 1990). Thus, what is typically thought of as

"limited resource farms or family farms" are mostly unaffected by these regulations. Without OSHA or a similar supervisory body, many potentially hazardous conditions will remain either unrecognized or unattended on farms.

Statement of the Problem

Agriculture is one of the most accident-prone industries in the United States. Injuries in farming range from cuts and scrapes to total disabilities and fatalities. In 1990, the annual occupational injury incidence rate per 100 full-time workers in production agriculture was 12.3 on farms employing 11 or more workers compared with 8.3 per 100 for all industries in the private sector (Runyan, 1993). Runyan also found that the occupational fatality rate in the agricultural industry was 28.3 per 100,000 full-time employees compared with 4.3 for all private sector industries.

From November 1989 to March 1992, about 150 farmers lost their lives in farm related injuries in North Carolina (McLymore, 1992). The Farm Injury Project, which operates in six eastern counties in North Carolina, reported that the occurrence of injuries/illnesses remained almost constant for 1992 and 1993 (128 and 127, respectively). Although injuries declined (from 123 to 104), illnesses increased (from 3 to 19), and fatalities doubled (from 20 to 40). Most injuries were the result of farmers being struck by vehicles, machinery, or objects. Only two deaths were reported from chemical exposure in 1991 (McLymore, 1992).

Farming presents unique safety problems not found in most other industries. The National Coalition for Agricultural Safety and Health (1989) found that nearly half of the 170,000 disabling farm injuries each year resulted in permanent impairment costing an

estimated $2.5 billion in hospital and rehabilitation expenses. Agricultural worker deaths may be underestimated because many farm workforces have fewer than 11 workers and are therefore not identified by a national data system. Most workforces of limited resource farmers include family members, and there is very little literature available that reports their farm injuries and illnesses. Some agriculturists criticize national data sources because they do not sufficiently identify the number of farm accidents, especially among under-represented groups. Efforts to monitor farm injuries and illnesses have also been hampered by the lack of adequate data to identify the populations at risk.

The National Safety Council (1987) estimated a rate as high as 51.1 deaths per 100,000 for agricultural workers, with tractor accidents having been identified as the leading cause of deaths and disabling injuries on farms (National Coalition, 1989). The nature of farming creates an environment conducive to accidents and illnesses. Farm workers are aware of the dangers of farming, but they make decisions that under more ideal conditions would have be considered dangerous. Runyan (1993) found that the home and work site are the same location for most farmers, and this environment allows family members the potential for greater exposure to hazards associated with machinery, tools, and chemicals. Also, little emphasis has been placed on researching the chronic effects of long-term exposure to pesticides and other farm chemicals, which could cause illnesses to limited resource farmers.

A ready source of labor for limited resource farmers is the family. These family members are often children who perform dangerous tasks. According to Purschwitz (1990), "Between 175 and 300 children die in farm accidents each year, and thousands

more are seriously injured" (p. 1). A study of Iowa farm families highlighted three major safety issues related to youth: (a) less than 40% of the children who operated equipment were supervised; (b) about 30% of the children more than 3 years old played alone in work areas, and (c) 80% of the children played near machinery in operation (Hawk, 1991).

Ford (1993) found that most of the limited resource farmers in Tennessee had less than a high school education, and two-thirds were full-time farmers. These farmers received little formal safety training and most training was learned on the job, largely by trial and error or through word of mouth from the farm equipment and supply dealers. Ford (1994) also found those Farm Magazines, the Cooperative Extension Service, and local equipment dealers were the most frequently used sources of safety information.

The U.S. Environmental Protection Agency's 1992 worker protection standard for pesticides covers every agricultural employer and makes few exemptions for farm owners and family members. The standard extends employer requirements for training workers who handle pesticides, protecting workers from exposure, and providing emergency assistance to exposed workers.

Khan (1978) found there was a likelihood that accident frequency would be minimized if the operators used proper safety devices. With regard to well being, 48% of farmers became worse off financially after farm accidents and they had to turn to pensions in low-income categories. These disabled people are usually unable to protect themselves by any type of insurance. In addition to the physical and mental suffering associated with

agriculture- related injuries and illnesses, the economic costs from medical expenses and total loss of workdays are considerable.

The National Coalition for Agricultural Safety and Health (1988) identified the major occupational injuries and diseases of farmers and farm workers. These included traumatic injuries and deaths, acute and chronic diseases, respiratory diseases, cancer, toxicity, dermatitis, musculoskeletal syndromes, noise-induced hearing losses, and mental diseases.

Research conducted by North Carolina Agricultural and Technical State University revealed that the incidence of farm accidents was higher for poorer farmers (Khan, 1978). It is therefore a logical premise that the incidence of farm-related accidents might be higher among limited resource farmers. This could be explained by the limited resource farmers' inability to pay for regular maintenance and repairs on farm machinery, a leading cause of farm accidents. A higher incidence of accidents among limited resource farmers might also be explained by their lack of awareness of the long term effects of over-exposure and inappropriate application of agri-chemicals, as well as poor maintenance and preparation schedules for farm machinery. A limited resource farmer would also be less likely to sacrifice his/her work schedule to attend a safety demonstration, unless the safety demonstration could improve economic returns to the limited resource farmer's farm.

It is common for an entire family to participate in farm labor. Children less than 16 years of age comprise 25% of the farm workforce. Seventeen percent of all farm operators are over the age of 65. Individuals in both of these age groups have a disproportionate number of work-related injuries per hour of work exposure.

Agricultural activities with hazardous potentials are not much different from other high-risk human activities. However, the hazards of agriculture with variable conditions of exposure are more difficult to control. Unlike other industries, farm activities are carried out under adverse environmental conditions such as rain, ice, snow, and mud. Agricultural workers, who may have inadequate training for the job, usually work with a minimum of supervision over an extended length of time while being subjected to stress, fatigue, and pressure to complete work.

Purpose and Objectives

The purpose of this study was to investigate the farm safety and health needs among limited resource farmers in selected North Carolina counties. The specific objectives of this study were as follows:

1. Identify accidents and illnesses among limited resource farmers;
2. Identify variables associated with farm injuries which have impact on the frequency and severity of injuries; and
3. Identify safety-training needs for limited resource farmers.

Limitations

This study was limited to the following counties in the State of North Carolina: Bladen, Columbus, Halifax, Stokes, Washington, and Yancey.

Terminology

Every field of knowledge has its own specialized terminology. Terms that have very simple meanings in everyday usage often are different and complicated when applied in a specialized field. This study will use the following terms as defined by agencies such as United States Department of Agriculture (USDA) and the Occupational Safety and Health Administration (OSHA).

Farm-Related Accidents A farm-related accident refers to an event or occurrence that results in injury or death of a person(s) or damage to property. This study concentrates only on those farm accidents that result in injuries. Damage to property was not included because the economic consequences were not considered significant. To qualify as a farm accident, an injury during working activities must occur on farm property. Incidents occurring inside the farmhouse or on public roads and highways are excluded.

Farm. A farm is a place consisting of 10 or more acres of land and selling $50 or more of agricultural products annually, or consisting of less than 10 acres and selling $1,000 or more of agricultural products annually (North Carolina State Statistical Abstract, 1994).

Agriculture. The term agriculture, used by the National Safety Council, includes not only production of crops and livestock (farming) and agricultural services, but also forestry (excluding logging), and hunting.

Hazard. A hazard is a condition that may create or increase the probability of a loss or accident. Hazards associated with farm work include, but are not limited to, risks of use of farm chemicals, exposure to silo gas, farm tractors and machinery, hazards related to grain bins, hazards resulting from weather, physical and emotional stress, extra riders, and hazards from use of electrical equipment.

Farm Injury. An injury is the harm done to the person's body by an external agent, such as a chemical, animal, equipment, machine, tool, or other material, device, or energy source. An accident may or may not result in an injury; a person may fall and not be injured. Injury and accidents are often used synonymously by many occupational safety and health professionals. This study will treat them synonymously.

Limited Resource Farmer (LRF). A limited resource farmer is defined as an individual who earns his/her livelihood from farming and has a yearly gross income of less than $50,000 in agricultural sales (Steel & Perry 1992).

Summary

Agriculture is one of the nation's most dangerous occupations. Agricultural work poses many safety hazards related to the use of sophisticated farm equipment. The technical complexities of the machines used for farming require special information/training for safe operation.

Injuries in farming range from cuts and scrapes to total disabilities and fatalities. North Carolina agricultural workers, like those nationwide, suffer a large share of deaths, injuries and illnesses compared to workers in other professions. Often farm owners and operators are not familiar with the proper use of agricultural machinery or with effective safety practices.

Ford (1993) found that most limited resource farmers in Tennessee had less than a high school education. It is common for an entire limited resource farm family to participate in farm labor. Children less than 16 years of age are frequently working on the farm. Unlike other industries, farm activities are carried out under adverse environmental

conditions. The health hazards not only affect the agricultural workers but also impose an added burden on their families and communities.

Based on the foregoing discussion, it is important to conduct research on the topic identified. It is equally important to be able to solve the numerous problems identified with educational programs. The next chapter will discuss related literature and research about farm injuries and illnesses, classification of farm injuries, and cost of accidents and loss of output due to the accidents.

CHAPTER 2

Literature Review

There has been extensive research conducted and reported on the general topic of farm safety and health needs. That research is reported in this chapter under the major headings of Farm Accidents and Illnesses, Causes of Farm Accidents and Illnesses, Variables Associated with Farm Injuries, and Safety Training.

Farm Accidents and Illnesses

Classification of Farm Injuries

The costs associated with an injury depend upon the severity of the injury and the type of accident. The National Safety Council (1982) classified injury severity as slight, severe, permanent, or fatal. A slight injury indicates minor cuts, sprains, and or burns that require no or minor medical treatment. Severe injury involves, among other things, a broken bone, cut ligament or tendon, sprained back, and major burns. A permanent injury includes amputation or loss of a function of body component. A fatal injury is one that results in a death. This classification of injury severity was used in the national standardized farm accident surveys sponsored by the National Safety Council in the 1970s and early 1980s.

Cost of Farm Accidents

Accidents may cause injury or even death to people. The National Safety Council (1991) reported that accident costs in the United States totaled at least $173.8 billion in 1990, of which $63.8 billion resulted from work-related accidents based on the 1982 National Safety Council data.

Suffering

Accidents create discomfort for the accident victims and the members of their families and friends. The aggregate suffering incurred by these individuals is the social cost of the accidents. The type of suffering considered in this literature review is that which is associated with the impact of the accident itself. Suffering due to a loss of real income is discussed below.

Direct Loss of Output

Farm accidents result in a loss of output if the quantity or productivity of natural resources, human resources, or man-made resources are reduced as a result of their occurrence. Consequently, there is a reduction in the quantity of "goods" (farm production) which would be available to society. The loss of these "goods" or, more fundamentally, the utility derived from them is the social cost of the accidents.

Indirect Loss of Output

Farm accidents result in an indirect loss of output if resources are diverted away from the production of other "goods" into the accident environment. These resources may be used within the accident environment to reduce human suffering; to prevent damage to factors of production or farm output; or to repair or replace natural, human, or man-made resources which are damaged in the accident. Resources used to reduce human suffering and to "repair" labor include emergency services, which take the victims to the hospital and medical services, which treat their injuries. In any particular accident, labor may be hired to replace that which has been injured. Resources may be used to repair equipment or produce replacement equipment. Alternative equipment may be rented as a temporary

replacement for equipment, which have been damaged and are undergoing repairs. The indirect loss of "goods" or, more fundamentally, the utility derived from them resulting from using resources to deal with the effects of accidents is a cost to the society.

Medical Treatment

The costs of medical treatment may include first aid, ambulance service, hospital emergency room treatment, hospital stay (both regular and intensive care), physician and surgeon charges, special laboratory tests, X-rays, prescribed drugs and other medicines, and other forms of medical care (Robbins, 1976). Injuries result in significant losses to the victim in terms of medical cost and lost work time. According to the North Carolina Medical Database Commission (1990) and the North Carolina Department of Labor (1988), hospital stays averaged 6.6 days and cost $8,184; lost workdays averaged 22 and cost $880. These costs may be borne in part by insurance, but they still place a financial burden on the worker's family.

An Iowa Agricultural Accident and Illness Study (1975) reported that medical expenses contributed the largest single dollar amount to the total cost of accidents. The average cost of medical care for an accident was $2,800.64, including an average hospital stay of 14 days. The maximum medical expense was $10,755. Average property damage was $44.63 with $3,000 being the maximum. The cost of replacement labor was $19.44 per accident. The average cost per accident when the three factors of medical expense, property damage, and cost of replacement labor were considered was approximately $346 (Bubolz, Kennedy, & Hull 1977). Although today prices are higher than the above.

Replacement Labor Costs

Replacement labor costs include training new workers (Bird & German, 1966), loss of efficiency while an experienced worker is injured and replaced by a less skilled substitute (Naquin, 1975), and extra insurance for replacement workers. In most cases it is very difficult to find suitable replacement labor.

Environmental Hazards in Agriculture

Agricultural workers are exposed to a tremendous variety of environmental hazards; more than any other occupational group (Moses, 1989). The agricultural workplace poses many hazards related to the use of chemical pesticides. Almost all crops grown in the United States are sprayed with chemicals for pest and weed control, the majority of which are toxic materials that pose both acute and chronic health problems to exposed farmers and their workers.

The number of farmers and workers in the United States affected by pesticide exposure is unknown (Wasserstrom,&Wiles 1985). According to Marion Moses (1989), there were annual incidences of 135 cases per 10,000 population of emergency room visits and hospitalizations for pesticide related illnesses reported during the 1984-85 crop season. Medical experts and others stated that many poisonings of farmers and all workers occurred through skin absorption of pesticide residues on crops they were picking (Midtling & Bernett 1984; Moses, 1989; Peoples, 1978; Saunders, 1987). These experts believed that most of the chemicals were organophosphate pesticides.

Little is known about the extent or magnitude of chronic health problems related to occupational exposure to pesticides. The great majority of farmers/workers do not know the name of the pesticides to which they are exposed or the acute and chronic risks to their health. Lack of record keeping and the failure to document exposures and illnesses are reasons that farmers/workers population-based scientific data are not available on the extent of chronic health problems in farmers/workers from pesticide exposures.

Increased risk of malignant lymphoma has been found in farmers in California (Stubbs, 1984), Iowa (Burmeister, 1981, 1983), Minnesota (Cantor, 1985), Utah (Schumacher, 1985), Wisconsin (Saftlas, 1987), and New Zealand (Pearce, 1985), and in grain mill workers (Alvanja, 1987).

A case study in Kansas found increased risk of non-Hodgkin's lymphoma in farmers who used herbicides more than 20 days a year; an even higher risk was found for farmers who frequently mixed or applied herbicides themselves (Moses, 1989).

Increased risk of leukemia has been found among the farmers in Iowa (Burmeister, 1981, 1982) Nebraska (Blair, & Thomas 979), North Carolina (Delzell, 1985). Other cancers found to be related to pesticide use include lung cancer, cancer of gastrointestinal tract, brain cancer, and testicular cancer.

Respiratory problems are another hazard agricultural workers face. Workers in poultry buildings can be adversely affected by contaminants in the interior air, including toxic gases, dust, allergens, and airborne endotoxins (toxic substances carried within airborne bacteria). Toxic gases include ammonia, methane, hydrogen sulfide, carbon

dioxide, and carbon monoxide. Health problems resulting from respiratory exposure to these contaminants may be chronic.

Another environmental hazard in agricultural occupations is exposure to excessive noise levels. Farmers may suffer disproportionately from work-related hearing loss. In a study Dan M. Hair (1991) conducted in Wisconsin he found that both male and female farmers showed a greater percent of hearing loss than did the non-farm population. The study also found that 25% of farmers had hearing loss that interfered with communication by the age of 30 and had a 50% hearing loss by the age of 50. Chronic exposure to high levels of noise may lead to permanent hearing loss. The major sources of noise are tractors, swine, and poultry. Farm tractors are a major producer of noise because their exhaust is usually funneled through a pipe, which sits directly in front of the tractor operator. Hair (1991) concluded that these losses occur because the majority of farmers do not wear ear protectors during operation. In some states, the majority of tractors do not have cabs to help reduce the noise level to which the operator is exposed.

Stress

Farmers, farm-workers, and family members have a high rate of work-related stress. Stress is a physiological and psychological response to elements in the environment. Causes of stress include fear of overloads or under loads, lack of control, ambiguity, and major life changes (Robinson, 1982). In farming, fear in the form of anxiety and worry helps to produce stress related conditions. These fears arise from unstable weather conditions, such as flooding, crop wash away, or drought. Worker overload occurs during the peak period when help is short and the workload is heavy. Outbreaks of insects

and diseases among crops and animals is another concern contributing to some forms of mental and economic stress. Most of the time it is very difficult for farmers to make safety decisions under stress.

Section Summary

The agricultural workplace poses many hazards related to the use of chemical pesticides. Little is known about the extent of chronic health problems related to occupational exposure to pesticides. Based on researchers' observations, these hazards occurred because farmers usually repair their own equipment and are exposed to varieties of solvents and fuel (Martinez, 1995).

Farmers are at high risk for respiratory disorder from agents in their work environment. These include inorganic and organic dusts, chemicals, and infectious agents that affect the respiratory system.

