Relationships between selected personal and farm characteristics of Tennessee beef producers, their contacts with extension, and their use of selected hay storage methods

Nathan H. Peery
To the Graduate Council:

I am submitting herewith a thesis written by Nathan H. Peery entitled "Relationships between selected personal and farm characteristics of Tennessee beef producers, their contacts with extension, and their use of selected hay storage methods." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural and Extension Education.

Roy R. Lessly, Major Professor

We have read this thesis and recommend its acceptance:

Randol Waters, Warren Gill, Gary Bates

Accepted for the Council:

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(Original signatures are on file with official student records.)
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[Signature]

Associate Vice Chancellor and
Dean of The Graduate School
RELATIONSHIPS BETWEEN SELECTED PERSONAL AND
FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS,
THEIR CONTACTS WITH EXTENSION, AND THEIR USE OF
SELECTED HAY STORAGE METHODS

A Thesis
Presented for the
Master of Science Degree
The University of Tennessee, Knoxville

Nathan H. Peery
May 1999
ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to the patience, support and leadership of his graduate committee chairman, Dr. Roy R. Lessly, Professor and Head of the Department of Agricultural and Extension Education, for without his guidance, the study could not have been accomplished. Appreciation is also given to members of his graduate committee, Drs. Randol Waters, Warren Gill, and Gary Bates, for their support, guidance, and encouragements.

Appreciate is expressed to Missy Kitts, Sherri Byrd, and Mioko Oliver for their assistance, patience, and encouragement, for without their help, finishing the thesis would have been a very difficult task.

A special appreciation is expressed to the author's parents and wife for their understanding, patience, and encouragement.
The purpose of this study was to characterize Tennessee beef producers by their personal and farm characteristics, the number and type of contacts made with Extension, their use of selected round bale hay storage methods, and to determine the interrelationships among the variables.

The sample of this study included Tennessee beef producers who participated in the 1996 Tennessee Beef Producers Survey and fed 75 percent or more of their hay as large round bales. A total of 543 Tennessee beef producers met these criterion and their responses were used for this study.

The 1996 Tennessee Beef Producer Survey was developed by University of Tennessee Agricultural Extension Service specialists in the Extension Animal Science-Beef and the Agricultural and Extension Education Sections. The survey was disseminated by Extension agents to their county producers. The number of producers surveyed per county varied depending upon the number of beef producers in the county. Surveys were completed and returned to the beef section at The University of Tennessee for analysis.

Descriptive statistics were used to summarize the survey data. The chi-square test was used to determine if significant relationship existed between dependent and independent variables. Chi-square values which were determine to be at the .05 probability level or lower were identified as statistically significant.

Forty-nine percent of Tennessee beef producers surveyed were between the ages of 41 and 60, with the average age of 54 years. Seventy-seven percent of the producers surveyed were part-time producers. Eighty-eight percent of the producers owned 100
head or less head of heifers and cows. Forty-one percent of the producers operated 51 to 150 acres of permanent pasture land.

Approximately 55 percent of the producers attended one to three Extension beef meetings and 44.5 percent received one to three visits from an Extension agent. Forty percent of the producers made telephone calls to the local Extension office, 65 percent of producers received one to three factsheets or publications, and 68.5 received quarterly newsletters.

Approximately 75 percent of the producers surveyed packaged 100 percent of their hay in round bales. Of the 543 producers surveyed, 154 producers stored 51 percent or more of their round bales of hay outside, on-the-ground, and uncovered, and 140 stored 51 percent or more of their round bales of hay inside a permanent structure.

There were no significant relationships found between age, farming status, number of heifers and cows exposed to the bull, number of acres of permanent pasture land and Extension beef meetings attended. There was also no significant relationship between age and number of visits received from an Extension agent.

A significant relationship was reported between farming status, number of heifers and cows exposed to the bull, number of acres of permanent pasture land operated by producers and visits received from an Extension agent. Producers reported as full-time, had 51 or more head of heifers and cows exposed to the bull, and operated 151 acres or more of permanent pasture land were more likely to have receive visits from an Extension agent.
A significant relationship was reported between the number of acres of permanent pasture land and the percent of round bales of hay producers stored inside a permanent structure. Producers with 50 acres or less of permanent pasture land were more likely to store 51 percent or more of their round bales inside a permanent structure than were producers with 51 or more acres of permanent pasture land.

There were no significant differences between producers age, farming status, and number of heifers and cows exposed to the bull when compared to round bales of hay stored: outside, on-the-ground, and uncovered; outside, off-the-ground, and uncovered; outside, off-the-ground, and covered.

There was no significant relationship between the number of Extension contacts and the four methods of round bale hay storage. A producer with six or more Extension contacts was no more likely to store rounds bales of hay in one of the four methods than a producer with five or less Extension contacts.
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CHAPTER I

THE PROBLEM AND ITS SETTING

Forage crops, including hay and silage, undoubtedly will continue as a major part of many United States farm enterprises. The proper use of forage crops is considered "best management practices" on many acres of land to reduce the amount of soil erosion, water runoff, and water pollution. When energy feed costs escalate, a premium will be placed on the producer's use of high quality legumes in rations for ruminant livestock production enterprises (Martin, 1980).

Large round balers offer the opportunity for labor efficient hay production. Unfortunately, poor storage methods often reduce hay quality and increase losses. Many hay producers are losing more than one-third of their harvested forage before it is removed from storage for feeding (Collins et al., 1987).

I. NEED FOR THE STUDY

The value of hay to Tennessee producers is often overlooked because most hay is used on the farms where it is produced (Verma and Nelson, 1983). Hay production is very important to Tennessee environmentally since much of Tennessee's land is best suited for forage production in order to protect the soil and water. It is also important to Tennessee economically since, according to the Tennessee Agricultural Statistics Service, Tennessee farmers harvested 1,790,000 acres of forage totaling 3,811,000 tons (2.13 tons/acre) with a value of $170,537,000 ($45/ton) in 1996. The market value of the hay may be more or less than reported depending on how the hay affects the production and
net dollar return of an individual farm. Since most of the hay is used on the farm of origin, the bulk of the economics of hay production in Tennessee will be "cashed in" as beef and dairy products.

By reducing hay waste and the amount of hay needed, it is easy to see that a positive effect on proper storage of hay would greatly affect the income of the farmer, as well as the economy of Tennessee. This study was conducted to identify selected Tennessee beef producers’ personal and farm characteristics, their contacts with Extension, and to determine if any of these characteristics or contacts influenced their use of selected round bale hay storage practices.

II. PURPOSE AND OBJECTIVES

The purpose of this study was to determine if there is a difference in round bale hay storage methods used by Tennessee beef producers based on farm and operator characteristics and producer contacts with The University of Tennessee Agricultural Extension Service.

The objectives of the study were:

1. To characterize Tennessee beef producers by selected personal and farm operation characteristics, the number and type of contacts with Extension, and their use of selected round bale hay storage methods.

2. To determine the relationships between selected personal and farm operation characteristics of Tennessee beef producers, the number of Extension meetings attended, and the number of farm visits received from an Extension agent.
3. To determine the relationships between selected personal and farm operation characteristics of Tennessee beef producers and their use of selected round bale hay storage methods.

4. To determine the relationships between the number and type of contacts producers had with Extension and their use of selected round bale hay storage methods.

III. LIMITATIONS OF THE STUDY

This study was limited to the analysis of the data available from the 1996 Tennessee Beef Survey. The data were obtained by Extension agents through a written survey with beef producers. The number of surveys completed varied from county to county, depending on the number of beef producers in the county. Each county was to survey a minimum of 25 producers.

IV. METHODS AND PROCEDURES

Population and Sample Studied

The sample for this study was drawn from a secondary data source. The original sample of 653 respondents was drawn from the population of all beef producers in Tennessee in the spring of 1996. The sub-sample selected for this study included those Tennessee beef producers who completed the 1996 Tennessee Beef Producers Survey and fed 75 percent or more of their hay in round bales. A total of 543 Tennessee beef producers met these criteria and their responses were used for this study.
Survey Instrument

The 1996 Tennessee Beef Producer Survey was developed by specialists in the Extension Animal Science-Beef and Agricultural and Extension Education Sections.

Conducting the Survey

The survey’s were distributed through The University of Tennessee’s Agriculture Extension Service’s county offices and at meetings conducted in Tennessee by the Extension Service’s beef specialists. Extension agents in each county determined, at their own discretion, how to disseminate their surveys. This was done either through mailings, handing them out at meetings, and/or having producers pick them up at the Extension office. When the survey was completed, the beef producer was to return it to the local Extension office to be forwarded to the Extension Animal Science-Beef Section for tabulation.