Causes of Injuries and Illnesses

Accident Causation Theory

To many people, accidents are generally considered an inevitable part of life. These are things to be dealt with once they occur, but they cannot be prevented. The prevalence of this philosophy has diminished, yet it is not uncommon to hear that some highly educated people still consider accidents as "acts of God," "part of life," "part of the job," "luck," or "chance." Haddon (1964) chastised such thinking by stating that such "Folklore of accidents is perhaps the last Folklore subscribed to by rational men" (p. 25). Greenwood and Woods (1919) showed that accidents do not happen randomly or by chance. This was substantiated by Newbold (1926) who stated that "The unequal liability theory (accident) .

. . is in all cases a great improvement on Poison's (pure chance). It is still far from a very good fit in some cases, but . . . on the whole is fair" (Report No 34). Many researchers used the work of Greenwood and Woods (1919) and Newbold (1926) to develop the theory of accident proneness. For example, Lykes (1954) pointed to the fact that 20% of the operators are responsible for most of the accidents. "The only possible explanation (for accidents), assuming they could have been avoided, is that, unconsciously the victims wanted them" (Report No 4, 1919). From this point of view, Worick (1975) classified accident causes into five categories: Inadequate knowledge, insufficient skills, environmental hazards, improper habits and attitudes, and unsafe behaviors.

The above discussion is based on accidents in general or industrial accidents. While the physiological and psychological characteristics of agricultural workers may or may not be similar to those of other populations, the environmental factors associated with agricultural work are unique. Murphy (1980) pointed out that hazards are brought on by nature (weather conditions) and intertwined with the physical hazards (machinery, animals, and others).

Unsafe Behaviors

Many analysts of accident causation in past years have concluded that unsafe behaviors are the major reasons for the majority of the accidents (Murphy, 1993). The occurrence of an injury invariably results from a complete sequence of events; the last one of these being the accident itself. The accident in turn is invariably caused or permitted directly by the unsafe behavior of a person. Unsafe performance includes such acts as working under raised hydraulically operated farm equipment, starting machinery without warning, and

removal of safeguards. Mechanical or physical hazards include conditions such as an unguarded "V" belt or chain in harvester or power take-off shaft of a tractor; or insufficient light; which can result directly in accidents when transporting farm equipment on the highway at night. A study of motor vehicle accidents in Texas reported that 6% of the fatalities were due to road defects, 3% to vehicle defects, and 91% were attributed to driver actions or behaviors. Behavior has been identified as a major contributor to accidents, and modification of behaviors has been a primary focus in accident reduction.

One major aspect of behavior modification has been to change unsafe behaviors through various educational measures. Much of the emphasis in safety education has been placed on changing attitudes. Schroder (1980) stated that "the achievement of safety may be understood developmentally as the evolvement of more mature safety attitudes that are expressed in the search for safer environments and the reduction of unsafe behavior acts" (p. 219). The National Safety Council (1983) indicated that attitudes are important to safety in a place of work. Worick (1975) has written that everything known about accidents leads to the conclusion that faulty habit and attitudes are the prime accident producers. He also noted that attitudes are the most important factors among knowledge, skills, habits, and attitudes. Murphy (1981) found no significant differences in the attitudes of farmers in different states by age toward various farm safety behavioral concepts in relation to accident involvement.

Causes of Farm Accidents

Tractor accidents continue to be the most frequent cause of farm fatalities, with tractor overturns being the primary source. But there are other contributing factors that include:

a. Operation on uneven terrain where control is lost,

b. Lack of rollover protection structure (ROPS),

c. Failure to use seatbelts when ROPS does exist,

d. Inexperienced operators (including but not limited to children), and

e. Operator boredom and fatigue due to long work hours (Hair, 1991, p. 18).

According to Roberts and Berry (1982), job-related accidents can occur when one or more of the interacting elements (human, the work-related activity, and environment) are significantly out of balance for the requirements of the job being done. In a study of fatal farm accidents conducted in Wisconsin, Jensen (1980) found several primary human errors that contributed to 50 of 69 accidents in 1977. These factors or errors include carelessness, poor judgment, and lack of supervision, attitude, haste, fatigue, depression, intoxication, and stress.

Financial pressures also play an adversarial role in the farm safety picture. Older equipment may not have critical safety devices, which are required on new equipment.

McKnight and Hetzel (1987) used an epidemiological model to study the causes of farm-related accidents. The model consisted of three components: the host (human), the agent, and the environment. The human factors constitute only one of the determinants of farm-related accidents. Characteristics of human factors include age, gender, marital status, socioeconomic status, and physical condition. The agent in injury events is physical

energy in its various forms (chemical, thermal, radiation, and electrical). Environmental factors include variables in the biological, social, and physical environment not included in the host and agent categories. Some examples of environmental factors listed in the McKnight and Hetzel (1987) study were: presence or absence of shields on PTO, farm family stress levels, presence or absence of rollover protection structures (ROPS) on tractors. Overhead electrical lines near irrigation fields or the farmstead type of crops planted and weather conditions.

Each of the components (human, agent, and environment) is interrelated to the others. The occurrence of an injury is usually the result of some interaction of these components.

Farm Machinery Hazards

As discussed by Purschwitz and Field (1990), as well as Lethola (1993) tractor and farm machinery accidents are the most dangerous hazards that occur on the farm. The hazard usually contributes to the interaction of an accident. Therefore, when emphasis is put on human behavior in accident prevention, the important role of hazards, such as tractors without ROPS and unshielded power take-offs, should also be recognized.

Upper and lower extremity amputations are common in farm machinery accidents. These accidents are usually a result of entanglement with cutting bars, rotating shaft, V-belts, and augers. Injuries often occur on machinery where safety devices have been removed. Removal may occur during peak harvest operations or when time pressures to harvest the crop prompt operators to leave devices off after adjustment or repair. A Pennsylvania State University study (1996) showed that the mean age of tractors in Pennsylvania was just over 20 years, and less than 20% of tractors had any type of

rollover protection. The study also revealed that on a national basis, 30 year-old tractors are still commonly in use. Tractors are not only used for a very long time, but, over time, operator attention to original safety features declines. Consequently, safety devices tend to be neglected as part of regular tractor maintenance.

Tractors

Agriculture is different from other industries where there is uniform enforcement of safety device use (Cogbill,& Bush, 1985). Often farmers operate equipment with power take-off (PTO) exposed, and the safety feature removed. The ease with which the PTO shields are removed varies. Some are easily removed, and others are an integral part of the machine, which cannot be removed (Swanson, Sachs, Dahlgren, & Tingely, 1987). Most of the farmers think that permanent removal of the PTO shield makes it faster and easier to repair in the field, especially during the peak farm operation period (Stallone, 1989).

According to Practor (1991), a national study of tractor- related accidents from 1980-1985 reported that 7% of the fatalities involved the PTO shaft. In a Purdue University study, Payne (1989) found 32 farm fatalities to be linked to PTOs in the years between 1970 and 1986. Twelve of those fatalities occurred in the operation of stationary equipment, such as elevators, augers, feed grinders, post-hole diggers, and corn shellers; four occurred in the operation of semi-stationary equipment, such as auger-wagons, sprayers and forage-wagons; five occurred in the operation of non-stationary equipment such as manure spreaders and balers. The remaining PTO fatalities occurred when farmers

were engaged in powering other non-specified equipment. The victims' ages ranged from 7 to 75.

The full extent of farm injuries is unknown because a large number of them are not reported (Ownsby, 1990). Occupational Safety and Health Administration legislation was passed to protect the health and safety of all workers, but in 1976 an exemption was granted for limited resource or small farmers. The exemption applies to all farms with 11 or fewer workers (Kelsey, 1991). Because of this exemption, agriculture is uniquely different from other occupations (Kelsey, 1991, Moretz, 1989).

The people that would be affected by mandatory farm safety rules are also the people who face restrictions imposed by farm safety regulations. Moretz (1989) reported that farms with 10 or fewer workers comprise approximately 96% of all U.S. farms. According to Kelsey (1991), rules in production agriculture are much more difficult to enforce than in other occupations such as mining. Kelsey further explained that it is hard to justify the economic and political cost of enforcement because those farmers that primarily benefit from the regulations are the same ones that are most opposed to them and who least want them. The Federal Government has to do something because those that are exempted from mandatory safety regulations are suffering an inordinately large number of injuries.

In a study of agricultural trauma conducted over a six-year period, Cogbill and Bush (1985) found that PTO shaft entanglement accounted for 29 of the 375 injuries studied. Those injuries ranged from amputations, de-gloving, urogenital injury, to near strangulation. Most of these accidents were caused by operating machines while wearing

loose or bulky clothing. The clothing became entangled in rotating shafts that were poorly shielded. In addition to the death and injury rate, farmers often work alone in fields where no one can keep an eye on them. It is not uncommon for farmers to get entangled in machinery, be unable to free themselves, and to remain entangled until a member of the family notices they have not returned on schedule (Moretz, 1989). To compound the problem, farms are often in isolated areas where medical help is not relatively or easily available.

Grain and silage handling activities also cause a large number of farm fatalities due to PTO mishaps. Grain handling equipment is the second leading cause of machinery-related deaths (Etherton, etal 1991). It was reported that more than one-third of the deaths in the agricultural industry occurred in the crop production sector (Bobick & Hanz, 992).

A five-year grain handling safety study conducted by the National Traumatic Occupational Fatality (NTOF) had results from 50 states in which 236-grain and silage-handling deaths were identified. The people included in this study were at least 16 years old and reported as fatally injured at work. Of these 236 deaths, 113 of the cases (48%) were attributed to machinery, and the remaining 123 cases (52%) were attributed to non-machinery sources.

In addition to tractors and machinery, animals also contribute to a great number of farm work-related accidents. Every year, thousands of farm injuries, including some deaths, occur as a result of animal-related accidents. According to the Hetzel and We Zhao (1993) survey of farm accidents in the State of Virginia, animals were found to be the leading cause of accidents to farm workers during 1990. Furthermore, a report by

Hanford etal (1982) stated that animals were the most common cause of farm accidents in a 31-state farm accident survey. When farmers work with larger farm animals, such as cattle and horses, fatalities can and do occur. A report from Virginia farms pointed out that most injuries occurred during livestock treatment or handling (Hetzel, 1990).

Nationally, 53% of tractor fatalities during 1992 involved overturns (National Safety Council, 1993). The Iowa tractor fatality data for 1947-71, as reported by Wardele and Hull (1975), stated that 62% of the tractor accidents were due to overturns. During the three years of farm accidents study 1988-90 at Iowa State University, 90 overturned tractor accidents were reported. Overturns accounted for 58.6% of the total tractor related fatalities. Side overturns accounted for 82.8% of overturns, while 7.8% were rear overturns. According to the Iowa Agricultural Accident and Illness study (1975), wheel arrangement is an important factor in tractor accidents. Tractors with tricycle-type front wheels are more likely to roll over on hillsides due to the inherent instability of the wheel arrangement.

Professor Carpenter of the agricultural engineering department at The Ohio State University identified some of the factors causing tractor overturns: "turning at high speed; hitting an obstruction, engaging the clutch too quickly especially when pulling a load, and raising the drawbar incorrectly." Tevis and Finck (1989) stated that Indiana University figures showed that 62% of fatal farm accidents involved tractors and 82% involved tractors and other farm machinery, such as augers and PTOs". Among children fatally injured on the farm, the most common piece of farm equipment involved is the tractor,

with death usually resulting from overturns or interaction with the power take-off (Karlson & Noren, 1979).

Not Wearing Seatbelts

Many farmers believe that wearing seatbelts is an inconvenience, so most farmers do not use seatbelts (Proctor, 1991). With rollover protective structures (ROPS), farmers usually are injured in tractor turnovers only when they are thrown from the tractors. Indeed, failure to use seatbelts in the presence of ROPS is one of the factors contributing to tractor fatalities (Hair, 1991). According to Campbell (1990), since the ROPS became a standard component on tractors manufactured after 1985, there have been no documented cases of tractor rollover fatalities when seatbelts were used.

The increase in road travel of agricultural equipment has resulted in a greater number of collisions with motor vehicles. A 1992 survey conducted by The Ohio State University reported that a total of 970 highway accidents involving tractors occur each year in Ohio (Ben & Lawrence, 1992). A similar survey conducted in 1991 by Ottey and Finck (1991) listed road travel of agricultural equipment as an important safety concern. A 1991 study in Ohio showed that of the surveyed farms, 79% operate in multiple locations (Ben & Lawrence, 1992). Some farms are separated by as much as 80 km, and the cost of equipment prohibits owning a different set of equipment for each farm location. As a result, farm equipment is moved between farms.

Extra Riders

Tractors and harvesting equipment are designed for one operator. Unfortunately, many operators permit extra riders. Severe injuries, or fatalities, particularly involving

children, may occur when riders are allowed. According to Hair (1991), extra passengers usually sit on the fenders or stand on the drawbars. Purschwitz (1990) reported that some children sit on the operator's lap as they drive the tractors. Whatever position an extra passenger took, he or she was not protected and was vulnerable to accidents when tractors hit unexpected bumps or made sharp turns.

A study in Iowa on extra riders (Hawk, & Gay, 1991) of family farms found that the mean age at which children began riding tractors with an adult was 3-4 years. In another Iowa study (Hawk,& Gay, in press1991), it was revealed that over a third of the children under age five (39%) rode on tractors without cabs, and this percentage rose to 76% in tractors with cabs. For children aged 15 to 18, these figures were 51% and 57% respectively.

The 1992 Farm Accident Survey found that among the 5-14 year age group, "riding" accounted for a larger percentage of injuries than for any other age group (National Safety Council, 1982).

Robert Aherin, Murphy & Westaby (1992) of the University of Illinois reported that national accident data show that a lot of injuries and deaths occur when children fall off equipment while their parents are driving, especially on tractors without cabs. This happened because parents feel more in control, so they perceive less risk.

Hawk, Gay, and Donham (1991) studied a random sample of 208 Iowa farm families with 470 children under 18 to determine the threat extra riders on tractors possess. They found that the extra rider continued to be a big problem. Fifty-seven percent of those aged 15-18 accompanied adults in tractors with cabs, while 51% of this age group were

extra riders on tractors without cabs. The highest percentage (82%) of age groups riding in tractors, with cabs, was those 5-9 years old. More of this age group (58%) were also extra riders on tractors without cabs. Iowa Rural Youth Disability Prevention Project (1991) data show that parents who were surveyed estimated that children are capable of operating a tractor at the age of 12.7 although the mean of onset age of tractor operation for their children was 11.4 years.

Carelessly Unclogging Machinery

One of the most important rules of farm operation is that machines must be turned off before making any adjustments or repairs, or unclogging jams (Hair, 1991). Many times machinery safety devices are removed to make these repairs and adjustments; and with operators trying to make up for lost time, the devices are often not replaced (Hair, 1991). Failure to replace or maintain safety devices contributed to the potential for farm injury or death.

Farm machinery injuries are one of the leading causes of death and disability among farmers and farm youths. According to Moretz (1989), a farmer lost his little finger and his thumb was badly cut when he pushed a jammed gear without turning off the power to the machine. The accident caused the farmer to spend nine days in the hospital resulting in $15,000 in medical bills. This researcher witnessed a farmer trying to put a "V" belt on a combine harvester in the pulley groove with the power engaged and the PTO in motion. When asked why he was doing that, he replied that the "V" belt would go on faster. Many farmers have lost their fingers trying to avoid a five-minute delay.

Non-Machinery Injuries

In most non-machinery related injuries, a farmer was struck by or against an object. These types of injuries generally result in bruises or fractures to the head, leg, or hand. Most often these accidents occur while performing chores involving animals or treating animals (Hoskin, etal 1988). A Pennsylvania study revealed that the largest percentage of farm injuries occurred in barns (30%), fields (16%), barnyards (14%), and farm buildings (12%) (Huizinga & Murphy, 1987). Additional examples of non-machinery injuries include jumping from machinery, falling and lifting. Furthermore, according to Stallones (1989), there were large numbers of Kentucky farm children 5 to 9 years of age who drowned in farm ponds and others who died while playing with guns believed to be unloaded.

Section Summary.

Unsafe behaviors are the major reasons for many accidents. One major aspect of behavior modification has been to change unsafe behavior through educational measures. Tractor accidents continue to be the most frequent cause of farm fatalities. In 1992, fatalities from tractor overturns showed the highest rate nationally of all causes (National Safety Council, 1993). Tractor and farm machinery accidents are the most dangerous hazards that occur on the farm.

According to Prator (1991) a national study of tractor related-accidents from 1980-85 reported that 7% of all fatalities involved the PTO shaft. In addition, extra riders were vulnerable to falling when tractors hit unexpected bumps or changed direction.

Failure to use seatbelts in the presence of ROPS is one of the factors that contribute to tractor fatalities. Most non-farm machinery related injuries were striking by or against an object, drowning in farm ponds, and deaths of children from playing with loaded guns.

Variables Associated with Injuries

Many studies reported that the variable which contributed to the most farm accident occurrences and severity of injuries is hired workers (Hair, 1991; Roberson & McLymore, 1993; Williams, 1983). Other variables were age and gender of operator, hours of exposure to farm work, size of farm, and status of employment.