Method of Analysis

Descriptive statistics were used to summarize the survey data. The chi-square test was used to determine if significant relationships existed between dependent and independent variables. Chi-square values which were determined to be at the .05 probability level or lower were identified as being statistically significant.
CHAPTER II

REVIEW OF RELATED STUDIES

In accordance with the objectives of the study, the review of related studies focuses on the following areas with each area discussed within a section.

1. Introduction
2. Quantity changes in round bale hay storage
3. Quality changes in round bale hay storage
4. Beef and dairy animals' performance when fed round bales hay stored outside vs. inside
5. Round bale hay storage methods
6. Economics of round bale hay storage
7. What is in the future for round bale hay storage?
8. Extension's effect on the adoption of recommended practices
9. Chapter Summary

I. INTRODUCTION

As the popularity and number of large round balers were building to their present level, livestock producers tended to ignore hay storage problems. A frequent response to questions about the magnitude of their losses was that they would take care of "that problem" when they could afford to build a storage structure. In the meantime, their solution was to roll more hay off larger acreage (Collins et al., 1987).
Producers may be unaware of the magnitude of such losses or may assume they are negligible. Weathering and deterioration of bales stored outside are slow, gradual events; their occurrence may not be obvious (Belyea et al., 1985).

The ability to harvest hay with less labor and at a greater rate has held a great appeal to hay and livestock producers. They have been willing to sacrifice quality of hay in order to reduce labor and increase tonnage. Now there is some desire to avoid the quality and quantity losses without reverting back to the conventional rectangular bale (Heslop and Bilanski, 1986).

In parts of North America where rainfall is significant, conventional rectangular bales were traditionally transported from the field to inside storage. Round bales and rectangular bale stacks were originally intended for outside storage in the dry regions of North America. As the use of the round baler moved into higher rainfall areas, increased spoilage was observed. Some farmers rejected the use of round bales which were stored outside, while others accepted the losses because of decreased labor requirements (Heslop and Bilanski, 1986).

Farm buildings designed for conventional rectangular bales were not well-suited for storage of large round bales, so many farmers stored large bales outside where damage from weather occurred. Some deterioration in the quality of hay and higher waste during feeding were accepted as the price paid for a fully mechanized haying system (Baxter et al., 1986).

Since large packages are generally stored outside, they are subjected to elements of the natural environment from time of harvest until they are fed. This weathering can result in deterioration in the quality of the hay, especially around the outside of the
package (Lechtenberg et al., 1974). The climate in the upper South may present a worst-case situation, because alternate freezing and thawing occurs throughout the winter (Baxter et al., 1986).

II. QUANTITY CHANGES IN ROUND BALE HAY STORAGE

Large hay packaging systems offer higher harvest capacities with reduced manual labor, but a higher level of management is needed to minimize harvest storage and feeding losses. Outside storage of large hay packages can result in extensive weathering losses unless managed properly. Inside storage of large packages should be considered when high quality hay is desired (Martin, 1980). Inside storage is defined as hay stored off of moist soil and under cover during the entire storage period.

Storage method has a large impact on hay loss. The best preservation of hay is obtained with shed storage. Total storage loss in large round bales was modeled as the sum of the loss during inside storage plus that due to weathering (Harrigan et al., 1994).

Dry matter loss in shed-stored hay is primarily a function of hay moisture with minor effects from bale density and crop maturity (Buckmaster et al., 1990).

The major cause of loss is respiration from microbial organisms (bacteria, fungi, and yeasts) in the hay. Through respiration, carbohydrates in the plant tissue and oxygen are converted to carbon dioxide, water, and heat. These products leave the hay causing dry matter loss. Hay containing less than 15 percent moisture is relatively stable and little respiration occurs (Harrigan et al., 1994).

Of the factors affecting loss during outside storage, weather, length of storage, and storage method have the greatest impact. The loss is again primarily caused by
microorganisms in the hay, and the biological activity is greatest when the hay is moist and warm. Loss is less in hay stored over cold winter periods in northern climates or in hay stored in more arid climates where the hay remains relatively dry. For a given set of conditions, the loss appears to be nearly proportional to the length of storage (Harrigan et al., 1994).

Moisture content inside the bale also may increase, leading to greater microbial activity and loss. When rain contacts exposed bales, a portion is absorbed in the outer layer of the bale increasing the moisture content to between 25 and 40 percent. When bales are set on damp soil, moisture migrates from the ground into the bale increasing microbial respiration, deterioration, and loss (Harrigan et al., 1994).

Rider et al. (1979) described a method of sampling hay from a round bale in which specific areas of the bale represent a certain percentage volume of the bale. They divide the bale into four areas: 1) as a round bale settles, approximately one-third of the circumference contacts the ground; 2) a substantial amount of moisture can be absorbed through the bottom of the bale resulting in spoilage as far up as 30 cm; 3) if the weather affects only the outer 15 cm at the bottom, 42 percent of the bale volume can be affected; and 4) assuming uniform bale density, the outer 15 cm of a round bale accounts for more than 20 percent of the mass (Heslop and Bilanski, 1986). Bales stored outside, without cover, showed substantial increases in moisture content. Total bale moisture content increased more than 50 percent, while the outer 10 cm layer increased over 120 percent (Huhnke, 1988).

If the bales are not covered and kept off-the-ground during outside storage, the dry matter loss can be almost 40 percent. A combination of handling, dry matter and
refusal losses is very high for bales stored outside on-the-ground. Storage on gravel, rock, and tires helps somewhat, but the total loss is still quite high (Verma and Nelson, 1983).

Collins et al. (1995) reported bales stored indoors had no measurable weathering, although there was some discoloration at the bale surface. The weathered layer from twine-tied bales stored outside contained 27 percent of the total package volume.

III. QUALITY CHANGES IN ROUND BALE HAY STORAGE

Dry matter loss and heating during hay storage affect the concentration of most nutrients. Respiration reduces forage quality by decreasing some of the most digestible nutrients. As carbohydrates are depleted, proteins and fats also are used in respiration, but at a slower rate (Harrigan et al., 1994).

A study conducted by Montgomery et al. (1986) revealed that round bales were more susceptible to heat damage than conventional bales made at the same moisture. Bledsoe and Bales (1992) found heat damage occurred in alfalfa-orchard grass bales with a baling moisture content in the 15 to 16 percent range (wet basis) and mean dry matter densities in the 205 to 235 kg/m³ range. Uniformity of density within the bale was determined. Pockets of hay within the bale with dry matter density in excess of 250 kg/m³ were found in typical bales undergoing heat damage. Decreased crude protein and digestible crude protein recovery resulted from sustained excess temperatures within the bales. Baxter et al. (1986) revealed that weathering or leaching did not greatly affect the calcium and phosphorus content of outside stored hay.
Harrigan et al. (1994) summarized several studies. He stated that quality changes in large round bales were variable, but reported data indicated some consistent trends. The most digestible portion of hay dry matter is lost, resulting in a decrease in digestible dry matter content (Russell and Buxton, 1985; Brasche and Russell, 1988; Huhnke, 1990; Russell et al., 1990). Fiber concentrations generally increase, due primarily to the loss of nonfiber constituents. In some studies, the increased fiber content is small, indicating that some fiber was oxidized or fermented (Verma and Nelson, 1983; Harrigan and Rotz, 1994). In other studies, the increased fiber content, particularly neutral detergent fiber, was very high, indicating little or no loss of fiber (Collins et al., 1987; Russell et al., 1990). Considering all studies reporting changes in neutral detergent fiber concentration during outside storage of round bales, an average of 17 percent of the dry matter lost was neutral detergent fiber (Verma and Nelson, 1983; Collins et al. 1987; Huhnke, 1988,1990; Brasche and Russell, 1988; Harrigan and Rotz, 1994).

With inside storage, crude protein concentration generally increases because other dry matter is lost at a faster rate (Buckmaster et al., 1989). Changes in crude protein concentration during outside storage of large round hay bales is highly variable. Some reported consistent increases (Verma and Nelson, 1983; Huhnke, 1988), but others reported consistent decreases during storage (Rider et al., 1979; Brasche and Russell, 1988; Russell et al., 1985). Collins (1986) noted a slight increase in crude protein for bales stored inside and a small decrease in bales stored outside. Many others have noted no consistent trends during storage (Harrigan and Rotz, 1994; Bledsoe and Bales, 1992; Montgomery, 1986; Russell and Buxton, 1985; Baxter et al., 1986). Baxter et al. (1986)
maintained that crude protein concentrations remained fairly stable, but crude protein digestibility may decrease.

Results from the Laflamme (1989) study showed that the main changes in forage quality occurred in the first 15 cm. layer of the bale which represented more than 40 percent of the volume of the bale. The results of his two experiments indicated major quality changes occurred in large round bales not covered during storage. These changes were related to decreases in the dry matter content leading to increases in the nondigestible fractions of the forage. The quality of this feed depended upon exposure to precipitation.

IV. BEEF AND DAIRY ANIMALS' PERFORMANCE WHEN FED ROUND BALES OF HAY STORED OUTSIDE VS. INSIDE

The magnitude of depressed production from unprotected hay is also related to the amount of hay in the rations fed to the herd. When a small portion of hay is mixed with corn and alfalfa silage, the effect is much less than when hay is the predominant forage (Harrigan et al., 1994).

Although protective treatment helped to preserve hay quality during storage, this effect was not large enough to affect daily gains in gestation Charolais-cross beef cows fed the forage with .82 kg of supplement daily. Because cow performance was not affected by storage treatment, the use of protective storage associated with the use of protective storage treatments on large round bales was from increased dry matter recovery (Brasche et al., 1988).
The nutritional objective of feeding beef cows and sheep is to maintain a healthy, thrifty animal and to provide for pregnancy or modest growth. The goal of feeding lactating cows, however, is maximum digestible nutrient intake. Because of the lactating cow's high nutrient requirements for milk production, she may be more sensitive to differences in hay storage systems than many other classes of livestock. Cows fed round bales stored inside did produce milk equally as well as those fed conventional rectangular bales. Cows fed round bales of hay in round bales stored outside and not covered produced significantly less milk than those fed bales protected from the weather. The greatest system differences in this study would seem to be the increased dry matter loss in storage and reduced utilization of weathered high quality alfalfa-orchardgrass hay. It is worth noting that the ration was predominately dry hay with one-third of the dry matter from a 16 percent crude protein grain mix. Dry matter intake was greater and milk yield was 4 to 6 percent higher with round bales stored inside than with bales stored outside and unprotected (Baxter et al., 1986). Belyea et al. (1985) reported greater dry forage intake and average daily gain (.2 lb. adg.) for dairy heifers fed round bales of hay stored inside compared to round bales of hay stored outside.

The animal has the ability to select weathered from unweathered hay, and the results effect feed requirements and animal performance (Harrigan et al., 1994). Baxter et al. (1986) reported that milk production would probably be lowered if cows fed bales stored outside were forced to eat more of the rot.

Baxter et al. (1986) found cows separated leaves and smaller stems from the coarse stems when they were fed hay not affected by weather. Conversely, refusal from round bales stored outside consisted primarily of weathered whole hay. A Verma and
Nelson (1983) study showed animal refusal and handling loss was the highest for bales stored on the ground.

Nutrient loss in the weathered portion of the package in most cases renders the hay too low in digestible energy to meet maintenance requirements of non-lactating beef cows. However, the unweathered portion does not change appreciably in chemical composition of digestible energy during outside storage (Martin, 1980).

V. ROUND BALE HAY STORAGE METHODS

Dry matter losses of large round bales stored outside and unprotected can be greater than appearance would suggest. Most large bales are cylindrical, and a considerable portion of volume and weight is in the outer layers. Penetration by water into the outer layers and the subsequent weathering and deterioration leads to a significant loss of dry matter (Belyea et al., 1985).

In order to minimize the total quantitative and qualitative losses during outside storage, the bales should be kept off-the-ground and protected from rain (Verma and Nelson, 1983).

Huhnke (1988) reported dry matter loss in large round bales of alfalfa hay was dependent on storage method. Bales stored under cover on pallets and bales stored in an enclosed barn had less than 2 percent dry matter loss. Bales in direct ground contact without cover had the greatest dry matter losses, averaging 13.1 percent. Quantitative and qualitative losses in large round alfalfa bales were minimized when elevated and covered. Protection from precipitation is the most important factor in outside storage.
Storage method had a significant effect on dry matter loss. Bales of wheat hay in the boot stage stored on pallets had less losses than bales in direct ground contact.

Verma and Nelson (1983) found large round bales under protection from the weather showed lower dry matter loss than unprotected bales (16 percent versus 37 percent for ryegrass). The dry matter loss was much lower for alfalfa bales than ryegrass bales because of the greater density of alfalfa bales (8 percent versus 30 percent for bales on racks without covers). The dry matter loss during storage was the major component of the total quantitative storage loss. Up to 65 percent total quantitative loss was observed with ryegrass bales in seven months stored outside, on-the-ground. Animal refusal and handling loss was the highest for bales stored on-the-ground.

Rider et al. (1979) conducted a study of storing alfalfa, bermudagrass, and sorghumXsudan grass hybrid. During long-term storage (approximately 20 months) dry matter losses for barn storage was 5.8 percent for alfalfa, 7.9 percent for bermudagrass, and 4.4 percent for sorghumXsudan grass hybrid. Comparatively, dry matter losses for ground contact and uncovered was 18.7 percent for alfalfa, 13.1 percent for bermudagrass, and 16.9 percent for sorghumXsudan.

Solid plastic wrap was superior to plastic mesh wrap for preservation of tall fescue hay dry matter during outside storage. Solid plastic wrap and indoor storage resulted in similar losses, less than 6 percent of the initial dry matter during 1 year of storage. Twine-tied bales stored outside, on-the-ground lost more than one-third of the initial dry matter during storage. Because dry matter losses were high, alternatives to twine-tied bales stored on-the-ground may be economical even for low quality grass hay (Collins et al, 1995).
In a University of Tennessee experiment, none of the bale wraps (twine, clingwrap, American mesh, and European mesh net wrap) provided protection against weathering to preserve hay digestible dry matter and quality comparable to inside storage. All three experimental wraps tended to preserve hay digestible dry matter better than twine for outside storage of bales, but only European mesh net wrap gave preservation values that were statistically significant (P<0.10), and only with alfalfa-orchardgrass bales. None of the three experimental wraps preserved digestible dry matter significantly better than twine for mixed grass bales stored outside (Bledsoe and Bales, 1992).

Sensory quality scores were significantly better for inside-stored compared to outside-stored bales. No significant differences were found among wraps for sensory quality scores of bales, although bales with the two net wraps tended to have higher scores than twine and clingwrapped bales, and American mesh net wrapped bales tended to have higher scores than European mesh net wrapped bales. All three experimental wraps made bale handling and storage operations easier, in that the bales were more stable than twine wrapped bales (Bledsoe and Bales, 1992).

Laflamme (1989) reported that storing grass-legume hay in large round bales inside or in plastic bags resulted in better forage quality with significant (P<0.05) differences for all parameters measured except protein.

Baxter et al; (1986) found that dry matter utilization of alfalfa-orchardgrass stored in large round bales outside, off-the-ground, and covered with 6-mil (0.15-cm) black polyethylene (ends exposed) was not significantly different from those bales stored inside.
Quantitative and qualitative changes in large round bales of bermudagrass hay were evaluated in another study. After eight months in storage, fixed chamber bales stored on-the-ground without covers had 14.1 percent dry matter loss while exposed variable chamber bales had 7.0 percent. Fixed-chamber and variable-chamber bales stored in barns had 3.4 percent loss in dry matter. Losses in dry matter and forage quality for fixed-chamber bales were greater than for variable-chamber bales in all other methods. Bale orientation had little affect on qualitative changes. There was no significant difference in outer-layer moisture contents for protected bales either stored under covers or in the barn. Protection from precipitation and bale type are the most important factors in outside storage (Huhnke, 1990).

Data indicated sufficiently large losses of dry matter and quality to justify elevation of round bales off-the-ground and the consideration of covering bales or inside storage. Depending upon the value of the hay, round bales stored inside lost only 4.6 percent of their initial dry matter during storage (2-year mean), very similar to the loss of dry in rectangular bales stored inside (Collins, et al, 1987).

VI. ECONOMICS OF ROUND BALE HAY STORAGE

Use of round bales for hay and silage is extremely common. Losses from storing round bales outside, on-the-ground, and uncovered are usually high enough to warrant some storage facility and equipment. Unless the hay has a value at harvest of less than $55/ton or experiences less than 15 percent loss during outside storage, it is difficult to identify scenarios where some protection from weather will be unprofitable (Buckmaster, 1993 b).
When dairy farmers experience alfalfa losses, the value reduction can be attributed to two effects: decreased milk production and/or increased feed costs (Buckmaster, et al, 1990). When rations were balanced to account for dry matter losses, net feed costs increased with less protection during storage. Since forage quality does not equally affect all livestock production, the major advantage of bale protection is improved dry matter recovery. The economic benefit of protection during hay storage depends upon the amount of hay in the diet (Harrigan, et al, 1994).