Hired Workers

Hired labor is used extensively in agriculture, and many workers are not aware of the potential hazards on the farm. A lack of knowledge about agricultural safety can contribute significantly to the higher rate in injuries and deaths from operating machinery.

Gender of Farm Workers

A farm accident survey in Nebraska which included 7,000 farmers on 1,764 farms (Schnieder, 1972) reported significant differences in injury rates by age and gender of injured workers. All male age groups, except 45 to 65 year-olds experienced more injuries than expected based on hours of exposure. Males aged 5 to 14 had the highest injury rates. Differences were also found among types of agricultural operations. Beef farms had a higher work injury rate than grain farms.

Size of Farms

Bubloz and Kennedy & Hall (1977) found that significantly more accidents occurred on farms of 200 acres and larger than on farms less than 200 acres. The researchers

suggested that the higher frequency on larger farms was largely due to increased work exposure, especially increased exposure to farm machinery.

Exposure to different hazardous environments will produce different likelihoods of an accident. McKnight and Hetzel (1985), Huizinga and Murphy (1989), and Piercy and Stallone (1984) showed in their studies that tractor without rollover protection structures (ROPS) have caused the most farm-related fatalities.

Hoff (1997) reported that accident rates per 100,000 workdays were higher for hired workers than for family members, based upon a survey conducted in New York. Male farm workers had a higher accident rate than females. Injury rates per 100,000 workdays were also found to be correlated with age of farm workers. Workers under the age of 15 had the highest rate of any age group. In addition, the inability to replace old and/or obsolete equipment, which may be prone to more frequent breakdowns and typically lacks newer safety devices, probably contributed to agricultural injury and fatality rates.

Age of Workers

Senior farm workers (workers over age 60) are a population of particular concern in terms of preventing injuries in production agriculture. Older workers represent a significant portion of the agricultural workforce and tend to remain active as primary sources of labor longer than their counterparts in comparable non-farm occupations. Approximately one-third of all farm operators are over 60 years of age (Bureau of the Census, 1989). Agricultural census figures indicate that the proportion of older farm operators is growing. In 1987, persons aged 65 and over represented approximately 21% of U.S. farm operators compared to 16% in 1978 (Bureau of the Census, 1989). Senior

farmers, like most agricultural workers, are at risk of sustaining serious tractor and machinery-related injuries. Senior operators, however, may be at additional risk due to normal physical and sensory deficiencies that come with aging. Evidence also indicates older farmers often do not recognize, or do not acknowledge, that they are susceptible to serious injuries.

Both ethnological data and empirical evidence indicated that senior farm workers are particularly vulnerable to work-related hazards. For instance, The National Safety Council (1995) reported that 17% of all work related-deaths in 1991, both farm and non-farm involved persons over 65 years of age. Occupational fatality data collected by the National Institute for Occupational Safety and Health (NIOSH) (Etherton, Myers & Bobick1994) indicated that agricultural worker' risks of experiencing a fatal injury increases with age. NIOSH researchers have reported a fatality rate of 26.5 fatalities per 100,000 agricultural workers aged 55-64, and 52.3 per 100,000 for farm workers over age 65. A study of Indiana farm fatalities found that 34% of work-related farm fatalities involved persons over age 60 (Purschwitz & Field, 1986). A review of the national agricultural injury data revealed similar trends in Pennsylvania (33%) (Murphy, 1991), Nebraska (27%), Iowa (27%), and Texas (26%) (Wilkinson & Field, 1990).

Research in the fields of behavior modification and health promotion has found that to impact people's behaviors, the underlying factors influencing a person's desire to adopt (or discontinue) targeted behaviors must first be addressed (Ajzen, 1985; Janz & Becker, 1984). Related research in health promotion and persuasive communication has identified factors affecting health and safety-related behaviors, including beliefs regarding personal

vulnerability, perceptions of hazard severity, the efficiency of preventive actions, and desire to avoid negative consequences, such as injury, pain, or financial loss (Maddux & Rogers, 1983; Petty & Cacioppo, 1986).

During the nine years between 1983 and 1991, 187 work-related farm fatalities were reported in Kansas. Of these, 40.6% were people of age 60 or older (Bradshaw, Krames, & Hacheister 1994). While the percentage of fatalities among people over 60 varied from year to year, according to the report, the highest percentages occurred in 1988 and 1991, 65% and 70% respectively.

In agricultural occupations, farmers and ranchers often do not retire at the age of 65. According to the 1987 Census of Agriculture, nearly 47% of Kansas farm operators are aged 55 or older with approximately 50% of these aged 65 or older.

Minors and Farm Accidents

The number of children dying from farm injuries each year is not precisely known. Rivara (1985) reported an average of 286 fatalities per year nationwide based on 1979-81 National Center for Health Statistics (NCHS). Field and Tormoehlen (1982) found an annual average of six farm fatalities among children ages 0-15 in Indiana based on death certificates. According to Field & Tormoehlen (1982), this figure represented 14.3% of all farm fatalities in Indiana. Tormoehlen (1986) found an annual average of 16 types of fatalities among minors in Wisconsin from 1970 to 1984, representing 28.6% of all farm work/worksite fatalities.

For tractor-related fatalities involving victims age 0-9, Karlson and Noren (1979) found an annual death rate of 4.1/100,000 for male farm children. Tractor runover (in

which the tractor runs over the victim) has the highest rate of deaths among children ages 0-4 at 2.25/100,000. Fatal falls from tractors due to extra riders with ages of 0-4 had a rate of 1.55/100,000. Also Baker (1989) reported that children aged 0-14 die in farm machinery accidents at 5-year national average rate of 0.2/100,000 (all children in the United States ages 0-14) with rates in some states as high as 0.9/100,000.

A study on farm injuries to children revealed that fatal farm injuries to children appear to occur during times of peak farm activity, particularly during planting and harvesting. Nationwide, Rivara (1985) found that fatal injuries to children ages 0-14 most frequently occur in May through October, with July as the peak month. Similarly, Salmi (1989) found that in Wisconsin the peak month for fatalities for ages 1-4 are June, July, and October, while June is clearly the peak month for ages 5-9.

There are many ways children are fatally injured on farms. In addition to accidents involving tractors and machinery, Rivara (1985) found causes of deaths among farm children included grain bin entrapments (Field & Bailey, 1977), exposure to toxic manure gases (Salmi, 1989), ATV accidents (McKnight & Hetzel, 1987), and firearms. Moses, (1989) reported that migrant workers are subject to the same potentially fatal hazards, including acute poisoning and work-related motor vehicle injuries when safety devices are removed during adjustments but never replaced.

Young (1978) found that 13% of 737 Ohio tractor fatalities involved extra riders; 73% of those extra rider victims were under the age of 10. He also found that in 42% of these fatal situations, the operator was a father or brother; in 24% of the situations, the operators were of ages 11-15. A study of fatal farm-related injuries to children nine years

of age and under in Wisconsin and Illinois from 1979 to 1985 was conducted by Salim (1989) using death certificate data. It was shown that the average annual death rates in the study populations were 3.2/100,000 in Wisconsin and 1.5/100,000 in Illinois. The study also found that the death rate was substantially higher for boys than for girls. Machinery was the source of more than one-half of the injuries in Wisconsin and Illinois during the period of the study (Salim 1989).

Section Summary

Many factors contribute to the injury problems on the farm. Among these are extended working hours of up to 18 hours per day, seven days per week during peak production periods. Many diverse tasks are performed under a variety of conditions. Economic factors may also play a role as farmers choose to disregard safety equipment which they deem to be cost prohibitive. A limited resource farmer with little revenues may be forced to retain older equipment that may lack safety devices.

Accidents create discomfort for the victims and result in an indirect loss of output. Hence, resources are diverted. In North Carolina, hospital stays average 6.6 days and cost $8,184.00 (North Carolina Medical Data 1990).

Safety Training

Safety Training Needs Among Limited Resource Farmers

To ensure protection against undue risks, agricultural workers need to be fully trained about agricultural health and safety education programs consisting largely of safety information about hazards and the means to avoid them. This approach has succeeded in

creating safety awareness. However, it seems to have relatively little effect on changing behavior associated with safety. According to Murphy (1993), the assumption that attitude and behavior changes can be accomplished simply by providing information is simplistic and perhaps invalid. Murphy maintained that recent studies showed that farmers do not follow recommended tractor safety practices including the 78% of 209 farmers that did not have fire extinguishers on their tractors and the significant percentages of parents who believed that it was safe for their children to ride on farm tractors.

Learning to Work

From this researcher's experience, learning on the farm is passed down from parents to children in a form of hands on, on-farm experience starting mostly at an early age. Many farm children received their first tractor ride by sitting between the legs of their parents, looking through the steering wheel. By the age of 10 many farm boys and girls can move tractors through gates or drive across the field by themselves. At age 13, chores requiring operation of a tractor and doing some field work are common.

Training in the safe operation of a tractor and attached equipment during the youth's initial learning period is, at worst, nonexistent and, at best, woefully inadequate. Adults often believe that simply telling the children how to do something and then monitoring them for a few minutes is adequate instruction, especially if the children have no immediate problems.

Many parents have allowed their mentally immature children to work in a hostile environment and operate dangerous machinery. They received little or no safety education at the beginning of their working experiences when it is most important. Moreover, the

only role models most of the children had are other adults who model unsafe behaviors. As a result, unsafe acts and unsafe behaviors can become firmly entrenched as a common way to work by the time youthful workers reach their adulthood.

Efforts must be made through education to inform both farm owners and workers of the potential hazards that farm operations pose to them. Farm workers must be taught to recognize the dangers they may face and must be trained in safe work practices. In the State of North Carolina, there are no uniform standards for farm safety education programs.

It is not known how effective safety education has been. Until an adequate evaluation or surveillance mechanism is developed, it will be difficult to measure the impact of farm safety education for farmers.

As part of on-going efforts to reduce farm accidents, it is now mandatory in the State of Virginia for minors of 14-15 years of age to undergo certificate training before they can operate tractors. Hetzel and Burke (1996) developed a new curriculum that will be used for training extension agents and agricultural education teachers. The agents and teachers are responsible for training the minors on safe tractor operation and other farm equipment. Enrollment in this program is open to every minor.

Section Summary

Agricultural production requires proper operation of equipment and accessories to avoid injuries and deaths. There are several safety practices needed for intervention. A review of literature found that educational training, changes in attitudes, and behavior

changes are necessary. Also, proper training for farm children is extremely important to avoid injuries and deaths.

Chapter Summary

Unsafe behaviors are the major reasons for the majority of farm accidents. Unsafe performance includes such acts as starting machinery without warning, driving a tractor at night without adequate light, and removing of safeguards. Behavior has been identified as a major contributor to accidents.

In addition, tractor overturns have the highest potential for unintentional injuries occurring on the farm. Farm machinery continues to be the single most important causative agent involved with childhood fatalities on the farm. An additional agent of farm accidents include trucks and other vehicles, power tools, and hand tools.

Accidents that occurred frequently include falls, jumps, and lifting. Grain and silage handling activities also cause a large number of farm fatalities due to PTO mishaps. A report by Hanford etal (1982) stated that animals were the most common cause of farm accidents in a 31-state farm accident survey.

Farming is subject to a host of occupationally related diseases, such as respiratory ailments, cancer, and pesticide poisoning. Farm workers live in homes surrounded by fields that are heavily and repeatedly sprayed. The number of farmers and farm workers in the United States affected by pesticide exposure is unknown. A lack of knowledge about agricultural safety can contribute significantly to the high rates in injuries and deaths caused by operating machinery.

CHAPTER 3

Research Methodology

This chapter describes the research design, population and sample, instrument construction, data collection procedures, and data analysis used for this study.

Research Objectives

The purpose of this study was to investigate the farm safety and health needs among limited resource farmers in selected North Carolina counties. The specific objectives of this study were as follows:

1. Identify farm accidents and illnesses among limited resource farmers;
2. Identify factors associated with farm injuries which have an impact on the frequency and severity of injuries; and
3. Identify safety training needs for limited resource farmers.

The review of related literature and research illustrated that the majority of research associated with farm safety has been directed toward exploring the impact of farm safety practices on large farms and medium agricultural production procedures. Most of the earlier findings have shed some insight on farm safety practices with regard to large agricultural producers. However, some of the findings are conflicting and therefore suggest the need for further study.

There is also a need to develop baseline information regarding farm safety among the population of limited resource farmers. This study is specifically designed to explore safety and health issues on such farmers; it is also intended to determine the magnitude of farm-related injuries and illnesses among limited resource farmers.

For this research to be conducted appropriately, it was necessary to obtain primary data involving limited resource farmers. This data can be gathered by using different methods: observation, survey, laboratory experiments, and simulations (Isaac & Michael, 1995). The survey method was used in this study because it enabled the researcher to acquire the necessary information (at an acceptable degree of accuracy) with a minimum inconvenience to the participants. According to Isaac and Michael (1995), "a survey may be conducted in several different ways: (a) survey of records, (b) mail questionnaires, telephone survey, group interview, and (c) individual interview" (p. 138). Because of time and financial constraints, the questionnaire method seemed most appropriate to obtain suitable data for this study.

Population and Sample

To obtain a sample for this study, it was necessary to first define the population. This included identifying characteristics, which the members of the sample had in common and which identified each unit as being a member of this particular group. For 26 of the 100 counties in North Carolina, more than 90% of the farmers were considered limited resource farmers. It was from six of these 26 counties that the population for this study was selected. The six counties chosen were Bladen, Columbus, Halifax, Washington, Stokes, and Yancy. Note Appendix B showing a map of the counties. These counties are located in six of the seven North Carolina Cooperative Extension Districts. The total population for this study was 620 limited resource farmers. Note Appendix A shows population of limited resource farmers by county, and number of farmers in each sample.

Sampling Procedure

According to Van Dalen (1979), sampling does not consist of collecting data casually from just any conveniently located unit. To obtain a representative sample, one systematically selects each unit in a specific way under controlled conditions. The four steps suggested in this process are (a) specify the sample unit, (b) specify the sampling frame, (c) specify the sample size, and (d) specify the sample plan (p. 128).

Determining the Sample Size

According to Churchill (1976), the question of a sample size is a complex issue since it depends on, among other things, the type of sample, and the time, money, and personnel available for the study. Based on these considerations, Churchill concluded that no specific rules on how to obtain an adequate sample can be formulated because each situation presents its own problem. For this study, a total sample of 297 limited resource farmers was the number used, with at least 10% in the sample frame in each county.

Kerlinger (1973) recommended as large a sample size as possible be used to effectively utilize the principle of randomization. Also, Borg and Gall (1971) "indicated that the larger the sample, the greater the probability that the mean and the standard deviation will be representative of the population mean and the standard deviation "(p. 123). Moreover, the larger the sample, the better for the researcher to obtain results which actually represent the population and Isaac and Michael (1995) recommended as minimum required, of 351, for 5% error.

Sample Selection

Because 80% of the limited resource farmers are concentrated in six North Carolina Extension Districts, the counties in these districts were selected to ensure a representative number of respondents. The first stage consisted of a stratified random sample in which counties were ranked by per capita income, and a random selection made from the lower quintile of the distribution. The second stage consisted of a random sample from the counties within each extension district whose farming population consisted of more than 90% of limited resource farmers. The county extension agent in selected counties provided an accurate and updated list of all limited resource farmers within the county. From these lists, a random sample was selected for the survey.

Questionnaire Construction

An instrument jointly designed by the Center for Disease Control (CDC), and North Carolina A&T State University Survey Research Laboratory (ASRL) was used as a basis for this study. However, the questionnaire was modified and field-tested in Virginia. The survey instrument measured quantitative items and also operator's attitudes about farm safety. The questionnaire variables were in operational form to permit analysis.

The questionnaire gathered data concerning the following:

- numbers, severity, cause, source and effects of farm accidents/illnesses occurring to Limited Resource Farmers (LRF);
- Identification of victims (children, workers, farmers, etc.);
- medical/health care provided, and economic outcome as a result of injury;
- the LRF knowledge of safety when using machinery/agricultural chemicals;
- characteristics of the farms; and

- Other socio-economic indicators.

Field Test

The researcher modified the instrument for this study since it was necessary to field-test the instrument for its readability and validity. County extension agents associated with Virginia State University gave the instrument to the farmers. Eleven Virginia limited resource farmers completed the field-test instrument as part of its development.

Validity and Readability

Validity information indicates the degree to which the test is capable of achieving a certain result. Validity "refers to the appropriateness, meaningfulness, and usefulness of the specific inferences made from test scores. Test validation is the process of accumulating evidence to support such inferences "(American Psychological Association, 1985, p. 90). Content validity was established by having an expert from Virginia Polytechnic and State University and North Carolina Agricultural and Technical State University to review the proposed instrument and recommend changes. Dr. F. Walson previously used this survey instrument in a telephone survey for limited resource farmers. Because the current study was designed to be self-administered, readability was a major concern. The expert reviewed the instrument prior to field-testing. The field-test was conducted with Virginia limited resource farmers. Both the expert and the test subject determined that the instrument readability be accepted.

Data Collection

The mail survey method was used to collect data from the limited resource farmers in selected counties, which were identified by the county extension personnel in North Carolina. The instruments were sent with a letter asking for participants to complete the farm safety survey (note Appendix C & D). A key holder was included in the initial mailing as an incentive. A follow-up post card was sent to all subjects after three weeks (Appendix E). Another letter was sent to non-respondents after 10 days asking for a response (Appendix F). Comparing the mean differences of controlled non-response error of early and late responses.

Analysis of Data

"The descriptive research technique seeks to find answers to questions through the relationship of analysis of variables. This technique is also concerned with summarizing and describing numerical data. These methods can either be graphical or involve computational analysis" (Kazmier, 1976, p. 3). Cross-tab will be use to determine descriptive statistics, frequencies, and cross-tab was use to analysis the data.

Summary

This chapter describes the research design, population and sample, instrument construction, data collection procedures, and data analysis used for this study. The instrument was partially taken from the instrument jointly developed by the Center for Disease Control, (CDC) and The North Carolina A&T State University Survey Research Laboratory (ASRL). A number of items were modified to include additional safety

concerns. The questionnaire was field-tested in Virginia for content validity and reliability. Descriptive statistics were used to analyze the data.

Chapter 4

Data Analysis and Results

The purpose of this study was to investigate the farm safety and health needs among limited resource farmers in selected counties in the State of North Carolina. The specific objectives that guided this study were as follows:

1. Identify accidents and illnesses among limited resource farmers;
2. Identify factors associated with farm injuries which have impact on the frequency and severity of injuries; and
3. Identify the safety training needs for limited resource farmers.

Descriptive research techniques seek to find answers to questions by describing the situations. The frame of the study consisted of 620 limited resource farmers from the following selected counties of North Carolina: Bladen, Columbus, Halifax, Stoke, Washington, and Yancey. A total of 297 responses were received and deemed useable. The SPSS statistical package for personal computers and descriptive statistics were used to analyze the data.

The instrument was developed utilizing experts from Virginia Polytechnic Institute and State University and North Carolina Agriculture and Technical State University (Appendix D) to establish validity and readability. The instrument was pilot tested on Virginia limited resource farmers.

The research findings of this study are divided into three major sections. The three sections are concerned with demographics, accidents and illnesses he third section is factors associated with injuries.

Demographics

Table 1 illustrates the frequency distribution of the enterprises reported as contributing the highest return for each farm. Tobacco ranked number one with 67.0%. It is interesting that crops accounted for 87.8% of the enterprises that produce the highest income per farm.

Table 1

Distribution of Farm Enterprises (n=297)

Enterprises	# Of respondent	% Of respondents
Tobacco	199	67.0
Peanut	19	6.4
Field crops	16	5.4
Cash grains	14	4.8
Livestock	12	4.1
Horticulture	9	3.1
Specialty crops	3	1.1
Poultry & eggs	1	0.1
Animal specialty	1	0.1
Others	18	6.2
Unknown	5	1.7
Total	297	100.0

Table 2 shows the frequency and percentage distribution of acres of land owned/rented and farmed in 1997. The highest number of respondents farmed 41-60 acres with 25.3% or 75 respondents in 1997. The second highest category was between 21-40 acres with 24.7% or 73 respondents and the smallest category acres were between 201-1200 acres with 5.7% or 17 respondents.

Table 2

Acres of Land Farmed in 1997 (n=297)

Number of Acres	# of respondents	% of respondents
1-20	68	22.9
21-40	73	24.7
41-60	75	25.3
61-80	22	7.4
81-200	42	14.0
201-1200	17	5.7
Total	297	100.0

Table 3 represents the residence of farmers. Almost twice as many farmers (64.3%) lived on-farm as those that did not live on-farm (35.4).

Table 3

Residence of Farmers (n= 297)

Location of residence	# of respondents	% of respondents
On farm	191	64.3
Off farm	105	35.4
Unknown	1	.3
Total	297	100.0

Table 4 shows the number of miles farmers drove from home to the farm. It can be noted that the majority of the farmers (53.3%) live two miles or less from the farm operation. Only two farmers traveled 30 miles.

Table 4

Miles Traveled From Place of Residence (n=105)

Miles	# of respondents	% of respondents
1	14	13.3
2	42	40.0
3	22	20.9
4	3	2.9
5	5	4.8
6	4	3.8
8	1	.9
10	2	1.9
12	1	.9
14	2	1.9
15	1	.9
30	2	1.9
Unknown	6	5.7
Total	105	99.8

Table 5 shows an almost equal distribution for the number of full-time and part-time farmers.

Table 5

Farmers Who Work Full- time and Part-time (n=297)

Amount of work	# of respondents	% of respondents
Full-time	147	49.5
Part-time	146	49.2
Not working	4	1.3
Total	297	100.0

Table 6 shows a total of 383 people working on the farms as reported by the 297 respondents. The majority of the farm work force comes from family members (56.9%). Only 12.8% are full-time non-family workers.

Table 6

Source of Labor on the Farm (n=383)

Name	# of workers	% of workers
Family-full-time	117	30.5
Family-part-time	101	26.4
Non family-full-time	49	12.8
Non family-part-time	116	30.3
Total	383	100.0

Table 7 shows the range of gross farm sales. The gross farm sales were bimodal with gross farm sales ranging from $5,001 to $20,000 representing 33.67% and $30,001 to $50,000 representing 39.4%

Table 7

Sales Income for 1997 (n=297)

Sales	# of respondents	% of respondents
Less than $1000.00	13	4.4
$1001-$5,000	36	12.1
$5,001-$10,000	52	17.5
$10,001-$20,000	48	16.1
$20,001-$30,000	29	9.7
$30,001-$40,000	49	16.5
$40,001-$50,000	68	22.9
More than 50,000	0	0.0
Unknown	2	0.7
Total	297	99.9

When asked their educational level, 297 of the limited resource farmers reported as shown in table 8. Fewer than 23.9% of them had less than a high school diploma, while 46.5% had high school diplomas, 14.9% had associate degrees, 8.4% had a bachelor's degree, and 3.4% above a bachelor's degree.

Table 8

Educational Level of Farmers (n= 297)

Educational level	# Of respondents	% Of respondents
Less than high school	71	23.9
High school diploma	138	46.5
Associate degree	44	14.8
Bachelor	25	8.4
Above bachelor	10	3.4
Unknown	9	3.0
Total	297	100.0

Respondents indicated that 176 (63.1%) had medical insurance, 94 (33.7%) did not have insurance, while 27 (9.1%) were unknown.

The question of hearing ability of respondents is shown in table 9. A majority (63.3%) of farmers reported some hearing problems, while only 35.7% reported good hearing.

Table 9

Hearing Ability of Farmers (n=297)

Hearing level	# of respondents	% of respondents
Good	106	35.7
Little trouble	152	51.2
Lot of trouble	36	12.1
Unknown	3	1.0
Total	297	100.0

Participants were asked about their eyesight. Their responses are contained in table 10. Of only 274 responding, 27.3% of the participants reported not using glasses while 23.2% used glasses all the time.

Table 10

Farmer's Eyesight (n=297)

Need for eye glasses	# Of respondents	% Of respondents
Do not use glasses	81	27.3
Use glasses for reading only	78	26.3
Use glasses for distance	46	15.5
Use glasses all the time	69	23.2
Unknown	23	7.7
Total	297	100.0

Accidents and Injuries

Table 11 illustrates the number of times a farmer visited a doctor/hospital in 1997. The results indicate that the total number of visits to a doctor/hospital were 636 times in 1997.

Table 11

Number of Times a Farmer Visited a Doctor or Hospital in1997 (n=297)

# Of visit	# Of respondents	# Of visits	% Of respondents
1	87	87	30.0
2	76	152	26.2
3	34	102	11.7
4	17	68	5.9
5	16	80	5.7
6	6	36	2.1
7	1	7	0.3
8	1	8	0.3
10	7	70	2.4
12	1	12	0.3
13	0	-	0
14	1	14	0.3
No visit	50	-	14.8
Total	297	636	100.0

Data in Table 12 reveals the nature of tractor accidents that occurred in 1997. Slips and falls from tractors caused more incidents (26.9%) than the other causes. Other nonspecific types of accidents were responsible for 30.8%; the least of the hazards was collisions (11.5%).

Table 12

Nature of Tractor Accidents (n=26)

Type of accident	Number of respondents	Percentage of respondents
Overturn	4	15.4
Collision	3	11.5
Fall from tractor	7	26.9
PTO	4	15.4
Other	8	30.8
Total	26	100.0

Table13 shows the frequency and percentage distribution of farmers' reasons to visit doctors or hospitals in 1997. The number one reason for a visit was check-ups with

46.5% or 138 respondents. The second highest reason for visits was personal problems with (22.9%) or 68 respondents. The least reason for a visit was non-work related with (3.0%) or nine respondents.

Table 13

Nature of Doctor or Hospital Visit (n=297)

Reason for visit	# Of respondents	% Of respondents
Check-up	138	46.5
Farm injury	52	17.5
Non-work related	9	3.0
Personal problem	68	22.9
Others	1	0.3
Non-visit	18	6.1
Unknown	11	3.7
Total	297	100.0

Table 14 reveals that 21.8% or 21 respondents were involved in a cut-type injury. The second highest injuries involved being crushed with 13.5% or 13 respondents. The least reported injuries were others with 2.1% or two respondents.

Table 14

Type of Injuries Reported (n=96)

Type of injury	Number of respondents	Percentage of respondents
Amputation	6	6.3
Asphyxiation	0	0
Bruise	9	9.4
Burn	4	4.2
Crushed	13	13.5
Cut	21	21.8
Fracture	10	10.4
Poisoning	6	6.3
Puncture	10	10.4
Sprain/Strain	7	7.3
Drowning	2	2.1
Electric shock	0	0
Multiple injuries	3	3.1
Fatality	4	4.2
Others	1	1.0
Total	96	100.0

Note. There was more than one type of injury received in some accidents.

Table 15 reports that the majority (58.2%) of the injured farmers and farm workers

used hospital services for their treatment. Only 17.6% of the participants did not seek medical care.

Table 15

Type of Medical Care Needed After the Farm Injury (n=91)

Type of medical care	Number of respondents	Percentage of respondents
Hospital care	53	58.2
Non-hospital	22	24.2
Did not seek medical care	16	17.6
Total	91	100.0

Table 16 explains the number of days that farmers were off the job due to injury. The table shows that the largest number occurred at 60 and 90 days.

Table 16

Numbers of Day's Farmers Were Off The- Job (n=91)

Days	# of respondents	% of respondents	Total number of days
0	16	17.6	0
1	4	4.4	4
2	9	9.9	18
3	3	3.3	9
5	6	6.6	30
6	1	1.2	6
7	1	1.2	7
8	3	3.3	24
10	3	3.3	30
14	1	1.2	14
15	3	3.3	45
16	1	1.2	16
20	2	2.2	40
30	10	10.9	300
32	1	1.2	32
35	1	1.2	35
38	1	1.2	38
40	2	2.2	80
60	11	12.1	660
90	11	12.1	990
210	1	1.2	210
Total	91	100.0	2588

Table 17 presents information regarding the ability of farmers and farm workers to continue working on the farm after injuries. It was found that 70.3% or 68 respondents were restricted from activities after injuries.

Table 17

Ability to Continue Farm Operation After Injuries (n=91)

After injuries	# of respondents	% of respondents
Restricted activity	68	70.3
Disability (full or partial)	7	7.7
Fatal	4	4.4
Unknown	16	17.6
Total	91	100.0

Factors Associated with Injuries

Table 18 revealed that (71.6%) or 212 participants never use hearing protection when operating farm machinery or performing any other job on the farm. The second most popular selection indicated that 26.0% (77 respondents) sometimes used hearing protection when working on the farm. The least amount of respondents was 2.4% or 7 respondents who said they always use hearing protection when operating machinery or doing any other job that requires the use of hearing protection.

Table 18

Farm Owners and Workers Using Protective Equipment When Working on the Farm

(n=297)

Protective equipment	# Never Used	% Never Used	# Used Sometimes	% Used Sometimes	# Always Used	% Always Used	# Non-respondent	% Non-respondent
Hearing protection								
Owners	212	71.6	77	26.0	7	2.4	1	.3
Workers	212	71.6	77	26.0	7	2.4	1	.3
Goggles								
Owners	168	57.4	105	35.8	20	6.8	4	1.3
Workers	167	57.0	106	36.2	20	6.8	4	1.3
Dust mask								
Owners	168	56.8	112	37.8	16	5.4	1	.3
Workers	166	57.0	113	38.3	16	5.4	2	.7

The information contained in the following table is related to the tractors used in the farming operation. It reports the number of tractors over 20 horsepower used on farms in the survey. Of the 297 farms surveyed, farmers reported there were 218 tractors equipped with a ROPS or C B compared to total number of 532 tractors their farms. However, there were 255 tractors reported with seat belts. This would seem to indicates that 37 owners removed a ROPS but did not did not remove the seat belt.

Table 19

Number of Tractor Over 20 Horsepower per Farm (n=532)

Response	# Of tractor	% Of Tractors
Tractors with ROPS	218	41.7
Tractors without ROPS	314	59.0
Total	532	100.0

There were 255 tractors reported as having a seat belt. This would seem to indicate that some owners may have removed the ROPS from 37 tractors but did not remove the seat belt.

Table 20 shows the number of tractors, by age categories, which are used on farms surveyed. The majority of the primary tractors (57.3 %) are between the ages of 0-20 years old. Most of the secondary tractors (60.5%) are between the ages of 11-20 and 21-30 years old.

Table 20

Age of Tractors Used on the Farms (n=436)

Age of tractors (in years)	# Primary Tractors	% Primary Tractors	# Secondary Tractors	% Secondary Tractors
0-10	81	29.6	48	29.6
11-20	76	27.7	62	38.3
21-30	66	24.1	36	22.2
31-51	51	18.6	16	9.9
Total	274	100.0	162	100.0

Note. Does not include number of tractors on farms having more than two-tractor per-farm.

Table 21 illustrates that 91.6% of the tractors owned by 297 participants were not equipped with CB radio or cellular phone. Only 7.4% reported they had at least one tractor equipped with either a CB or cellular phone.

Table 21

Tractors Equipped with CB Radio or Cellular Phone (n=297)

Number of tractors	# Of respondents	# Of tractors	% Of respondents
1 Tractor	15	15	5.1
2 Tractor	5	10	1.7
3 Tractors	1	3	0.3
4 Tractors	0	0	0
5 Tractors	1	5	0.3
No CB	272	*	92.5
Unknown	3	-	1.0
Total	297		100.0

Note. Of those people reporting no CB, some of them have more than one tractor

Table 22 indicates farmers that were certified to apply pesticides. A total number of 212 farmers (71.4%) were certified to apply pesticides and 26.9% were not certified to apply pesticides.

Table 22

Farmers With Current Certification to Apply Pesticide (n=297)

Status	# Of respondents	% Of respondents
Yes	212	71.4
No	80	26.9
Unknown	5	1.7
Total	297	100.0

Table 23 shows that of the 297 farmers surveyed, 93.3% answered that they used pesticides in 1997 and 6.7% said they did not use pesticides on the farm.

Table 23

Farmers That Used Pesticides in the Year 1997 (n=297)

Response	# Of respondents	% Of respondents
Yes	277	93.3
No	20	6.7
Total	297	100.0

Data in Table 24 represents the usage of personal protective equipment by farmers. The data revealed that the one item always used by the greatest number of respondents when applying pesticides was a hat with 45.8%. The second highest always-used item was rubber gloves with 14.5%. The item always used by the fewest respondents was raingear with (2.0%). The finding also revealed that chemical aprons were the number one item not used with 12.1%, followed by rubber boots with 10.1%, and the least item not used was a hat with 5.1%.

Table 24

Farmers That Use Personal Protective Equipment (PPE) When Applying Pesticide (n=297)

Items	# Always	% Always	# Usually	% Usually	# Seldom	% Seldom	# Not Used	% Not Used	# Non-respon-dents	% Non-respon-dents
Coverall	26	8.8	53	17.8	180	60.6	27	9.1	11	3.7
Raingear	6	2.0	31	10.5	210	70.7	30	10.1	20	6.7
Rubber gloves	43	14.5	129	43.4	99	33.3	21	7.1	5	1.7
Rubber boot	15	5	43	14.5	190	64	30	10.1	19	6.4
Respirator	37	12.4	127	42.8	95	32	25	8.4	13	4.4
Goggles	31	10.5	101	34	124	41.7	28	9.4	13	4.4
Chemical apron	16	5.4	73	24.6	153	51.5	36	12.1	19	6.4
Hat	136	45.8	64	21.6	69	23.2	17	5.7	11	3.7

Table 25 indicates some of the locations where pesticides are stored. Of the choices given for responding, the most widely used was other methods such as storing the pesticide in the field, metal boxes, abandoned houses etc. with 32.9%. The second highest method was in the barn (29.6%), while the least used location was the house (8.4%).

Table 25

Location of Pesticide Storage (n=297)

Location	# of respondents	% of respondents
House	25	8.4
Barn	88	29.6
Garage	48	16.1
Others	95	32.9
Unknown	41	13.6
Total	297	100.6

Table 26 reveals that of the injured farmers and farm workers 45 (54.1%) respondents worked on the farm part-time while the rest of the participants worked full-time.