Generally, any benefits of protection from weather will exceed the sum of costs due to added machinery, added labor, a structure, site preparation, and bale covering. However, determination of the most profitable alternative requires an individualized analysis. The value lost during outside storage varies with location, time of storage and value of the hay being stored. A decision regarding hay storage alternatives involves a comparison of the benefits and costs. Evaluation of a storage alternative should consider all costs incurred with the alternative (Buckmaster, 1993 b).

All storage loss cannot be eliminated. Some dry matter loss occurs in dry hay even during inside or covered outside storage (Buckmaster et al, 1990). The gain from a storage structure or covering is not the total value of the loss, but rather the value of the loss which was avoided. Inside or covered storage of hay generally results not only in more dry matter recovery, but also higher quality in what is recovered (i.e., the digestible nutrients). Value of the avoidable loss, then, is a function of dry matter loss avoided and the associated hay quality (Buckmaster, 1993 a).

Regardless of the storage method, some machine and labor costs are incurred. For evaluation of alternative storage methods, only the difference in these costs should be
used. For some alternatives, the differences in machine and labor needs are negligible (Buckmaster, 1993 a).

Round bale storage structures may be justified as aids to management. Such buildings generally have multiple uses on livestock farms, including animal shelter, machinery storage, and hay storage. A permanent structure is almost essential to protect the "drought-hay" supply (that hay carried over to the second winter as an emergency cache). Special caution is required in barn storage—the hay crop must be well cured to prevent molding and to lessen potential for spontaneous combustion (Collins, et al, 1987).

The effect of storage treatment on dry matter recovery is highly dependent on the amount of rainfall the bale receives during the storage period. Due to seasonal precipitation, protection of first-cutting hay should be of more value than protection of subsequent cuttings if the hay is fed within 8 to 9 months (Brasche, et al, 1988).

Hay can be valued for its feeding value, its cost of production, its market value or a combination of these (Martin, 1980). Round bale harvesting with inside storage was less expensive than square bale harvesting, especially at low annual harvest volume. A penalty cost attributed to the inputs required to harvest hay that will spoil could increase the worth of inside storage (Heslop and Bilanski, 1986). Loss of alfalfa dry matter and the associated quality changes resulted in an average decrease in net return. The alfalfa value lost during the baling operation was not significantly affected by baler type; however, the value lost during storage and feeding of round bales stored outside was nearly twice that associated with rectangular bales stored inside (Buckmaster, et al, 1990).
Farm operators may choose different types of new or even used equipment and may have different dollar costs and costs of operation. These differences will change the optimum decision points for each individual operator (Heslop and Bilanski, 1986).

Because the costs involved in group covering and individual wrapping are not dominated by one particular factor (site, labor, machine, or covering material), generalized results are largely inappropriate. This emphasizes the importance of a producer-specific analysis. For the in-barn alternative; however, approximately 70 percent of the cost involved was due to the structure itself. With the cost dominated by one particular factor, a break-even analysis can be useful. Clearly the value of the barn (through reduced loss) is a function of the value of the hay to be stored. The benefit of reducing loss in high value hay is higher than that in low value hay. Using a barn built for less than the breakeven unit cost would result in higher profits than storing hay outside uncovered. With the current economic climate, typical costs for building a hay storage barn range from about $5 to $10/sq ft. With typical outside storage losses commonly exceeding 15 percent and easily reaching 20 percent, it is hard to identify situations where building a hay storage barn is not economical (Buckmaster, 1993 b).

VII. WHAT IS IN THE FUTURE FOR ROUND BALE HAY STORAGE?

Experiments are currently being conducted by The University of Tennessee comparing hollow-core and solid large round bales of high moisture alfalfa hay (20-30 percent wet bases). These studies indicated that when a solar-heated, forced-air dryer was used, hollow-core bales dried more than 50 percent faster than solid bales of equal dry matter density and moisture content. Results encourage the use of hollow-core bales to
develop more compact, simpler, cost-effective designs for solar-heated, forced-air dryer to preserve premium quality hay at a reasonable cost in humid climates (Bledsoe, et al, 1997).

VIII. EXTENSION'S EFFECT ON THE ADOPTION OF RECOMMENDED PRACTICES

This section presents findings from four studies concerning beef cattle production. All four studies were conducted with Tennessee beef producers. Three were studies from the 1985 Tennessee Beef Cow-Calf Producer Survey and one study was from the 1987 Beef Cattle Handling Facilities Survey. Both surveys were developed by The University of Tennessee Agricultural Extension Service, the Animal Science Beef Section specialist staff and the Agricultural Extension Education Sections.

A study conducted in 1990 revealed that the number of contacts beef producers had with Extension was found to be significantly related to the availability of each of the beef cattle handling facility components. When compared to beef producers with eight Extension contacts or less, beef producers that had 9 to 13 Extension contacts were more likely to have constructed or repaired a headgate, holding chute, working chute, crowding pen and holding pen during the CATCH FOUR program (Signaigo, 1990).

Extension contacts were significantly related to producers' use of seven of the eight recommended feeding management practices in a study by Myers (1989). Producers with Extension contacts were more likely than those with no Extension contacts to: 1) group feed by age and production; 2) feed dry cows low quality feed; 3) feed crop residues in the winter; 4) feed supplement protein in the winter; 5) forage test;
6) use temporary winter or summer pasture; and 7) have at least 30 percent legumes in their pastures (Myers, 1989).

A 1988 study by Walker found producers who made a total of one or more Extension contacts during a 12-month period were more likely than those with no Extension contacts to: 1) vaccinate for leptospirosis, IBR, BVD, and PI3; 2) vaccinate calves for blackleg and replacement heifers for brucellosis; 3) implant their calves; 4) deworm their cows, bulls, and calves; and 5) control flies, lice and grubs (Walker, 1988).

Ivy (1988) conducted a study that indicated that producers who had contacts with Extension were more likely than others to: 1) use artificial insemination; 2) use performance tested bulls; 3) have their cows and heifers pregnancy checked; 4) use calf implants; 5) deworm their calves; and 6) vaccinate cows and heifers for leptospirosis.

IX. CHAPTER SUMMARY

Farm operators, like most businessmen, strive to ensure that the combination of input costs to a particular commodity or process are kept below the output value (Heslop and Bilanski, 1986). Stockmen must improve the utilization of their land and forage resources to reduce production costs. Producers strongly dependent on large round hay bales in their feeding programs should make every effort to reduce waste. Others may gain greater returns by directing their initial effort to reduce waste. Others may gain greater returns by directing their initial efforts to improving forage production programs (Collins, et al., 1987).

The choice of storage methods for hay resources will depend on individual farm needs and economics. Many farms have permanent shelter for better quality forages, and
the lesser-cost storage techniques can be readily put to use as secondary storage (Collins, et al., 1987). All studies showed inside storage to be superior to any type of outside storage.

It has always been the goal of The University of Tennessee Agricultural Extension Service to assist producers in increasing efficiency and profitability on the farm which is why a study is needed to evaluate how producers are storing their round bale hay so that Extension can plan and conduct programs that will truly help producers, as well as make efficient use of Extension funds and resources.
CHAPTER III

CHARACTERIZATION OF TENNESSEE BEEF PRODUCERS, THEIR FARM OPERATION, THE NUMBER AND TYPE OF CONTACTS WITH EXTENSION, AND THEIR USE OF SELECTED ROUND BALE STORAGE METHODS

The purpose of this chapter is to characterize Tennessee beef producers, their farm operation, contacts with the Agriculture Extension Service, and their use of selected round bale hay storage methods. The findings presented in this chapter are organized into four sections. Section I presents findings regarding the personal characteristics of Tennessee beef producers. Section II presents findings regarding the farm operation characteristics of Tennessee beef producers. Section III presents findings regarding the Extension contacts of Tennessee beef producers. Section IV presents the findings of selected hay storage methods used by Tennessee beef producers.

I. PERSONAL CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS

Data in Section I presents findings regarding characteristics of Tennessee beef producers with regard to age and farming status. These findings are reported in Table 1. Frequencies and percentages are used to summarize the findings.

Age

Approximately 21 percent (109) of the producers surveyed were under the age of 40 years, 49 percent (256) of the producers were between the ages of 41 and 60 years and
### TABLE 1. Characterization of Tennessee Beef Producers, Their Farm Operation, the Number and Type of Contacts with Extension, and Their Use of Selected Round Bale Storage Methods

<table>
<thead>
<tr>
<th>Selected Personal and Farm Characteristics, Extension Contacts and the Use of Selected Storage Methods</th>
<th>TN Beef Cattle Producers</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Number</td>
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<td></td>
<td></td>
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<tr>
<td><strong>PERSONAL CHARACTERISTICS</strong></td>
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<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>Under 40</td>
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</tr>
<tr>
<td>41 to 60</td>
<td>256</td>
</tr>
<tr>
<td>Over 61</td>
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<td>Mean = 54</td>
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</tr>
<tr>
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<tr>
<td>Full-Time</td>
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<tr>
<td>Part-Time</td>
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<td><strong>FARM CHARACTERISTICS</strong></td>
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<td>Heifers and Cows Exposed to the Bull</td>
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<td>25 or less</td>
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<td>26 to 50</td>
<td>161</td>
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<td>101 or More</td>
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<tr>
<td>Acres of Permanent Pasture Land</td>
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<tr>
<td>Under 50</td>
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</tr>
<tr>
<td>51 to 150</td>
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<td>151 and Over</td>
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TABLE 1. (Continued)

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<td>EXTENSION CONTACTS</td>
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<td>Beef Cattle Meetings Attended</td>
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<td>4 or More</td>
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<td>177</td>
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<tr>
<td>1 to 3</td>
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<td>4 or More</td>
<td>95</td>
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<td>137</td>
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<tr>
<td>1 to 3</td>
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<tr>
<td>4 or More</td>
<td>154</td>
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<tr>
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<tr>
<td>Visits From Extension Agent</td>
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<tr>
<td>1 to 3</td>
<td>227</td>
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<tr>
<td>No Response</td>
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</tr>
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<td>Total</td>
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<tr>
<td>Factsheets or Publications Received</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>56</td>
</tr>
<tr>
<td>1 to 3</td>
<td>256</td>
</tr>
<tr>
<td>4 or More</td>
<td>82</td>
</tr>
<tr>
<td>No Response</td>
<td>149</td>
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<tr>
<td>Selected Personal and Farm Characteristics, Extension Contacts and the Use of Selected Storage Methods</td>
<td>TN Beef Cattle Producers</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td>Number</td>
</tr>
<tr>
<td>Quarterly Newsletter Received</td>
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<tr>
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<td>348</td>
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<tr>
<td>No</td>
<td>160</td>
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<tr>
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<td>35</td>
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<td>Total</td>
<td>543</td>
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<tr>
<td>SELECTED HAY STORAGE METHODS</td>
<td></td>
</tr>
<tr>
<td>Large Bale Percent Fed</td>
<td></td>
</tr>
<tr>
<td>100 Percent</td>
<td>406</td>
</tr>
<tr>
<td>75 Percent</td>
<td>137</td>
</tr>
<tr>
<td>Total</td>
<td>543</td>
</tr>
<tr>
<td>Percent of Round Bales Stored Outside, On-the-Ground, and Uncovered</td>
<td></td>
</tr>
<tr>
<td>50 Percent or Less</td>
<td>90</td>
</tr>
<tr>
<td>51 Percent or More</td>
<td>154</td>
</tr>
<tr>
<td>No Response</td>
<td>299</td>
</tr>
<tr>
<td>Total</td>
<td>543</td>
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<tr>
<td>Percent of Round Bales Stored Outside, Off-the-Ground, and Uncovered</td>
<td></td>
</tr>
<tr>
<td>50 Percent or Less</td>
<td>29</td>
</tr>
<tr>
<td>51 Percent or More</td>
<td>18</td>
</tr>
<tr>
<td>No Response</td>
<td>496</td>
</tr>
<tr>
<td>Total</td>
<td>543</td>
</tr>
<tr>
<td>Percent of Round Bales Stored Outside, Off-the-Ground, and Covered</td>
<td></td>
</tr>
<tr>
<td>50 Percent or Less</td>
<td>49</td>
</tr>
<tr>
<td>51 Percent or More</td>
<td>20</td>
</tr>
<tr>
<td>No Response</td>
<td>474</td>
</tr>
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<td>543</td>
</tr>
<tr>
<td>Percent of Round Bales Stored Inside a Permanent Structure</td>
<td></td>
</tr>
<tr>
<td>50 Percent or Less</td>
<td>102</td>
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<tr>
<td>51 Percent or More</td>
<td>140</td>
</tr>
<tr>
<td>No Response</td>
<td>301</td>
</tr>
<tr>
<td>Total</td>
<td>543</td>
</tr>
</tbody>
</table>
30 percent (159) of the producers were over 61 years. The average age of the beef producers surveyed was 54.

**Farming Status**

Of the producers surveyed, 77 percent (407) were part-time producers, while only 23 percent (120) indicated that they were full-time producers.

**II. FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS**

Presented in Section II are findings regarding selected farm characteristics of Tennessee beef producers as they relate to heifers and cows exposed to the bull and acres of permanent pasture land. Frequencies and percentages are used to summarize the findings.

**Number of Heifers and Cows Exposed to the Bull**

Thirty-two percent (172) of the producers reported owning 25 head or less, 30 percent (161) of the producers reported owning 26 to 50 head, and almost 24 percent (131) of the producers reported owning 51 to 100 head. Only 13 percent (72) of the producers reported owning 101 or more head of heifers and cows.

**Number of Acres of Permanent Pasture Land**

Thirty-one percent (164) of the producers surveyed operated less than 50 acres of permanent pasture land, 41 percent (219) of the producers operated 51 to 150 acres, and 28 percent (148) of the producers operated 151 or more acres.
III. THE NUMBER AND TYPE OF CONTACTS TENNESSEE BEEF PRODUCERS HAD WITH EXTENSION

Presented in Section III are findings regarding the number and type of contacts Tennessee beef producers had with Extension. The Extension contacts used in this study were beef cattle meetings attended, visits to the local Extension office, telephone calls made to the local Extension office, farm visits from an Extension agent, fact sheets, and quarterly newsletters. Frequencies and percentages are used to summarize the findings.

**Beef Cattle Meetings Attended**

Approximately 21 percent (108) of the producers surveyed attended no Extension meetings, while almost 55 percent (276) of the producers attended one to three meetings, and 24 percent (120) of the producers attended four or more meetings.

**Office Visits to Local Extension Office.**

Slightly more than 36 percent (177) of the producers surveyed had never made a visit to the Extension office, 44.5 percent (218) of the producers made one to three visits, while 19 percent (95) of the producers made more than four visits.

**Telephone Calls Made to Local Extension Office**

Just more than 28 percent (137) of the producers made no telephone calls to the Extension office, 40 percent (193) of the producers made one to three calls, and 32 percent (154) of the producers made four or more calls to the Extension office.
Visits from the Extension Agent

Approximately 53 percent (251) of the producers responded receiving no visits from the Extension agent, while 47.5 percent (227) of the producers responded receiving one or more visits from the agent.

Fact sheets or Publications Received

Sixty-five percent (256) of the producers surveyed received one to three fact sheets or publications, while 14 percent (56) of the surveyed producers received no fact sheets or publications from Extension.

Received Quarterly Newsletter

Sixty-eight percent (348) of the producers surveyed received a quarterly newsletter, while 31.5 percent (160) of the producers did not.

IV. SELECTED HAY STORAGE METHODS OF TENNESSEE BEEF PRODUCERS

Presented in Section IV are findings regarding the producers’ use of selected hay storage methods. Reported are the percent of hay fed in round bales; percent round bales stored outside, on-the-ground, and uncovered; percent round bales stored outside, off-the-ground, and uncovered; percent round bales stored outside, off-the-ground, and covered; and percent large bales store inside in permanent structure.
Percent of Hay Fed as Large Bales

Seventy-five percent (406) of the producers fed 100 percent of their hay in large bales and 25 percent (137) of the producers fed only 75 percent of their hay in large bale.

Percent of Round Bales Stored Outside, On-the-Ground, and Uncovered

Of the 244 producers who indicated they stored their round bales outside, on-the-ground, and uncovered, thirty-seven percent (90) stored 50 percent or less of their round bales using this storage method, whereas 63 percent (154) of the producers stored 51 percent or more of their round bales using this method.

Percent of Round Bales Stored Outside, Off-the-Ground, and Uncovered

Forty-seven producers indicated they stored their round bales outside, off-the-ground, and uncovered. Of this group, 62 percent (29) of the producers surveyed stored 50 percent or less round bales outside, off-the-ground, and uncovered, while 38 percent (18) of the producers stored 51 percent or more using this method.