Table 26

Working Status of Injured Person (n= 91)

Work status	# Of respondents	% Of respondents
Part-time	45	54.1
Full-time	39	45. 9
Unknown	7	7.7
Total	91	100.0

Data in Table 27 reveals that tractors were the number one factor (25.0.%) that caused farm related injuries for farmers in 1997. The second highest factor was machinery with 18.5% and the least factor was other vehicles and plant/tree with 1.0%.

Table 27

Factors Causing Injuries in the Year 1997 (n=92)

Factor	Number of respondents	Percentage of respondents
Tractor	23	25.0
Machinery	17	18.5
Livestock	11	12.0
Hand tool	12	13.1
Power	9	9.8
Pesticide	7	7.6
Plant/tree	1	1.0
Walking surface	2	2.2
Other Vehicle	1	1.0
Truck/automobile	2	2.2
Other Objects	7	7.6
Total	92	100.0

Note. In some cases more than one object was involved in the accident

Table 28 lists the types of operation farmers were performing when an injury occurred. Field work (tillage, planting, and harvesting) was the operation being performed with 30.7% or 28 respondents. The second highest operation was machinery services with 24.2% or 22 respondents and the least frequently occurring operation was storing or handling harvested crop with six respondents (6.6%).

Table 28

Activity of Farmers When Injured (n=91)

Name	Number respondents	Percentage of respondents
Farmstead maintenance or Construction	19	20.8
Machinery service or repair	22	24.2
Field work (tillage, planting harvesting)	28	30.7
Storing or handling harvested crop	6	6.6
Livestock handling	11	12.2
Unknown	5	5.5
Total	91	100.0

Table 29 shows the gender status of 91 injured persons. Males were victims 79.1% of the time while females were victims of accidents 17.6% of the time.

Table 29

Gender of Injured Persons (n=91)

Gender	# Of respondents	% Of respondents
Males	72	79.1
Females	16	17.6
No response	3	3.3
Total	91	100.0

Table 30 reveals that family members sustained the highest injuries with (87.9%) or 80 respondents. Other non-specific personnel accounted for the second to the highest injured with (4.4%).

Table 30

Relationship of the Injured Person to the Farmer (n=91)

Status of injured person	# Of the respondents	% Of respondents
Family	80	87.9
Partner (s)	0	0.0
Farm labor	3	3.3
Other	4	4.4
Unknown	4	4.4
Total	91	100.0

Data in Table 31 reveals that farmers with ages between 36-50 yeas old were injured most with 38.5% or 35 respondents. The second most injured age group was between the ages of 51-62 with 21.9% or 20 respondents. The least injured age group was 65 and up, which accounted for 7.7% or 7 respondents.

Table 31

Age Distribution of People Injured (n=91)

Age category	# Of respondents	% Of respondents
2-18	13	14.3
19-35	16	17.6
36-50	35	38.5
51-62	20	21.9
65-up	7	7.7
Total	91	100.0

Chapter 5

Summary, Conclusions, and Recommendations

This chapter consists of four sections; first a summary of research is given. Second, the conclusions developed from the research are presented. Third, the recommendations for further research and safety training for limited resource farmers are made. Fourth suggestions for further research are provided for the purpose of stimulating continued research in the area of farm safety and health among farmers.

Summary

Limited resource farmers need essential work related attitudes toward farm safety and health for success in their every day operations. An important consideration will be whether limited resource farmers need to have certification before operating or using farm equipment. In 1976 limited resource farmers or small farmers were exempted from mandatory occupational safety and health legislation. The exemption has created an avenue for them to ignore correct farm safety practices. Safety is a relative state of being well and free from hazards. It is important for farmers to note that there is no such thing as a perfect machine. However, through proper design, management, and safe practice. safety can be enhanced and the goal to reduce incidents, injuries, and illness can be achieved. Safety is not just the responsibility of one person or group. Safety is a shared responsibility among owners, operators, suppliers, manufacturers, processors, and other individuals in the production chain. Researchers have found that unsafe behaviors are the major reasons for the majority of the accidents. Worick (1975) classified accident causes

into five categories: inadequate knowledge, insufficient skills, environmental hazards, improper habits and attitudes, and unsafe behavior. Behavior has been identified as a major contributor to accidents, and modification of behavior has been a primary focus in accident reduction.

The primary purpose of this study was to investigate health and safety needs among limited resource farmers in selected North Carolina counties. The specific objectives of this study were as follows:

1. Identify farm accidents and illnesses among limited resource farmers;
2. Identify factors associated with farm injuries which have impact on the frequency; and
3. Identify safety-training needs for limited resource farmers.

The Population and Sample

The study population consisted of 620 limited resource farmers from six North Carolina counties. These counties were selected because 80% of the farmers in the counties are limited resource farmers. The counties are Bladen, Columbus, Halifax, Stoke, Washington, and Yancey. The sample consisted of 297 subjects.

Instrumentation

The survey instrument measured quantitative items and also operator attitudes about farm safety. The questionnaire variables were in operational form to permit analysis. The instrument addressed the following: demographic information, severity, cause, source, and effects of farm accidents/illnesses sustained by limited resource farmers, identification of victims (children, workers, farmers etc), medical /health care provided, the limited

resource farmers' knowledge when using machinery and agricultural chemicals, and farmers' income.

Data collection

Extension agents in six North Carolina counties were contacted by phone asking for their cooperation to provide the names and addresses of the active limited resource farmers in their respective counties. A four-page questionnaire, a letter, and self-addressed envelope were mailed to the limited resource farmers asking them to participate in a farm safety survey (note Appendix D). A total number of 620 questionnaires were mailed to the farmers.

Data analysis

Of the 620 questionnaires mailed, 297 were returned and deemed usable for analysis purposes. The data were analyzed at the computing center of North Carolina A&T State University. A frequency count was completed to obtain the numbers and percentages for each of the independent variables. In addition, a frequency count was completed to obtain the means and standard deviations.

Findings

In addition to determining basic demographic information, this study sought answers to three major research questions. Demographic information and each of the three research questions is presented along with associated data and findings.

Demographic Information. The most dominant enterprise for the farmers was tobacco with 67.0% of the respondents reporting it as returning the highest income for their farm. The low-income farmers reported small acreage with over 70% farming from one to 60

acres. There was an equal split between full-time and part-time farmers. The majority (56.9%) of the farm help was family members. The majority of limited resource farmers had a high school diploma or less. Most farmers had suffered some type of hearing and sight loss.

Accidents and Illnesses Among Limited Resource Farmers. In regard to accidents during the farm operation, it was found that 79.1% of those injured were males compared to 18% females. It was also found that 70.3% of the participants were injured and restricted from any activities for some time. Participants with ages between 36-50 had the highest percentage of accidents (38.5%). In this study tractor accidents had the highest percentage of injuries (25.0%) followed by machinery with 18.5%. 22 percent of the participants sustained cut-type injuries followed by crushed by tractor (13.5%), fractures and punctures were 10.4% each, and 9.4% were bruises. However, all other characteristics were each below 10% of the sample (see table 14).

One of the potential hazards in agricultural occupations is exposure to excessive farm chemicals. In this study it was found that pesticides poisoned 6.3% of the participants and there were two fatalities as a result of poisoning.

Factors Associated with Frequency and Severity of Farm Injuries. Tractors were the number one cause of injury among those farm surveyed in 1997 follow by farm machinery and hand tools. Field work (tillage, planting, and harvesting) was the type of operation farmers were performing when most of the injuries occurred. Machinery maintenance, farmstead construction, and maintenance were activities leading to some of the injuries.

Safety training needs for limited resource farmers. Safety training and increased awareness are strongly needed among limited resource farmers and their workers. In this study, it was found that 93% of the participants had no CB or cellular phone on their tractor to call for help in case of an accident. Fifty-eight percent of the farmers did not keep their pesticide records. Good records make it easier for doctors in case of accidents. Training is also needed for limited resource farmers on farm chemical storage. It was found in this study that most of the farmers stored their chemicals in the house, garage, metal box, porch, etc. Few farmers or farm workers indicated they used personal protective equepment. Seventy-five percent of farm owners and workers in this study never used hearing protection to prevent or reduce hearing loss when working on the farm. Goggles and dust masks were generally not used to protect eyes and lungs. Training is very necessary for the farmer to prevent hazards associated with the above-mentioned areas.

The study found that 65% of the participants seldom used coveralls and other PPE such as raingear, rubber gloves, rubber boots, respirators, goggles, chemical aprons, or hats when applying pesticides.

Conclusions

Based upon the results of this study, the following conclusions can be derived:

1. A profile of the typical limited resource farmer participating in this study is one whose major income is from crops. They farm small acreage, live on the farm, and are equally likely to farm full-time or part time, use primarily family labor, do not make more than $50,000 gross farm income, have a high school education, and have suffered some hearing and sight loss.

2. The risks to limited resource farmers and their workers associated with use of tractors, machinery, and other agricultural equipment are very high. In this study only 7.7% of the accidents could be contributed to tractor operation. There is no enough accidents due to tractor operation to speculate about safety equipment on tractors.
3. Farmers between the ages of 36-50 have the highest expected injury compared to other age groups.
4. Training associated with use of tractors and machinery and the need for personal protective equipment (PPE) is essential for limited resource farmers and their workers. Note (appendix G Q 31A-31H) 63.5% of the participants seldom use coverall when applying pesticide, a farmer who do not use coverall have chance of been injured if accident occurred. (Q 31B) 75.8% seldom use raingear during pesticide application. (Q 31C) 44.2% of the participant said they usually used rubber glove when mixing or applying chemical, although non use of rubber gloves will not cause accidents but can increase chance of been seriously injured. (Q 31D) 68.3% of the participants seldom wear rubber boots when applying pesticide non-wearing rubber during pesticide application can increase number of accidents. (Q 31E) 44.1% of the participants usually wear respirators when applying pesticides non use of respirator will not cause accidents but can increase great chances of been poisoning and long time effect to the longs may be possible. (Q 31F) 43.7% oft the farmers surveyed seldom in their farm operations not using goggle can increase number of accidents on the farm. (Q 31G) 55.5% of the participants

seldom use chemical apron not using chemical apron do not cause accidents but increase chance of injury in case accidents occurred. (Q31H) 47.6% of the participants said they usually wear hats when applying.

5. Increased efforts are needed to reduce and prevent the severe injuries occurring to limited resource farmers and their family through education. Note appendix (G Q 29) 57.1% of the farmers surveyed did not keep the record of pesticide used in the year 1997, keeping record can help doctor in case of emergency also if was found that 26.9% of the farmers surveyed are not certified to apply pesticide. (Note appendix G Q26)
6. This research suggested that the hazards exposed by using tractors without ROPS could result in high numbers of severe injuries among limited resource farmers and workers. (Note appendix G Q 22) however, in this study there is no enough accident due to lack of rollover protective structure on a tractor.

Recommendations

1. Both Federal and State agencies should give incentives to farmers to encourage them to retrofit ROPS on their old tractors.
2. Mandatory training for small scale or limited resource farmers on farm equipment operation and personal protective equipment (PPE) utilization should be implemented.
3. New designs of preventive guards and shields that can be easily removed or opened for maintenance and remounted or closed afterward are needed.
4. More educational programs to promote wearing personal protective equipment and clothing are needed.

5. Slip resistant materials and devices specially designed for farm workers to prevent and reduce falls should be installed or retrofitted.
6. State government should introduce yearly tractor inspections just like motor vehicle inspections.
7. Mandatory installation of automatic seat belts on tractors having a ROPS or CAB should be made.

Discussion

As illustrated in table 29, male farmers generally experienced more injuries than females. Injuries to male farmers were much more than that of females possibly because males generally have relatively greater exposure to tractors, machinery, and animals that often cause more severe injuries. Experience, safety consciousness, and health status significantly differ from one age group to another and the injury frequency and severity for different age groups also varies. Table 31 illustrates the frequency and percentage distribution of different age groups involved in accidents.

Many researchers have identified that the age of farm equipment, such as tractors, can be a contributing cause to accidents. It is not uncommon to see 40-year-old tractors still in operation. Tractors are not only used for a very long time, but over time operator attention to original safety features declines. Consequently, safety devices tend to be neglected by farmers. Table 20 indicated the frequency and percentage distribution of tractor age categories in this study.

Many old tractors do not have seat belts, yet they are still in operation, Hair, (1991) found that farmers with tractors with rollover protective structures usually are not

injured in tractor turnovers. Injuries usually occur only when farmers are thrown from the tractor because they did not wear the seat belt. This study found that 60.3% of the participant's tractors had no ROPS and seat belt.

The great majorities of farmers do not know the name of the pesticide to which they are exposed. The results of this research showed that the majority of the participants did not keep records of the pesticides they used. It also indicated that more farmers used pesticides that had a certificate to apply pesticides.

Need for further study

1. This study should be replicated in other states to further understand safety practices among farmers
2. More study is needed to determine the extent to which limited resource farmers were exposed to agricultural chemicals.
3. More study is needed to understand how limited resource farmers perceive farm safety practices.

Plan for Farm Safety Training

Based upon the findings and conclusion of this study many limited resource farmers were injured because they failed to use or did not use protective equipment correctly. This training plan will help extension agents and technicians to train the farmers.

1. Precaution when handling and applying pesticides
    - (a) Use of PPE
    - (b) Environmental concerns
    - (c) Weather condition

2. Need for use of PPE
    - (a) Hearing protection
    - (b) Eye protection
    - (c) Protection of hands and feet
    - (d) Respiratory protection
    - (e) Head protection

3. Appropriate dress for various farming activities
    - (a) Most work
    - (b) Applying pesticides

4. Storage of pesticides
    - (a) Requirements of storage
    - (b) Where to store
    - (c) How store

5. Need for record keeping
    - (a) Why
    - (b) How

6. Need for certification to apply pesticides
    - (a) Who
    - (b) Why
    - (c) How to become certified

7. Tractor Safety
    - (a) Need for communication equipment
    - (b) Need for ROPS/CAB
    - (c) Use of seat belt
    - (d) Wheel spacing and ballasting
    - (e) Operating on slopes
    - (f) Training of operator
    - (g) Pre-use inspection

8. Tractor Safety
    (h) Use of SMV and light
    (i) Signs
    (j) Shield & Guards
    (k) Speed of operation
    (l) PTO operations.

For this training plan to be a success it will be necessary to conduct train the trainer workshops for those responsible to train the farmers.

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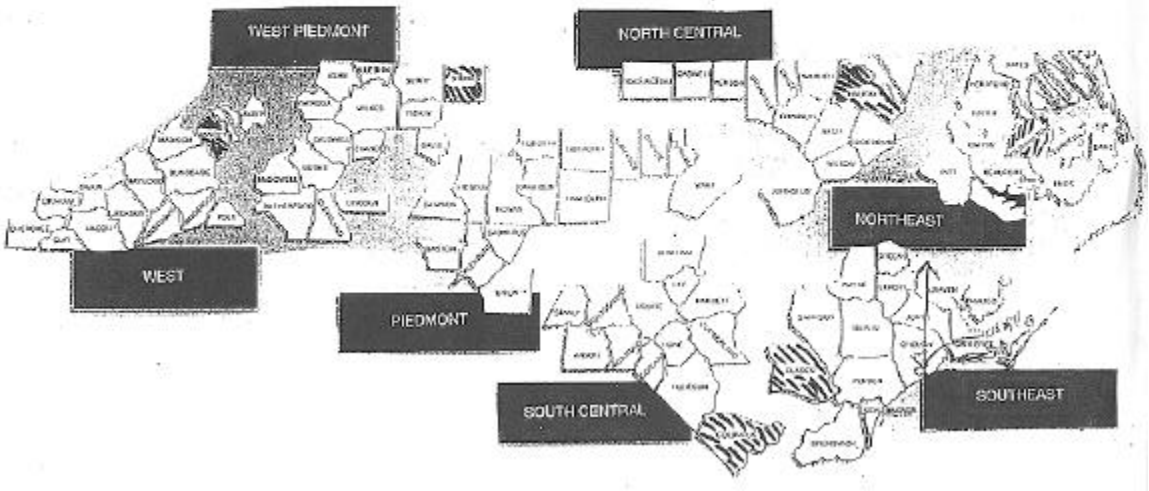
APPENDIX A
POPULATION TABLE

COUNTY	POPULATION	SAMPLE
Bladen	120	45
Columbus	130	60
Halifax	110	45
Stokes	30	25
Washington	30	20
Yancey	200	102
Total	620	297

APPENDIX B
MAP OF NORTH CAROLINA EXTENSION DISTRICTS

NORTH CAROLINA EXTENSION DISTRICTS



APPENDIX C
COVER LETTER

P. O Box 13325
Greensboro
NC 27415

June 10, 1998

Dear farmer:

Some have said that farming is the "Most Dangerous Occupation." If you are like me and agree with that statement, then other North Carolina farmers need your help. You have been selected to be part of a small sample of farmers asked to complete the enclosed questionnaire about safety on your farm. I sincerely hope you will take 15-20 minute that are required to complete it. Your information will be kept confidential and you will not be identified.

I am please that Yancey County was one of just six counties chosen to participate in this survey. Your honest comments will help all farmers across the State of North Carolina.

Please complete the questionnaire as soon as possible and mail it back in the enclosed postage paid envelope. Please return this letter to Mr. Claude Deytion Agriculture Technician Yancey County Extension office for a price drawing.

Yours truly,
Mohammed J. Ibrahim.

APPENDIX D

INSTRUMENT

FARM SAFETY SURVEY

109

PLEASE ANSWER THE FOLLOWING QUESTIONS FOR THE YEAR 1997.

1. How many acres of land did you farm including both owned and rented land? _____acres

2. Do you live on the farm? _____ If not, how far is your home from the farm? _____ miles

3. Do you work on the farm full time? Yes _____ No _____

4. How many people (including yourself) work on the farm?
   Family: _____Part-time _____Full-time
   Non-Family _____Part-time _____Full-time

5. Please identify, based on income, the enterprises (parts) of your total farming operation which produced the highest, (2) second, and (3) third highest returns?

___1.	Cash grains	___5.	Livestock	___9.	Tobacco
___2.	Field crops	___6.	Dairy	___10.	Peanut
___3.	Specialty crops	___7.	Poultry & eggs	___11.	Others
___4.	Horticultural specialties	___8.	Anima specialties		

6. How many farm works related injuries occurred on your farm in the last 3 years? _____

7. Record the three most recent injuries occurred on your farm in the last 3 years.

Month/Year	**Most recent**	**2nd Most Recent**	**3rd Most Recent**
_ _ ___	_ _____ ___	_ _____ _____	_ _____ _____
_ _ ___	_ _____ ___	_ _____ _____	_ _____ _____
_ _ ___	_ _____ ___	_ _____ _____	_ _____ _____

8. What was the object or substance which caused the most recent injury in 1997 ? (Please check only one)

___1.	Tractor	___7.	Plant/tree
___2.	Machinery (specify)	___8.	Working surface
___3.	Livestock (specify)	___9.	Truck/automobile
___4.	Hand tool (specify)	___10.	Other vehicle (specify)
___5.	Power tool	___11.	Other object (specify)
___6.	Pesticide or other chemical		

9. If a tractor was involved, what was the nature of the accident(s) that occurred?
   ❒1. Overturn ❒2. Collision ❒3. Fall from the tractor
   ❒4. PTO ❒5. Other_____

10. What was the type of (most recent, etc.) injury that occurred in 1997 ?

	Most Recent	**2nd**	**3rd**
❒ Amputation	____	____	____
❒ Asphyxiation	____	____	____
❒ Bruise	____	____	____
❒ Burns	____	____	____

❒ Cut	____	____	____
❒ Fracture	____	____	____
❒ Poisoning	____	____	____
❒ Puncture	____	____	____
❒ Sprain/strain	____	____	____
❒ Drowning	____	____	____
❒ Electric shock	____	____	____
❒ Multiple injuries	____	____	____
❒ Fatality	____	____	____
❒ Other	____	____	____

11. What was the overall effect to the injured person's ability to continue on the farm?

	Most Recent	**2nd**	**3rd**
❑ Restricted activity	____	____	____
❑ Disability (full or partial)	____	____	____
❑ Bruise	____	____	____
❑ Burns	____	____	____

12. What type of work was the person(s) doing when (most recent, etc.) injury occurred?

	Most Recent	**2nd**	**3rd**
❑ Farmstead maintenance or construction	____	____	____
❑ Machinery service or repair	____	____	____
❑ Field Work (tillage, planting harvesting)	____	____	____
❑ Storing or handling harvested crops	____	____	____
❑ Livestock handling	____	____	____

13. Does your family have medical insurance? ❒ Yes ❒ No

14. What type of medical care was needed for the (most recent, etc.) injury?

	Most Recent	**2nd**	**3rd**
❑ Hospital care	____	____	____
❑ Non-hospital	____	____	____
❑ Didn't seek medical care	____	____	____

15. How many days did the injury keep you from doing a full days work?

	Most Recent	**2nd**	**3rd**
Number of days	____	____	____

16. What was the relationship of the person who was injured (for the most recent, etc.)injury?

	Most Recent	**2nd**	**3rd**
❒ Family (paid or unpaid)	____	____	____
❒ Partner(s)	____	____	____
❒ Hired farm labor	____	____	____

❒ Others_____	____	____	____

17. Was the injured person part-time or full-time?

	Most Recent	2nd	3rd
❒ Part-time	____	____	____
❒ Full-time	____	____	____

18. What is the sex of the person(s) who was injured (for the most recent injury, etc.)?

	Most Recent	2nd	3rd
❒ Male	____	____	____
❒ Female	____	____	____

19. What is the age of the person who was injured (the most recent, etc.)?

	Most Recent	2nd	3rd
❒ Male	____	____	____
❒ Female	____	____	____

Tractor

20. How many tractors over 20 horsepower do you use on your farm? _____

21. What are the approximate ages of these tractors? _____, _____, _____, _____, _____, _____

22. How many of your tractors have rollover protection? (ROPS) _____

23. How many or your tractors have seat belts? _____

24. How many of your tractors have cabs? _____

25. How many tractors are equipped with a CB or cellular phone? _____

26. Are you currently certified to apply pesticides? ❑ Yes ❑ No

27. When does the certification expire? (Month/Year)_____

28. In 1997, did you use pesticides on your farm? ❑ Yes ❑ No

29. Did you keep the records of the pesticides used? ❑ Yes ❑ No

30. Who does the mixing, loading and application of pesticides?

	Mixing	Loading	Application
❑ Yourself	_____	_____	_____
❑ Family members	_____	_____	_____

❑ Hired worker _____ _____ _____

31. How often is the following protective equipment used by those working with pesticides?

Item	Always	Usually	Seldom
Coveralls			
Rain Gear			
Rubber Gloves			
Rubber Boots			
Respirator			
Goggles			
Chemical Apron			
Hat			
None			

32. In what building do you store your pesticides? _____

33. How often do those working on the farm wear ear plugs or other hearing protection devices when operating farm equipment?

	You	Other
❑ Never	____	____
❑ Some of the time	____	____
❑ Always required	____	____

34. What statement best describes your eyesight:
❑ Do not use glasses
❑ Use glasses for reading only
❑ Use glasses for distance only
❑ Use glasses all the time

35. Do you or any others working on the farm wear safety glasses or goggles while working?

	You	Other
❑ Never	____	____
❑ Some of the time	____	____
❑ Always required	____	____

36. Do you or any other working on the farm use dust masks or other respiratory protection while working?

	You	Other
❑ Never	____	____
❑ Some of the time	____	____
❑ Always required	____	____

37. How many times did you see a doctor or visit a hospital in 1997? _____

38. What are the natures of your latest doctor or hospital visit?
❑ Check-up ❑ Injury from farm-related work ❑Non-work-related
❑ Personal medical problem ❑Other (specify) _____

39. What statement best describes your hearing?
❑ Good ❑Little trouble hearing ❑Lots of trouble hearing

40. Circle the answer that best describes your educational level.
Less than High School Diploma Associate degree Above Bachelor's
High School Diploma Bachelor's degree

41. Gross farm sales for 1997 were:
❑ Less than $1,000 ❑ $1,001-$5,000 ❑ $5,001-$10,000 ❑ $10,001-$20,000
❑ $20,001-$30,000 ❑ $30,001-$40,000 ❑ $40,001-$50,000 ❑ More than $50,000

APPENDIX E

FOLLOW UP POST CARD

Farm Safety Survey
P.O. Box 13325
Greensboro NC 27415

Dear farmer,

Last week you received a survey form regarding safety practices on your farm. If you have already returned your survey, thank you. If you have not had a chance to complete it, please take a few moments to do so. Your respond is critical to the outcome of this study.

If you did not receive a survey, please call me collect at (336) 334-7734 and I will mail another survey to you.

Thank you for cooperation,
Mohammed Ibrahim.

APPENDIX F

SECOND LETTER

Dear farmer,

About two weeks ago you receive a survey regarding farm safety on your farm.

As of today, I have not received your response. Your input is very important on this critical issue. Please take a moment to complete and return your survey at earliest convenience.

If you have questions about the study or completing the survey, please call me collect at (336) 334 –7734.

Sincerely

Mohammed J. Ibrahim

APPENDIX G
CROSS TAB ANALYSES

Q6 * TRACTOR

Crosstab

			TRACTOR		Total
			.00	1.00	
Q6	.00	Count	193	0	193
		Expected Count	178.1	14.9	193.0
		% within Q6	100.0%	.0%	100.0%
		% within TRACTOR	70.4%	.0%	65.0%
		% of Total	65.0%	.0%	65.0%
	1.00	Count	53	18	71
		Expected Count	65.5	5.5	71.0
		% within Q6	74.6%	25.4%	100.0%
		% within TRACTOR	19.3%	78.3%	23.9%
		% of Total	17.8%	6.1%	23.9%
	2.00	Count	24	5	29
		Expected Count	26.8	2.2	29.0
		% within Q6	82.8%	17.2%	100.0%
		% within TRACTOR	8.8%	21.7%	9.8%
		% of Total	8.1%	1.7%	9.8%
	3.00	Count	3	0	3
		Expected Count	2.8	.2	3.0
		% within Q6	100.0%	.0%	100.0%
		% within TRACTOR	1.1%	.0%	1.0%
		% of Total	1.0%	.0%	1.0%

	4.00	Count	1	0	1
		Expected Count	.9	.1	1.0
		% within Q6	100.0%	.0%	100.0%
		% within TRACTOR	.4%	.0%	.3%
		% of Total	.3%	.0%	.3%
Total		Count	274	23	297
		Expected Count	274.0	23.0	297.0
		% within Q6	92.3%	7.7%	100.0%
		% within TRACTOR	100.0%	100.0%	100.0%
		% of Total	92.3%	7.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.009(a)	4	.000
Likelihood Ratio	54.792	4	.000
Linear-by-Linear Association	24.879	1	.000
N of Valid Cases	297		

a 5 cells (50.0%) have expected count less than 5. The minimum expected count is .08.

Q6 * MACHINE

Crosstab

			MACHINE		Total
			.00	1.00	
Q6	.00	Count	191	2	193
		Expected Count	182.6	10.4	193.0
		% within Q6	99.0%	1.0%	100.0%
		% within MACHINE	68.0%	12.5%	65.0%
		% of Total	64.3%	.7%	65.0%
	1.00	Count	65	6	71
		Expected Count	67.2	3.8	71.0
		% within Q6	91.5%	8.5%	100.0%
		% within MACHINE	23.1%	37.5%	23.9%
		% of Total	21.9%	2.0%	23.9%
	2.00	Count	22	7	29
		Expected Count	27.4	1.6	29.0
		% within Q6	75.9%	24.1%	100.0%
		% within MACHINE	7.8%	43.8%	9.8%
		% of Total	7.4%	2.4%	9.8%
	3.00	Count	2	1	3
		Expected Count	2.8	.2	3.0
		% within Q6	66.7%	33.3%	100.0%
		% within MACHINE	.7%	6.3%	1.0%
		% of Total	.7%	.3%	1.0%
	4.00	Count	1	0	1

		Expected Count	.9	.1	1.0
		% within Q6	100.0%	.0%	100.0%
		% within MACHINE	.4%	.0%	.3%
		% of Total	.3%	.0%	.3%
Total		Count	281	16	297
		Expected Count	281.0	16.0	297.0
		% within Q6	94.6%	5.4%	100.0%
		% within MACHINE	100.0%	100.0%	100.0%
		% of Total	94.6%	5.4%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.133(a)	4	.000
Likelihood Ratio	25.339	4	.000
Linear-by-Linear Association	28.421	1	.000
N of Valid Cases	297		

a 6 cells (60.0%) have expected count less than 5. The minimum expected count is .05.

Q6 * Q40

Crosstab

		Q40			
			1.00	2.00	3.00	4.00	5.00	9.00	Total
Q6	.00	Count	50	87	29	17	6	0	189
		Expected Count	46.4	90.2	28.8	16.3	6.5	.7	189.0
		% within Q6	26.5%	46.0%	15.3%	9.0%	3.2%	.0%	100.0%
		% within Q40	70.4%	63.0%	65.9%	68.0%	60.0%	.0%	65.4%
		% of Total	17.3%	30.1%	10.0%	5.9%	2.1%	.0%	65.4%
	1.00	Count	16	33	10	5	3	1	68
		Expected Count	16.7	32.5	10.4	5.9	2.4	.2	68.0
		% within Q6	23.5%	48.5%	14.7%	7.4%	4.4%	1.5%	100.0%
		% within Q40	22.5%	23.9%	22.7%	20.0%	30.0%	100.0%	23.5%
		% of Total	5.5%	11.4%	3.5%	1.7%	1.0%	.3%	23.5%

	2.00	Count	5	18	4	2	0	0	29
		Expected Count	7.1	13.8	4.4	2.5	1.0	.1	29.0
		% within Q6	17.2%	62.1%	13.8%	6.9%	.0%	.0%	100.0%
		% within Q40	7.0%	13.0%	9.1%	8.0%	.0%	.0%	10.0%
		% of Total	1.7%	6.2%	1.4%	.7%	.0%	.0%	10.0%
	3.00	Count	0	0	1	1	0	0	2
		Expected Count	.5	1.0	.3	.2	.1	.0	2.0
		% within Q6	.0%	.0%	50.0%	50.0%	.0%	.0%	100.0%
		% within Q40	.0%	.0%	2.3%	4.0%	.0%	.0%	.7%
		% of Total	.0%	.0%	.3%	.3%	.0%	.0%	.7%
	4.00	Count	0	0	0	0	1	0	1
		Expected Count	.2	.5	.2	.1	.0	.0	1.0

		% within Q6	.0%	.0%	.0%	.0%	100.0%	.0%	100.0%
		% within Q40	.0%	.0%	.0%	.0%	10.0%	.0%	.3%
		% of Total	.0%	.0%	.0%	.0%	.3%	.0%	.3%
Total		Count	71	138	44	25	10	1	289
		Expected Count	71.0	138.0	44.0	25.0	10.0	1.0	289.0
		% within Q6	24.6%	47.8%	15.2%	8.7%	3.5%	.3%	100.0%
		% within Q40	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	24.6%	47.8%	15.2%	8.7%	3.5%	.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.052(a)	20	.003
Likelihood Ratio	20.303	20	.439

Linear-by-Linear Association	1.928	1	.165
N of Valid Cases	289		

a 19 cells (63.3%) have expected count less than 5. The minimum expected count is .00.

Q6 * Q31A

Crosstab

			Q31A			
			.00	1.00	2.00	3.00
Q6	.00	Count	19	20	30	115	184
		Expected Count	17.4	16.8	33.6	116.2	184.0
		% within Q6	10.3%	10.9%	16.3%	62.5%	100.0%
		% within Q31A	70.4%	76.9%	57.7%	63.9%	64.6%
		% of Total	6.7%	7.0%	10.5%	40.4%	64.6%

	1.00	Count	5	5	15	43	68
		Expected Count	6.4	6.2	12.4	42.9	68.0
		% within Q6	7.4%	7.4%	22.1%	63.2%	100.0%
		% within Q31A	18.5%	19.2%	28.8%	23.9%	23.9%
		% of Total	1.8%	1.8%	5.3%	15.1%	23.9%
	2.00	Count	1	1	7	20	29
		Expected Count	2.7	2.6	5.3	18.3	29.0
		% within Q6	3.4%	3.4%	24.1%	69.0%	100.0%
		% within Q31A	3.7%	3.8%	13.5%	11.1%	10.2%
		% of Total	.4%	.4%	2.5%	7.0%	10.2%
	3.00	Count	1	0	0	2	3
		Expected Count	.3	.3	.5	1.9	3.0

		% within Q6	33.3%	.0%	.0%	66.7%	100.0%
		% within Q31A	3.7%	.0%	.0%	1.1%	1.1%
		% of Total	.4%	.0%	.0%	.7%	1.1%
	4.00	Count	1	0	0	0	1
		Expected Count	.1	.1	.2	.6	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q31A	3.7%	.0%	.0%	.0%	.4%
		% of Total	.4%	.0%	.0%	.0%	.4%
Total		Count	27	26	52	180	285
		Expected Count	27.0	26.0	52.0	180.0	285.0
		% within Q6	9.5%	9.1%	18.2%	63.2%	100.0%
		% within Q31A	100.0%	100.0%	100.0%		

100.0% | 100.0% |
 | | ---------- | ------ | ------ | ------ | ------ | ------ |
	% of Total	9.5%	9.1%	18.2%	63.2%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.274(a)	12	.140
Likelihood Ratio	13.147	12	.358
Linear-by-Linear Association	.175	1	.676
N of Valid Cases	285		

a 10 cells (50.0%) have expected count less than 5. The minimum expected count is .09.