Percent of Round Bales Stored Outside, Off-the-Ground, and Covered

Sixty-nine producers indicated they stored their round bales outside, off-the-ground, and covered. Of this group, seventy-one percent (49) of the producers stored 50 percent or less of their round bales outside, off-the-ground, and covered, while 29 percent (20) of the producers stored 51 percent or more using this method.
Percent of Round Bales Stored Inside a Permanent Structure

Of the 242 producers who indicated they stored their round bales inside a permanent structure, 42 percent (102) of the producers stored 50 percent or less of their round bales in this method, while almost 58 percent (140) of the producers stored 51 percent or more in a permanent structure.

V. CHAPTER SUMMARY

Forty-nine percent of Tennessee beef producers surveyed were between the ages of 41 to 60, with the average age of 54 years. Seventy-seven percent of the producers surveyed were part-time producers. Eighty-eight percent of the producers indicated they owned 100 or less head of heifers and cows. Forty-one percent of the producers operated 51 to 150 acres of permanent pasture land.

Approximately 55 percent of the producers attended one to three Extension beef meetings, and 44.5 percent of the producers made one to three visits to the local Extension office. Forty percent of the producers made telephone calls to the local Extension office, and 65 percent of the producers received one to three visits from an Extension agent. Sixty-five percent of the producers received one to three fact sheets or publications, and 68.5 percent received quarterly newsletters.

Approximately 75 percent of the producers surveyed stored 100 percent of their hay in round bales. Of the 543 producers surveyed, 154 producers stored 51 percent or more of their round bales of hay outside, on-the-ground, and uncovered, while 140 producers stored 51 percent or more of their round bales of hay inside a permanent structure.
CHAPTER IV

RELATIONSHIPS BETWEEN SELECTED PERSONAL AND FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS AND THEIR EXTENSION CONTACTS

This chapter presents findings regarding of the relationships between personal and farm operation characteristics of Tennessee beef producers and the contact they had with Extension. The personal and farm characteristics (independent variables) of Tennessee beef producers used in this study were age, farming status, number of heifers and cows exposed to the bull, and number of acres of permanent pasture land. The Extension contacts of beef meetings attended and visits from agents were the dependent variables. The chi-square test was used to determine the relationships between dependent and independent variables. The 0.05 probability level was used to determine significant relationships.

The data were summarized in two tables with each table constituting a section. Presented in Section I are findings regarding relationships between Tennessee beef producers' selected personal and farm characteristics and the number of Extension beef meetings attended. Presented in Section II are findings regarding relationships between Tennessee beef producers' selected personal and farm characteristics and the number of visits from an Extension agent.
I. RELATIONSHIPS BETWEEN TENNESSEE BEEF PRODUCERS’ SELECTED PERSONAL AND FARM CHARACTERISTICS AND THE NUMBER OF EXTENSION BEEF MEETINGS ATTENDED

This section (Table 2) presents findings regarding the relationships between personal and farm characteristics of Tennessee beef producers and the number of beef meetings attended. The number of meetings attended were divided into three groups: producers who attended no meetings, producers who attended one to three meetings, and producers who attended four or more meetings.

Personal Characteristics

The producers’ characteristics in this study were used as independent variables. They indicated age: under 40, 41 to 60, and 61 and over; and farming status: full-time and part-time. The number of Extension beef meetings attended were used as the dependant variable. They were categorized as; none, 1 to 3, and 4 or more meetings attended.

Age. Approximately 52 percent (54) of the producers under 40 years of age, 55 percent (133) of the producers between 41 and 60 years old, and 56 percent (84) of the producers 61 years of age and over attended one to three Extension beef meetings. When these differences were compared using the chi-square test, there was no significant relationship between producers’ age and the number of beef meetings attended. Producers over 61 years of age were no more likely than producers under 40 to attend Extension beef meetings.
TABLE 2. Relationships Between Tennessee Beef Producers' Selected Personal and Farm Characteristics and the Number of Beef Meetings Attended

<table>
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<tr>
<th>Selected Personal and Farm Characteristics</th>
<th>Extension Beef Meetings Attended</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>One to Three</td>
<td>Four or More</td>
<td>Total*</td>
<td></td>
</tr>
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<td>Number of Producers</td>
<td>Percent of Producers</td>
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<td>PERSONAL CHARACTERISTICS</td>
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<td>Age</td>
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</tr>
<tr>
<td>Under 40</td>
<td>32</td>
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<td>54</td>
<td>51.9%</td>
<td>18</td>
</tr>
<tr>
<td>41 to 60</td>
<td>46</td>
<td>18.9%</td>
<td>133</td>
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<td>64</td>
</tr>
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<td>Over 61</td>
<td>29</td>
<td>19.3%</td>
<td>84</td>
<td>56.0%</td>
<td>37</td>
</tr>
<tr>
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<td>Farming Status</td>
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</tr>
<tr>
<td>Full-time</td>
<td>21</td>
<td>18.1%</td>
<td>64</td>
<td>55.2%</td>
<td>31</td>
</tr>
<tr>
<td>Part-time</td>
<td>86</td>
<td>22.4%</td>
<td>209</td>
<td>54.4%</td>
<td>89</td>
</tr>
<tr>
<td>Statistics $X^2 = 1.243$; $p = .537$</td>
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<td>FARM CHARACTERISTICS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heifers and Cows Exposed to Bull</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 or less</td>
<td>38</td>
<td>24.4%</td>
<td>83</td>
<td>53.2%</td>
<td>35</td>
</tr>
<tr>
<td>26 to 50</td>
<td>37</td>
<td>24.2%</td>
<td>84</td>
<td>54.9%</td>
<td>32</td>
</tr>
<tr>
<td>51 to 100</td>
<td>17</td>
<td>14.0%</td>
<td>71</td>
<td>58.7%</td>
<td>33</td>
</tr>
<tr>
<td>101 or more</td>
<td>14</td>
<td>20.6%</td>
<td>35</td>
<td>51.5%</td>
<td>19</td>
</tr>
<tr>
<td>Statistics $X^2 = 6.581$; $p = .361$</td>
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</tr>
<tr>
<td>Acres of Permanent Pasture Land</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 or less</td>
<td>31</td>
<td>20.3%</td>
<td>85</td>
<td>55.6%</td>
<td>37</td>
</tr>
<tr>
<td>51 to 150</td>
<td>50</td>
<td>24.5%</td>
<td>111</td>
<td>54.4%</td>
<td>43</td>
</tr>
<tr>
<td>151 or more</td>
<td>26</td>
<td>18.8%</td>
<td>72</td>
<td>52.2%</td>
<td>40</td>
</tr>
<tr>
<td>Statistics $X^2 = 3.693$; $p = .449$</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*Totals may not equal N due to missing data.
Farming status. Fifty-five percent (64) of the full-time producers compared to 54 percent (209) of the part-time producers attended one to three beef meetings. When these differences were compared using the chi-square test, there was no significant relationship between producers' farming status and the number of beef meetings attended. Full-time farmers were no more likely to attend Extension beef meetings than were part-time farmers.

Farm Characteristics

Farm characteristics used in this study as independent variables included number of heifers and cows exposed to the bull and number of acres of permanent pasture land. The dependant variable, Extension beef meetings attended, was categorized as none, 1 to 3, and 4 or more.

Number of heifers and cows exposed to the bull. Approximately 53 percent (83) of the producers who owned 25 head or less, 55 percent (84) of the producers who owned 26 to 50 head, 59 percent (71) of the producers who owned 51 to 100 head, and 51.5 percent (35) of the producers who owned 101 or more head attended one to three Extension beef meetings. When these differences were compared using the chi-square test, there was no significant relationship between number of heifers and cows owned and the number of Extension beef meetings attended. Producers with 101 or more heifers and cows were no more likely to have attended Extension beef meetings than producers with 25 or less heifers and cows.

Number of Acres of permanent pasture land. Fifty-six percent (85) of the producers operating 50 acres or less of permanent pasture land, more than 54 percent
of the producers operating 51 to 150 acres, and 52 percent (72) of the producers operating 151 or more acres attended one to three Extension beef meetings. When these differences were compared using the chi-square test and there was no significant relationship between the number of acres of permanent pasture land producers operated and the number of Extension beef meetings they attended. Producers operating 151 or more acres were no more likely to have attended Extension beef meetings than were producers operating 50 acres or less.

II. RELATIONSHIPS BETWEEN SELECTED PERSONAL AND FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS AND THE NUMBER OF FARM VISITS RECEIVED

This section (Table 3) presents findings regarding the relationship between personal and farm characteristics of Tennessee beef producers and the number of visits made by the Extension agent. The total number and percent of producers was given for each variable, as well as the chi-square value and probability level.

Personal Characteristics

The producer characteristics used in this study as independent variables were age and farming status. The dependant variable was visits received from the Extension agent.

Age. Greater than 41 percent (41) of the producers under the age of 40, 52 percent (120) of the producers between the ages of 41 and 60, and 45 percent (63) of the producers the age of 61 and over received one or more visits from the Extension agent. When these differences were compared using the chi-square test, there was no significant
TABLE 3. Relationships Between Selected Personal and Farm Characteristics of Tennessee Beef Producers and the Number of Farm Visits Received

| Selected Personal and Farm Characteristics | Farm Visits Received | Total* |  |
|--------------------------------------------|----------------------|--------|
|                                           | None | One or More | Number of Producers | Percent of Producers | Number of Producers (N = 543) | Percent of Producers |
| PERSONAL CHARACTERISTICS                   |       |             |                   |                  |                             |                  |
| Age                                        |       |             |                   |                  |                             |                  |
| Under 40                                   | 58   | 41          | 99                | 100.0            |                             |                  |
| 41 to 60                                    | 112  | 120         | 232               | 100.0            |                             |                  |
| Over 61                                     | 77   | 63          | 140               | 100.0            |                             |                  |
| Statistics $X^2 = 3.480; p = .176$          |       |             |                   |                  |                             |                  |
| Farming Status                             |       |             |                   |                  |                             |                  |
| Full-Time                                  | 38   | 68          | 160               | 100.0            |                             |                  |
| Part-Time                                  | 210  | 158         | 368               | 100.0            |                             |                  |
| Statistics $X^2 = 14.849; p < .001$         |       |             |                   |                  |                             |                  |
| FARM CHARACTERISTICS                        |       |             |                   |                  |                             |                  |
| Heifers and Cows Exposed to the Bull        |       |             |                   |                  |                             |                  |
| 25 or Less                                 | 102  | 44          | 146                | 100.0            |                             |                  |
| 26 to 50                                    | 76   | 70          | 146                | 100.0            |                             |                  |
| 51 to 100                                   | 46   | 71          | 117                | 100.0            |                             |                  |
| 100 or More                                 | 25   | 39          | 64                 | 100.0            |                             |                  |
| Statistics $X^2 = 30.456; p < .001$         |       |             |                   |                  |                             |                  |
| Acres of Permanent Pasture Land             |       |             |                   |                  |                             |                  |
| 50 or Less                                 | 98   | 42          | 140                | 100.0            |                             |                  |
| 51 to 150                                   | 109  | 89          | 198                | 100.0            |                             |                  |
| 151 or More                                 | 40   | 92          | 132                | 100.0            |                             |                  |
| Statistics $X^2 = 43.794; p < .001$         |       |             |                   |                  |                             |                  |

*Total may not equal N due to missing data.
relationship between age and the numbers of visits producers received from an Extension agent. Producers under the age of 40 were no more likely to have received visits from the Extension agent than producers age 61 and over.

Farming status. Sixty-four percent (68) of the full-time producers, compared to 43 percent (158) of the part-time producers received one or more visits from the Extension agent. When these differences were compared using the chi-square test there was a significant relationship between farming status and the number of visits received from the Extension agent. Full-time producers were more likely to have received farm visits from the Extension agent than were part-time producers.

Farm Characteristics

The farm characteristics in this study used as independent variables were number of heifers and cows exposed to the bull and acres of permanent pasture land. The dependant variable was the number of farm visits received from Extension agent.

Number of heifers and cows exposed to the bull. Thirty percent (44) of the producers with 25 head or less, 48 percent (70) of the producers with 26 to 50 head, 61 percent (71) of the producers with 51 to 100 head, and 61 percent (39) of the producers with 101 or more head received one or more visits from an Extension agent. When these differences were compared using the chi-square test, there was a significant relationship between the number of heifers and cows exposed to the bull and the number of farm visits received from agents. Producers with 51 or more head of heifers and cows exposed to the bull were more likely to have received visits from an Extension agent than producers with less than 50 head.
Number of acres of permanent pasture land. Thirty percent (42) of the producers operating 50 acres or less of permanent pasture land, 45 percent (89) of the producers operating 51 to 150 acres, and 70 percent (92) of the producers operating 151 or more acres received one or more visits from an extension agent. When these differences were compared using the chi-square test, there was a significant relationship between the number of acres of permanent pasture operated and the number of farm visits received from the agent. Producers operating more than 151 acres of permanent pasture land were more likely to have received visits from Extension agents than producers operating 50 acres or less.

III. CHAPTER SUMMARY

This chapter reported on selected personal and farm characteristics of Tennessee beef producers and their Extension contacts. The producers' personal characteristics were age and farming status, while the farm characteristics were number of heifers and cows exposed to the bull and number of acres of permanent pasture land operated. The selected Extension contacts were beef meetings attended and visits received from an Extension agent.

There were no significant relationships found between age, farming status, number of heifers and cows exposed to the bull, number of acres of permanent pasture land operated, and the number of Extension beef meetings attended. There was also no significant relationship found between producers' age and number of visits received from an Extension agent.
A significant relationship was reported between the producers' farming status, the number of heifers and cows exposed to the bull, number of acres of permanent pasture operated by producer, and visits received from an Extension agent. Producers that were reported as full-time farmers, had 51 or more head of heifers and cows exposed to the bull, and operated 151 acres or more of permanent pasture were more likely to have received visits from an Extension agent.
CHAPTER V

RELATIONSHIPS BETWEEN TENNESSEE BEEF PRODUCERS’ PERSONAL AND FARM CHARACTERISTICS AND THEIR USE OF SELECTED ROUND BALE HAY STORAGE METHODS

This chapter presents data regarding the relationships between selected personal and farm characteristics and the producers’ use of selected round bale hay storage practices. The personal characteristics of the producer were age and farming status, while the farm characteristics were the number of heifers and cows exposed to the bull and number of acres of permanent pasture land operated by the producer. There were four round bale hay storage methods selected: 1) hay stored outside, on-the-ground, and uncovered; 2) hay stored outside, off-the-ground, and uncovered; 3) hay stored outside, off-the-ground, and covered; and 4) hay stored inside permanent structure. Each round bale hay storage method was divided into two categories: 50 percent or less of hay stored and 51 percent or more hay stored for each of four storage methods. These data are presented in four tables with each table being presented and discussed in its own section.

Section I presents findings regarding relationships between selected personal and farm characteristics of Tennessee beef producers and the percent of round bales of hay stored outside, on-the-ground, and uncovered.

Section II presents findings regarding relationships between selected personal and farm characteristics of Tennessee beef producers and the percent of round bales of hay stored outside, off-the-ground, and uncovered.
Section III presents findings regarding relationships between selected personal and farm characteristics of Tennessee beef producers and the percent of round bales of hay stored outside, off-the-ground, and covered.

Section IV presents findings regarding relationships between selected personal and farm characteristics of Tennessee beef producers and the percent of round bales of hay stored inside a permanent structure.

I. RELATIONSHIPS BETWEEN SELECTED PERSONAL AND FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS AND THE PERCENT OF ROUND BALES OF HAY STORED OUTSIDE, ON-THE-GROUND, AND UNCOVERED

This section (Table 4) presents data regarding the relationship between the personal and farm characteristics of 244 Tennessee beef producers and their use of storing round hay bales outside, on-the-ground, and uncovered.

Personal Characteristics

Age. For producers indicating they stored their round hay bales outside, on-the-ground, and uncovered; 44 percent (23) of these producers under the age of 40, 34 percent (43) of the producers between the ages of 41 to 60, and 34 percent (21) of the producers over the age of 61 stored 50 percent or less of their round bale hay using this storage method. Fifty-six percent (29) of the producers under the age of 40, 65 percent (82) of the producers between the ages of 41 and 60, and 66 percent (41) of the producers over the age of 61 stored 51 percent or more of their hay using this method. When the
### TABLE 4.