Q6 * Q31B

Crosstab

		Q31B			Total
		.00	1.00	2.00	3.00	
--	----	----------	------	------	------	------	------

Q6	.00	Count	19	6	21	134	180
		Expected Count	19.5	3.9	20.1	136.5	180.0
		% Within Q6	10.6%	3.3%	11.7%	74.4%	100.0%
		% Within Q31B	63.3%	100.0%	67.7%	63.8%	65.0%
		% Of Total	6.9%	2.2%	7.6%	48.4%	65.0%
	1.00	Count	6	0	6	55	67
		Expected Count	7.3	1.5	7.5	50.8	67.0
		% Within Q6	9.0%	.0%	9.0%	82.1%	100.0%
		% Within Q31B	20.0%	.0%	19.4%	26.2%	24.2%
		% Of Total	2.2%	.0%	2.2%	19.9%	24.2%
	2.00	Count	3	0	4	19	26
		Expected Count	2.8	.6	2.9	19.7	26.0

		% Within Q6	11.5%	.0%	15.4%	73.1%	100.0%
		% Within Q31B	10.0%	.0%	12.9%	9.0%	9.4%
		% Of Total	1.1%	.0%	1.4%	6.9%	9.4%
	3.00	Count	1	0	0	2	3
		Expected Count	.3	.1	.3	2.3	3.0
		% within Q6	33.3%	.0%	.0%	66.7%	100.0%
		% within Q31B	3.3%	.0%	.0%	1.0%	1.1%
		% of Total	.4%	.0%	.0%	.7%	1.1%
	4.00	Count	1	0	0	0	1
		Expected Count	.1	.0	.1	.8	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% Within Q31B	3.3%	.0%	.0%	.0%	.4%

		% Of Total	.4%	.0%	.0%	.0%	.4%
--	----	----------	----	----	----	----	----
Total	Count		30	6	31	210	277
	Expected Count		30.0	6.0	31.0	210.0	277.0
	% Within Q6		10.8%	2.2%	11.2%	75.8%	100.0%
	% Within Q31B		100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total		10.8%	2.2%	11.2%	75.8%	100.0%
--	----	----------	----	----	----	----	----

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.621(a)	12	.263
Likelihood Ratio	12.567	12	.401
Linear-by-Linear Association	.406	1	.524
N of Valid Cases	277		

```
             |
 | --------------------------- | --------- | -- | ---------
------------ |
```

a 13 cells (65.0%) have expected count less than 5. The minimum expected count is .02.

Q6 * Q31C

Crosstab

```
-----------------------------------------------------------------
-----------------
 |                               | Q31C
      | Total  |
 |                               | ------ | ------ | ------ | -
----- |        |
 |                               | .00    | 1.00   | 2.00   |
3.00   |        |
 | -- | ---- | -------------- | ------ | ------ | ------ | -
----- | ------ |
 | Q6 | .00  | Count          | 14     | 29     | 85     |
62     | 190    |
 |    |      | -------------- | ------ | ------ | ------ | -
----- | ------ |
 |    |      | Expected Count | 13.7   | 28.0   | 83.9   |
64.4   | 190.0  |
 |    |      | -------------- | ------ | ------ | ------ | -
----- | ------ |
 |    |      | % within Q6    | 7.4%   | 15.3%  | 44.7%  |
32.6%  | 100.0% |
 |    |      | -------------- | ------ | ------ | ------ | -
----- | ------ |
 |    |      | % within Q31C  | 66.7%  | 67.4%  | 65.9%  |
62.6%  | 65.1%  |
 |    |      | -------------- | ------ | ------ | ------ | -
----- | ------ |
 |    |      | % of Total     | 4.8%   | 9.9%   | 29.1%  |
21.2%  | 65.1%  |
 |    | ---- | -------------- | ------ | ------ | ------ | -
----- | ------ |
 |    | 1.00 | Count          | 3      | 11     | 29     |
26     | 69     |
 |    |      | -------------- | ------ | ------ | ------ | -
----- | ------ |
 |    |      | Expected Count | 5.0    | 10.2   | 30.5   |
23.4   | 69.0   |
 |    |      | -------------- | ------ | ------ | ------ | -
----- | ------ |
```

		% within Q6	4.3%	15.9%	42.0%	37.7%	100.0%
		% within Q31C	14.3%	25.6%	22.5%	26.3%	23.6%
		% of Total	1.0%	3.8%	9.9%	8.9%	23.6%
	2.00	Count	2	3	14	10	29
		Expected Count	2.1	4.3	12.8	9.8	29.0
		% within Q6	6.9%	10.3%	48.3%	34.5%	100.0%
		% within Q31C	9.5%	7.0%	10.9%	10.1%	9.9%
		% of Total	.7%	1.0%	4.8%	3.4%	9.9%
	3.00	Count	1	0	1	1	3
		Expected Count	.2	.4	1.3	1.0	3.0
		% within Q6	33.3%	.0%	33.3%	33.3%	100.0%
		% within Q31C	4.8%	.0%	.8%	1.0%	1.0%

		% of Total	.3%	.0%	.3%	.3%	1.0%
	4.00	Count	1	0	0	0	1
		Expected Count	.1	.1	.4	.3	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q31C	4.8%	.0%	.0%	.0%	.3%
		% of Total	.3%	.0%	.0%	.0%	.3%
Total		Count	21	43	129	99	292
		Expected Count	21.0	43.0	129.0	99.0	292.0
		% within Q6	7.2%	14.7%	44.2%	33.9%	100.0%
		% within Q31C	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	7.2%	14.7%	44.2%	33.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.129(a)	12	.112
Likelihood Ratio	9.746	12	.638
Linear-by-Linear Association	.059	1	.808
N of Valid Cases	292		

a 11 cells (55.0%) have expected count less than 5. The minimum expected count is .07.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Contingency Coefficient	.242	.112
N of Valid Cases		292	

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.

Q6 * Q31D

Crosstab

			Q31D			
			.00	1.00	2.00	3.00	Total
Q6	.00	Count	21	13	28	118	180
		Expected Count	19.4	9.7	27.8	123.0	180.0
		% within Q6	11.7%	7.2%	15.6%	65.6%	100.0%
		% within Q31D	70.0%	86.7%	65.1%	62.1%	64.7%
		% of Total	7.6%	4.7%	10.1%	42.4%	64.7%
	1.00	Count	6	2	11	48	67
		Expected Count	7.2	3.6	10.4	45.8	67.0
		% within Q6	9.0%	3.0%	16.4%	71.6%	100.0%
		% within Q31D	20.0%	13.3%	25.6%	25.3%	24.1%
		% of Total	2.2%	.7%	4.0%		

							17.3%	24.1%
		2.00	Count	1	0	4	22	27
			Expected Count	2.9	1.5	4.2	18.5	27.0
			% within Q6	3.7%	.0%	14.8%	81.5%	100.0%
			% within Q31D	3.3%	.0%	9.3%	11.6%	9.7%
			% of Total	.4%	.0%	1.4%	7.9%	9.7%
		3.00	Count	1	0	0	2	3
			Expected Count	.3	.2	.5	2.1	3.0
			% within Q6	33.3%	.0%	.0%	66.7%	100.0%
			% within Q31D	3.3%	.0%	.0%	1.1%	1.1%
			% of Total	.4%	.0%	.0%	.7%	1.1%
		4.00	Count	1	0	0	0	1

		Expected Count	.1	.1	.2	.7	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q31D	3.3%	.0%	.0%	.0%	.4%
		% of Total	.4%	.0%	.0%	.0%	.4%
Total	Count		30	15	43	190	278
	Expected Count		30.0	15.0	43.0	190.0	278.0
	% within Q6		10.8%	5.4%	15.5%	68.3%	100.0%
	% within Q31D		100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total		10.8%	5.4%	15.5%	68.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.232(a)	12	.181

Likelihood Ratio	14.427	12	.274
Linear-by-Linear Association	.727	1	.394
N of Valid Cases	278		

a 12 cells (60.0%) have expected count less than 5. The minimum expected count is .05.

Q6 * Q31E

Crosstab

			Q31E			
			.00	1.00	2.00	3.00	Total
Q6	.00	Count	17	26	83	58	184
		Expected Count	16.4	24.2	81.2	62.2	184.0
		% within Q6	9.2%	14.1%	45.1%	31.5%	100.0%
		% within Q31E	68.0%	70.3%	66.9%	61.1%	65.5%
		% of Total	6.0%	9.3%	29.5%	20.6%	65.5%

		----	--------------	------	------	------	------
		1.00	Count	4	10	29	27	70
			--------------	------	------	------	------
			Expected Count	6.2	9.2	30.9	23.7	70.0
			--------------	------	------	------	------
			% within Q6	5.7%	14.3%	41.4%	38.6%	100.0%
			--------------	------	------	------	------
			% within Q31E	16.0%	27.0%	23.4%	28.4%	24.9%
			--------------	------	------	------	------
			% of Total	1.4%	3.6%	10.3%	9.6%	24.9%
		----	--------------	------	------	------	------
		2.00	Count	2	1	12	9	24
			--------------	------	------	------	------
			Expected Count	2.1	3.2	10.6	8.1	24.0
			--------------	------	------	------	------
			% within Q6	8.3%	4.2%	50.0%	37.5%	100.0%
			--------------	------	------	------	------
			% within Q31E	8.0%	2.7%	9.7%	9.5%	8.5%
			--------------	------	------	------	------
			% of Total	.7%	.4%	4.3%	3.2%	8.5%
		----	--------------	------	------	------	------
		3.00	Count	1	0	0	1	2
			--------------	------	------	------	------
			Expected Count	.2	.3	.9	

		% within Q6	50.0%	.0%	.0%	50.0%	100.0%
		% within Q31E	4.0%	.0%	.0%	1.1%	.7%
		% of Total	.4%	.0%	.0%	.4%	.7%
	4.00	Count	1	0	0	0	1
		Expected Count	.1	.1	.4	.3	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q31E	4.0%	.0%	.0%	.0%	.4%
		% of Total	.4%	.0%	.0%	.0%	.4%
Total		Count	25	37	124	95	281
		Expected Count	25.0	37.0	124.0	95.0	281.0
		% within Q6	8.9%	13.2%	44.1%	33.8%	100.0%

	% within Q31E	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	8.9%	13.2%	44.1%	33.8%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.036(a)	12	.088
Likelihood Ratio	13.402	12	.340
Linear-by-Linear Association	.047	1	.828
N of Valid Cases	281		

a 10 cells (50.0%) have expected count less than 5. The minimum expected count is .09.

Q6 * Q31F

Crosstab

		Q31F			Total
		.00	1.00	2.00	3.00	

Q6	.00	Count	19	21	69	75
		Expected Count	18.1	20.1	65.4	80.3
		% within Q6	10.3%	11.4%	37.5%	40.8%
		% within Q31F	67.9%	67.7%	68.3%	60.5%
		% of Total	6.7%	7.4%	24.3%	26.4%
	1.00	Count	4	9	20	34
		Expected Count	6.6	7.3	23.8	29.3
		% within Q6	6.0%	13.4%	29.9%	50.7%
		% within Q31F	14.3%	29.0%	19.8%	27.4%
		% of Total	1.4%	3.2%	7.0%	12.0%
	2.00	Count	3	1	11	14
		Expected Count	2.9	3.2	10.3	12.7

		% within Q6	10.3%	3.4%	37.9%	48.3%	100.0%
		% within Q31F	10.7%	3.2%	10.9%	11.3%	10.2%
		% of Total	1.1%	.4%	3.9%	4.9%	10.2%
	3.00	Count	1	0	1	1	3
		Expected Count	.3	.3	1.1	1.3	3.0
		% within Q6	33.3%	.0%	33.3%	33.3%	100.0%
		% within Q31F	3.6%	.0%	1.0%	.8%	1.1%
		% of Total	.4%	.0%	.4%	.4%	1.1%
	4.00	Count	1	0	0	0	1
		Expected Count	.1	.1	.4	.4	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q31F	3.6%	.0%	.0%		

.0% | .4% |
| | | ---------- | ------ | ------ | ------ | ------ | ------ |
		% of Total	.4%	.0%	.0%	.0%	.4%
Total	Count	28	31	101	124	284
	----------	------	------	------	------	------
	Expected Count	28.0	31.0	101.0	124.0	284.0
	----------	------	------	------	------	------
	% within Q6	9.9%	10.9%	35.6%	43.7%	100.0%
	----------	------	------	------	------	------
	% within Q31F	100.0%	100.0%	100.0%	100.0%	100.0%
	----------	------	------	------	------	------
	% of Total	9.9%	10.9%	35.6%	43.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.333(a)	12	.176
Likelihood Ratio	12.192	12	.430
Linear-by-Linear Association	.028	1	.868

N of Valid Cases	284	

a 10 cells (50.0%) have expected count less than 5. The minimum expected count is .10.

Q6 * Q31G

Crosstab

			Q31G			Total
			.00	1.00	2.00	3.00	
Q6	.00	Count	23	12	54	90	179
		Expected Count	23.2	10.3	47.0	98.5	179.0
		% within Q6	12.8%	6.7%	30.2%	50.3%	100.0%
		% within Q31G	63.9%	75.0%	74.0%	58.8%	64.4%
		% of Total	8.3%	4.3%	19.4%	32.4%	64.4%
	1.00	Count	8	4	17	38	67
		Expected Count	8.7	3.9	17.6	36.9	67.0

		% within Q6	11.9%	6.0%	25.4%	56.7%	100.0%
		% within Q31G	22.2%	25.0%	23.3%	24.8%	24.1%
		% of Total	2.9%	1.4%	6.1%	13.7%	24.1%
	2.00	Count	3	0	2	23	28
		Expected Count	3.6	1.6	7.4	15.4	28.0
		% within Q6	10.7%	.0%	7.1%	82.1%	100.0%
		% within Q31G	8.3%	.0%	2.7%	15.0%	10.1%
		% of Total	1.1%	.0%	.7%	8.3%	10.1%
	3.00	Count	1	0	0	2	3
		Expected Count	.4	.2	.8	1.7	3.0
		% within Q6	33.3%	.0%	.0%	66.7%	100.0%
		% within Q31G	2.8%	.0%	.0%	1.3%	1.1%

		% of Total	.4%	.0%	.0%	.7%	1.1%
	4.00	Count	1	0	0	0	1
		Expected Count	.1	.1	.3	.6	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q31G	2.8%	.0%	.0%	.0%	.4%
		% of Total	.4%	.0%	.0%	.0%	.4%
Total		Count	36	16	73	153	278
		Expected Count	36.0	16.0	73.0	153.0	278.0
		% Within Q6	12.9%	5.8%	26.3%	55.0%	100.0%
		% Within Q31G	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	12.9%	5.8%	26.3%	55.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.244(a)	12	.063
Likelihood Ratio	20.955	12	.051
Linear-by-Linear Association	.891	1	.345
N of Valid Cases	278		

a 11 cells (55.0%) have expected count less than 5. The minimum expected count is .06.

Q6 * Q31H

Crosstab

			Q31H			Total
			.00	1.00	2.00	3.00	
Q6	.00	Count	11	88	45	43	187
		Expected Count	11.1	88.9	41.8	45.1	187.0

		% Within Q6	5.9%	47.1%	24.1%	23.0%	100.0%
		% Within Q31H	64.7%	64.7%	70.3%	62.3%	65.4%
		% Of Total	3.8%	30.8%	15.7%	15.0%	65.4%
	1.00	Count	3	33	11	21	68
		Expected Count	4.0	32.3	15.2	16.4	68.0
		% within Q6	4.4%	48.5%	16.2%	30.9%	100.0%
		% within Q31H	17.6%	24.3%	17.2%	30.4%	23.8%
		% of Total	1.0%	11.5%	3.8%	7.3%	23.8%
	2.00	Count	1	14	8	4	27
		Expected Count	1.6	12.8	6.0	6.5	27.0
		% Within Q6	3.7%	51.9%	29.6%	14.8%	100.0%
		% Within Q31H	5.9%	10.3%	12.5%	5.8%	9.4%

		% of Total	.3%	4.9%	2.8%	1.4%	9.4%
	3.00	Count	1	1	0	1	3
		Expected Count	.2	1.4	.7	.7	3.0
		% within Q6	33.3%	33.3%	.0%	33.3%	100.0%
		% within Q31H	5.9%	.7%	.0%	1.4%	1.0%
		% of Total	.3%	.3%	.0%	.3%	1.0%
	4.00	Count	1	0	0	0	1
		Expected Count	.1	.5	.2	.2	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q31H	5.9%	.0%	.0%	.0%	.3%
		% of Total	.3%	.0%	.0%	.0%	.3%
Total		Count	17	136	64	69	286

	Expected Count	17.0	136.0	64.0	69.0	286.0
	% within Q6	5.9%	47.6%	22.4%	24.1%	100.0%
	% within Q31H	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	5.9%	47.6%	22.4%	24.1%	100.0%
--	----					

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.537(a)	12	.012
Likelihood Ratio	14.225	12	.287
Linear-by-Linear Association	.536	1	.464
N of Valid Cases	286		

a 10 cells (50.0%) have expected count less than 5. The minimum expected count is .06.

Q6 * Q31I

Crosstab

			Q31I		Total
			.00	4.00	
Q6	.00	Count	2	1	3
		Expected Count	2.0	1.0	3.0
		% within Q6	66.7%	33.3%	100.0%
		% within Q31I	100.0%	100.0%	100.0%
		% of Total	66.7%	33.3%	100.0%
Total		Count	2	1	3
		Expected Count	2.0	1.0	3.0
		% within Q6	66.7%	33.3%	100.0%
		% within Q31I	100.0%	100.0%	100.0%
		% of Total	66.7%	33.3%	100.0%

Chi-Square Tests

	Value
Pearson Chi-Square	.(a)
N of Valid Cases	3

a No statistics are computed because Q6 is a constant.

Q6 * Q26

Crosstab

		Q26		Total

			.00	1.00	2.00	
Q6	.00	Count	4	137	52	193
		Expected Count	3.2	137.8	52.0	193.0
		% within Q6	2.1%	71.0%	26.9%	100.0%
		% within Q26	80.0%	64.6%	65.0%	65.0%
		% of Total	1.3%	46.1%	17.5%	65.0%
	1.00	Count	0	52	19	71
		Expected Count	1.2	50.7	19.1	71.0
		% within Q6	.0%	73.2%	26.8%	100.0%
		% within Q26	.0%	24.5%	23.8%	23.9%
		% of Total	.0%	17.5%	6.4%	23.9%
	2.00	Count	0	20	9	29

		Expected Count	.5	20.7	7.8	29.0
		% within Q6	.0%	69.0%	31.0%	100.0%
		% within Q26	.0%	9.4%	11.3%	9.8%
		% of Total	.0%	6.7%	3.0%	9.8%
	3.00	Count	0	3	0	3
		Expected Count	.1	2.1	.8	3.0
		% within Q6	.0%	100.0%	.0%	100.0%
		% within Q26	.0%	1.4%	.0%	1.0%
		% of Total	.0%	1.0%	.0%	1.0%
	4.00	Count	1	0	0	1
		Expected Count	.0	.7	.3	1.0
		% within Q6	100.0%	.0%	.0%	

100.0% |
 | | | ------------- | ------ | ------ | ------ | -
----- |
 | | | % within Q26 | 20.0% | .0% | .0% |
.3% |
 | | | ------------- | ------ | ------ | ------ | -
----- |
 | | | % of Total | .3% | .0% | .0% |
.3% |
 | -- | ---- | ------------- | ------ | ------ | ------ | -
----- |
 | Total | | Count | 5 | 212 | 80 |
297 |
 | | | ------------- | ------ | ------ | ------ | -
----- |
 | | | Expected Count | 5.0 | 212.0 | 80.0 |
297.0 |
 | | | ------------- | ------ | ------ | ------ | -
----- |
 | | | % within Q6 | 1.7% | 71.4% | 26.9% |
100.0% |
 | | | ------------- | ------ | ------ | ------ | -
----- |
 | | | % within Q26 | 100.0% | 100.0% | 100.0% |
100.0% |
 | | | ------------- | ------ | ------ | ------ | -
----- |
 | | | % of Total | 1.7% | 71.4% | 26.9% |
100.0% |
 | -- | ---- | ------------- | ------ | ------ | ------ | -
----- |

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	61.704(a)	8	.000
Likelihood Ratio	13.955	8	.083

Linear-by-Linear Association	.226	1	.635
N of Valid Cases	297		

a 9 cells (60.0%) have expected count less than 5. The minimum expected count is .02.

Q6 * Q29

Crosstab

			Q29			Total
			.00	1.00	2.00	3.00	
Q6	.00	Count	0	78	112	2	192
		Expected Count	.7	79.7	109.7	2.0	192.0
		% within Q6	.0%	40.6%	58.3%	1.0%	100.0%
		% within Q29	.0%	63.9%	66.7%	66.7%	65.3%
		% of Total	.0%	26.5%	38.1%	.7%	65.3%
	1.00	Count	0	32	38	0	70

		Expected Count	.2	29.0	40.0	70.0
		% within Q6	.0%	45.7%	54.3%	100.0%
		% within Q29	.0%	26.2%	22.6%	23.8%
		% of Total	.0%	10.9%	12.9%	23.8%
	2.00	Count	0	10	17	28
		Expected Count	.1	11.6	16.0	28.0
		% within Q6	.0%	35.7%	60.7%	100.0%
		% within Q29	.0%	8.2%	10.1%	9.5%
		% of Total	.0%	3.4%	5.8%	9.5%
	3.00	Count	0	2	1	3
		Expected Count	.0	1.2	1.7	3.0
		% within Q6	.0%	66.7%	33.3%	100.0%

		% within Q29	.0%	1.6%	.6%	.0%	1.0%
		% of Total	.0%	.7%	.3%	.0%	1.0%
	4.00	Count	1	0	0	0	1
		Expected Count	.0	.4	.6	.0	1.0
		% within Q6	100.0%	.0%	.0%	.0%	100.0%
		% within Q29	100.0%	.0%	.0%	.0%	.3%
		% of Total	.3%	.0%	.0%	.0%	.3%
Total		Count	1	122	168	3	294
		Expected Count	1.0	122.0	168.0	3.0	294.0
		% within Q6	.3%	41.5%	57.1%	1.0%	100.0%
		% within Q29	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	.3%	41.5%	57.1%		

1.0% | 100.0% |
| -- | ---- | -------------- | ------ | ------ | ------ | ------ | ------ |

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	298.055(a)	12	.000
Likelihood Ratio	17.438	12	.134
Linear-by-Linear Association	1.072	1	.301
N of Valid Cases	294		

a 14 cells (70.0%) have expected count less than 5. The minimum expected count is .00.

Q6 * Q22

Crosstab

			Q22					Total
			.00	1.00	2.00	3.00	4.00	5.00	
Q6	.00	Count	123	55	11	1	1	1	192

		Expected Count	115.9	58.6	12.4	2.6	1.3	1.3	192.0
		% within Q6	64.1%	28.6%	5.7%	.5%	.5%	.5%	100.0%
		% within Q22	69.1%	61.1%	57.9%	25.0%	50.0%	50.0%	65.1%
		% of Total	41.7%	18.6%	3.7%	.3%	.3%	.3%	65.1%
	1.00	Count	40	22	5	1	1	1	70
		Expected Count	42.2	21.4	4.5	.9	.5	.5	70.0
		% within Q6	57.1%	31.4%	7.1%	1.4%	1.4%	1.4%	100.0%
		% within Q22	22.5%	24.4%	26.3%	25.0%	50.0%	50.0%	23.7%
		% of Total	13.6%	7.5%	1.7%	.3%	.3%	.3%	23.7%
	2.00	Count	15	10	3	1	0	0	29
		Expected Count	17.5	8.8	1.9	.4	.2	.2	29.0
		% within Q6	51.7%	34.5%	10.3%	3.4%	.0%	.0%	100.0%

		% within Q22	8.4%	11.1%	15.8%	25.0%	.0%	.0%	9.8%		
		% of Total	5.1%	3.4%	1.0%	.3%	.0%	.0%	9.8%		
	3.00	Count	0	2	0	1	0	0	3		
		Expected Count	1.8	.9	.2	.0	.0	.0	3.0		
		% within Q6	.0%	66.7%	.0%	33.3%	.0%	.0%	100.0%		
		% within Q22	.0%	2.2%	.0%	25.0%	.0%	.0%	1.0%		
		% of Total	.0%	.7%	.0%	.3%	.0%	.0%	1.0%		
	4.00	Count	0	1	0	0	0	0	1		
		Expected Count	.6	.3	.1	.0	.0	.0	1.0		
		% within Q6	.0%	100.0%	.0%	.0%	.0%	.0%	100.0%		
		% within Q22	.0%	1.1%	.0%	.0%	.0%	.0%	.3%		
		% of Total	.0%	.3%	.0%	.0%	.0%	.0%	.3%		

| -- | ---- | -------------- | ------ | ------ | ------ | ------ | ------ | ------ |
Total	Count	178	90	19	4	2	2	295
	Expected Count	178.0	90.0	19.0	4.0	2.0	2.0	295.0
	% within Q6	60.3%	30.5%	6.4%	1.4%	.7%	.7%	100.0%
	% within Q22	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	60.3%	30.5%	6.4%	1.4%	.7%	.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.050(a)	20	.026
Likelihood Ratio	17.774	20	.602
Linear-by-Linear Association	5.925	1	.015
N of Valid Cases	295		

a 23 cells (76.7%) have expected count less than 5. The

minimum expected count is .01.

Q6 * Q23

Crosstab

		Q23					Total
		.00	1.00	2.00	3.00	5.00	
Q6	.00	Count	90	65	33	2	191
		Expected Count	78.0	70.2	38.3	3.2	191.0
		% within Q6	47.1%	34.0%	17.3%	1.0%	100.0%
		% within Q23	75.0%	60.2%	55.9%	40.0%	65.0%
		% of Total	30.6%	22.1%	11.2%	.7%	65.0%
	1.00	Count	22	29	16	2	70
		Expected Count	28.6	25.7	14.0	1.2	70.0
		% within Q6	31.4%	41.4%	22.9%	2.9%	100.0%

		% within Q23	18.3%	26.9%	27.1%	40.0%	50.0%	23.8%
		% of Total	7.5%	9.9%	5.4%	.7%	.3%	23.8%
	2.00	Count	8	12	8	1	0	29
		Expected Count	11.8	10.7	5.8	.5	.2	29.0
		% within Q6	27.6%	41.4%	27.6%	3.4%	.0%	100.0%
		% within Q23	6.7%	11.1%	13.6%	20.0%	.0%	9.9%
		% of Total	2.7%	4.1%	2.7%	.3%	.0%	9.9%
	3.00	Count	0	1	2	0	0	3
		Expected Count	1.2	1.1	.6	.1	.0	3.0
		% within Q6	.0%	33.3%	66.7%	.0%	.0%	100.0%
		% within Q23	.0%	.9%	3.4%	.0%	.0%	1.0%
		% of Total	.0%	.3%	.7%	.0%	.0%	1.0%

	4.00	Count	0	1	0	0	0	1			
		Expected Count	.4	.4	.2	.0	.0	1.0			
		% within Q6	.0%	100.0%	.0%	.0%	.0%	100.0%			
		% within Q23	.0%	.9%	.0%	.0%	.0%	.3%			
		% of Total	.0%	.3%	.0%	.0%	.0%	.3%			
Total		Count	120	108	59	5	2	294			
		Expected Count	120.0	108.0	59.0	5.0	2.0	294.0			
		% within Q6	40.8%	36.7%	20.1%	1.7%	.7%	100.0%			
		% within Q23	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%			
		% of Total	40.8%	36.7%	20.1%	1.7%	.7%	100.0%			

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)

Pearson Chi-Square	16.081(a)	16	.447
Likelihood Ratio	16.473	16	.420
Linear-by-Linear Association	8.599	1	.003
N of Valid Cases	294		

a 16 cells (64.0%) have expected count less than 5. The minimum expected count is .01.

Q6 * Q24

Crosstab

			Q24				Total
			.00	1.00	2.00	3.00	4.00	
Q6	.00	Count	171	17	2	1	0	191
		Expected Count	164.3	20.9	4.6	.7	.7	191.0
		% within Q6	89.5%	8.9%	1.0%	.5%	.0%	100.0%
		% within Q24	67.9%	53.1%	28.6%			

		% of Total	58.4%	5.8%	.7%	.3%	.0%
			65.2%				100.0%
	1.00	Count	58	8	2	0	1
			69				
		Expected Count	59.3	7.5	1.6	.2	.2
			69.0				
		% within Q6	84.1%	11.6%	2.9%	.0%	1.4%
			100.0%				
		% within Q24	23.0%	25.0%	28.6%	.0%	100.0%
			23.5%				
		% of Total	19.8%	2.7%	.7%	.0%	.3%
			23.5%				
	2.00	Count	20	7	2	0	0
			29				
		Expected Count	24.9	3.2	.7	.1	.1
			29.0				
		% within Q6	69.0%	24.1%	6.9%	.0%	.0%
			100.0%				
		% within Q24	7.9%	21.9%	28.6%	.0%	.0%
			9.9%				
		% of Total	6.8%	2.4%	.7%	.0%	.0%
			9.9%				

	3.00	Count	2	0	1	0	0	3
		Expected Count	2.6	.3	.1	.0	.0	3.0
		% within Q6	66.7%	.0%	33.3%	.0%	.0%	100.0%
		% within Q24	.8%	.0%	14.3%	.0%	.0%	1.0%
		% of Total	.7%	.0%	.3%	.0%	.0%	1.0%
	4.00	Count	1	0	0	0	0	1
		Expected Count	.9	.1	.0	.0	.0	1.0
		% within Q6	100.0%	.0%	.0%	.0%	.0%	100.0%
		% within Q24	.4%	.0%	.0%	.0%	.0%	.3%
		% of Total	.3%	.0%	.0%	.0%	.0%	.3%
--	----	----------	----	----	----	----	----	----
Total	Count	252	32	7	1	1	1	293
	Expected Count	252.0	32.0	7.0	1.0	1.0	1.0	293.0
	----------	----	----	----	----	----	----	----

```
----- | ------ | ------ |
 |           | % within Q6    | 86.0%  | 10.9%  | 2.4%   |
.3%    | .3%    | 100.0% |
 |           | -------------- | ------ | ------ | ------ | -
----- | ------ | ------ |
 |           | % within Q24   | 100.0% | 100.0% | 100.0% |
100.0% | 100.0% | 100.0% |
 |           | -------------- | ------ | ------ | ------ | -
----- | ------ | ------ |
 |           | % of Total     | 86.0%  | 10.9%  | 2.4%   |
.3%    | .3%    | 100.0% |
 | -- | ---- | -------------- | ------ | ------ | ------ | -
----- | ------ | ------ |
```

Chi-Square Tests

```
-----------------------------------------------------------------
---------------
 |                                | Value     | df | Asymp.
Sig. (2-sided) |
 | ------------------------------ | --------- | -- | ---------
------------ |
 | Pearson Chi-Square             | 27.066(a) | 16 | .041
             |
 | ------------------------------ | --------- | -- | ---------
------------ |
 | Likelihood Ratio               | 17.352    | 16 | .363
             |
 | ------------------------------ | --------- | -- | ---------
------------ |
 | Linear-by-Linear Association | 8.383     | 1  | .004
             |
 | ------------------------------ | --------- | -- | ---------
------------ |
 | N of Valid Cases               | 293       |    |
             |
 | ------------------------------ | --------- | -- | ---------
------------ |
a 20 cells (80.0%) have expected count less than 5. The
minimum expected count is .00.
```

Q6 * Q28

Crosstab

```
-----------------------------------------------------------------
 |                              | Q28             | Total  |
 |                              | ------ | ------ |        |
 |                              | 1.00   | 2.00   |        |
```

| -- | ---- | -------------- | ------ | ------ | ------ |
Q6	.00	Count	180	13	193
		Expected Count	180.0	13.0	193.0
		% within Q6	93.3%	6.7%	100.0%
		% within Q28	65.0%	65.0%	65.0%
		% of Total	60.6%	4.4%	65.0%
	1.00	Count	68	3	71
		Expected Count	66.2	4.8	71.0
		% within Q6	95.8%	4.2%	100.0%
		% within Q28	24.5%	15.0%	23.9%
		% of Total	22.9%	1.0%	23.9%
	2.00	Count	26	3	29
		Expected Count	27.0	2.0	29.0
		% within Q6	89.7%	10.3%	100.0%
		% within Q28	9.4%	15.0%	9.8%
		% of Total	8.8%	1.0%	9.8%
	3.00	Count	3	0	3
		Expected Count	2.8	.2	3.0
		% within Q6	100.0%	.0%	100.0%
		% within Q28	1.1%	.0%	1.0%
		% of Total	1.0%	.0%	1.0%
	4.00	Count	0	1	1
		Expected Count	.9	.1	1.0
		% within Q6	.0%	100.0%	100.0%

		% within Q28	.0%	5.0%	.3%
		% of Total	.0%	.3%	.3%
--	----				
Total		Count	277	20	297
		Expected Count	277.0	20.0	297.0
		% within Q6	93.3%	6.7%	100.0%
		% within Q28	100.0%	100.0%	100.0%
		% of Total	93.3%	6.7%	100.0%
--	----				

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.380(a)	4	.004
Likelihood Ratio	7.150	4	.128
Linear-by-Linear Association	1.157	1	.282
N of Valid Cases	297		

a 6 cells (60.0%) have expected count less than 5. The minimum expected count is .07.

VITA

EDUCATION

MS	Agricultural Education and Extension North Carolina Agricultural and Technical State University Greensboro North Carolina.	1991
BS	Industrial Technology (Automotive) North Carolina Agricultural and Technical State University Greensboro North Carolina.	1988
HND	Higher National Diploma in Mechanical Engineering Hindustan Institute of Engineering Technology, Madras India.	1982
F T C	Full Technological Certificate (Automotive) City and Guild of London, London.	1979

Work Experience

Extension Specialist Environmental, Farm Energy and Safety, 1998-present. North Carolina Cooperative Extension System, North Carolina A & T State University Greensboro.

Extension Associate 1991-198
North Carolina Cooperative Extension
North Carolina A & T State University, Greensboro.

Technical Instructor, (two years) Abuja Technical College, Abuja, Nigeria. 1984 -85

Laboratory Technician, North Carolina A & T State University, Animal Research Center 1990- 91.

Graduate Research Assistance, North Carolina A & T State University, Agricultural Education and Extension Department 1990-91.

Professional Affiliations

Gamma sigma Delta, Institute of Engineers and Technicians London, Institute of Automotive Engineers, India, Institute Agricultural Engineers India, and America Society of Agricultural Engineers.

Born in Nigeria West Africa on November 18, 1957 to Ladan Ibrahim and Mariama Ibrahim.

Mohammed is marred to Princella Ibrahim and has one child Mariama.