**Relationships Between Selected Personal and Farm Characteristics of Tennessee Beef Producers and the Percent of Round Bales Stored Outside, On-the-Ground, and Uncovered**

<table>
<thead>
<tr>
<th>Selected Personal and Farm Characteristics</th>
<th>Hay Stored Outside, On-the-Ground, and Uncovered</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 Percent of Less</td>
<td>51 Percent or More</td>
<td>Total*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
<td>Number of Producers (N = 244)</td>
</tr>
<tr>
<td><strong>PERSONAL CHARACTERISTICS</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 40</td>
<td>23</td>
<td>44.2</td>
<td>29</td>
<td>55.8</td>
<td>52</td>
</tr>
<tr>
<td>41 to 60</td>
<td>43</td>
<td>34.4</td>
<td>82</td>
<td>65.6</td>
<td>125</td>
</tr>
<tr>
<td>Over 61</td>
<td>21</td>
<td>33.9</td>
<td>41</td>
<td>66.1</td>
<td>62</td>
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<tr>
<td>Statistics X² = 1.765; p = .414</td>
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<td>Farming Status</td>
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</tr>
<tr>
<td>Full-Time</td>
<td>23</td>
<td>34.8</td>
<td>43</td>
<td>65.2</td>
<td>66</td>
</tr>
<tr>
<td>Part-Time</td>
<td>66</td>
<td>37.7</td>
<td>109</td>
<td>62.3</td>
<td>175</td>
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<tr>
<td><strong>FARM CHARACTERISTICS</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Heifers and Cows Exposed to the Bull</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 or Less</td>
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<td>42</td>
<td>67.7</td>
<td>62</td>
</tr>
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<td>26 to 50</td>
<td>24</td>
<td>31.2</td>
<td>53</td>
<td>68.8</td>
<td>77</td>
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<tr>
<td>51 to 100</td>
<td>30</td>
<td>47.6</td>
<td>33</td>
<td>52.4</td>
<td>63</td>
</tr>
<tr>
<td>101 or More</td>
<td>14</td>
<td>36.8</td>
<td>24</td>
<td>63.2</td>
<td>38</td>
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<td>Acres of Permanent Pasture Land</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 or Less</td>
<td>18</td>
<td>36.0</td>
<td>32</td>
<td>64.0</td>
<td>50</td>
</tr>
<tr>
<td>51 to 150</td>
<td>36</td>
<td>32.7</td>
<td>74</td>
<td>67.3</td>
<td>110</td>
</tr>
<tr>
<td>151 or More</td>
<td>34</td>
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</tr>
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</tbody>
</table>

*Total may not equal N due to missing data.*
differences were compared using the chi-square test, there was no significant relationship between producers’ age and the percent of round bale hay producers stored outside, on-the-ground, and uncovered.

**Farming status.** Almost 35 percent (23) of the full-time producers compared to 38 percent (66) of the part-time producers stored 50 percent or less of their round bale hay outside, on-the-ground, and uncovered. More than 65 percent (43) of the full-time producers, compared to 62 percent (109) of the part-time producers, stored 51 percent or more of their round bale hay using this method. When these differences were compared using the chi-square test, there was no significant relationship between the producers’ farming status and the percent of round bales of hay producers stored outside, on-the-ground, and uncovered.

**Farm Characteristics**

**Number of heifers and cows exposed to the bull.** Thirty-two percent (20) of the producers owning 25 head or less, 31 percent (24) of the producers owning 26 to 50 head, 48 percent (30) of the producers owning 51 to 100 head, and 37 percent (14) of the producers owning 101 or more head stored 50 percent or less of their round bales of hay outside, on-the-ground, and uncovered. Just less than 68 percent (42) of the producers owning 25 head or less, 69 percent (53) of the producers owning 26 to 50 head, 52 percent (33) of the producers owning 51 to 100 head, 63 percent (24) of the producers owning 101 or more head stored 51 percent or more using this method. When compared using the chi-square test there was no significant relationship between the producers’
number of heifers and cows exposed to the bull and the percent of round bales producers stored outside, on-the-ground, and uncovered.

**Number of acres of permanent pasture land.** Thirty-six percent (18) of the producers operating 50 acres or less of permanent pasture land, 33 percent (36) of the producers operating 51 to 150 acres, 43 percent (34) of the producers operating 151 or more acres stored 50 percent or less of their round bale of hay outside, on-the-ground, and uncovered. Sixty-four percent (32) of the producers operating 50 acres or less, 67 (74) operating 51 to 150 acres, and 58 percent (46) of the producers operating 151 or more acres stored 51 percent or more using this method. No significant differences were found when compared using the chi-square test between the number of acres of permanent pasture land producers operated and the percent of round bales they stored outside, on-the-ground, and uncovered.

II. RELATIONSHIPS BETWEEN SELECTED PERSONAL AND FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS AND THE PERCENT OF ROUND BALES OF HAY STORED OUTSIDE, OFF-THE-GROUND, AND UNCOVERED

This section (Table 5) presents data regarding the relationships between the personal and farm characteristics of 47 Tennessee beef producers and the percent of round bale hay they stored outside, off-the-ground, and uncovered.
<table>
<thead>
<tr>
<th>Selected Personal and Farm Characteristics</th>
<th>Hay Stored Outside, Off-the-Ground, and Uncovered</th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 Percent of Less</td>
<td>51 Percent or More</td>
</tr>
<tr>
<td></td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
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<td>PERSONAL CHARACTERISTICS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 40</td>
<td>5</td>
<td>45.5</td>
</tr>
<tr>
<td>41 to 60</td>
<td>15</td>
<td>68.2</td>
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<tr>
<td>Over 61</td>
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<td>64.3</td>
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<tr>
<td>Full-Time</td>
<td>7</td>
<td>70.0</td>
</tr>
<tr>
<td>Part-Time</td>
<td>22</td>
<td>61.1</td>
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<tr>
<td>$X^2 = .265; p = .606$</td>
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<tr>
<td>FARM CHARACTERISTICS</td>
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<td></td>
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<tr>
<td>Heifers and Cows Exposed to the Bull</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 or Less</td>
<td>11</td>
<td>73.3</td>
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<tr>
<td>26 to 50</td>
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<td>56.3</td>
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<tr>
<td>51 to 100</td>
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<td>55.6</td>
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<td>101 or More</td>
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<td>57.4</td>
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<td>Statistics</td>
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<tr>
<td>Acres of Permanent Pasture Land</td>
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<td></td>
</tr>
<tr>
<td>50 or Less</td>
<td>11</td>
<td>68.8</td>
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<td>51 to 150</td>
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<td>151 or More</td>
<td>6</td>
<td>42.9</td>
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<td>Statistics</td>
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<td>$X^2 = 2.741; p = .254$</td>
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</tr>
</tbody>
</table>

*Total may not equal N due to missing data.
Personal Characteristic

Age. For the producers indicating they stored round bales of hay outside, off-the-ground, and uncovered; 46 percent (5) of the producers under the age of 40, 68 percent (15) of the producers between the ages of 41 to 60, and 64 percent (9) of the producers over the age of 61 stored 50 percent or less of their round bale hay outside, off-the-ground, and uncovered. For the producers storing 51 percent or more of their round bale hay using this method; 55 percent (6) of the producers were under the age of 40, 32 percent (7) of the producers were between the ages of 41 to 60, and 36 percent (5) of the producers were over the age of 61. When the differences were compared using the chi-square test, there was no significant relationship between age and the percent of round bale hay producers stored outside, off-the-ground, and uncovered.

Farming status. Seventy percent (7) of full-time producers and 61 percent (22) of part-time producers stored 50 percent or less of their round bale hay outside, off-the-ground, and uncovered. Thirty percent (3) of the full-time producers, compared to 39 percent of the part-time producers, stored 51 percent or more of their round bale hay using this method. When these differences were compared using the chi-square test, there was no significant relationship between farming status and the percent of round bales producers stored outside, off-the-ground, and uncovered.

Farm Characteristics

Number of heifers and cows exposed to the bull. Seventy-three percent (11) of the producers owning 25 head or less, 56 percent (9) of the producers owning 26 to 50 head, 56 percent (5) of the producers owning 51 to 100 head, and 57 percent (4) of the
producers owning 101 or more head stored 50 percent or less of their round bale hay outside, off-the-ground, and uncovered. Twenty-seven percent (4) of the producers owning 25 head or less, 44 percent (7) of the producers owning between 26 to 50 head, 44 percent (4) of the producers owning 51 to 100 head and 43 percent (3) of the producers owning 101 or more head stored 51 percent of more of their round bale hay using this method. When the differences were compared using the chi-square test, there was no significant relationship between the number of head of heifers and cows a producer owned and the percent of round bales hay a producer stored outside, off-the-ground, and uncovered.

**Number of acres of permanent pasture land.** Sixty-nine percent (11) of producers operating 50 acres or less, 69 percent (11) of the producers operating 51 to 150 acres and 43 percent (6) operating 151 or more acres stored 50 percent or less of their round bale hay outside, off-the-ground, and uncovered. Thirty-one percent (5) of producers operating 50 acres or less, 31 percent (5) of the producers operating 51 to 150 acres, and 57 percent (8) of the producers operating 151 or more acres stored 51 percent or more of their round bales hay using this method. When the differences were compared using the chi-square test, there was no significant relationship between number of acres of permanent pasture land operated and the percent of round bales of hay producers stored outside, off-the-ground, and uncovered.
III. RELATIONSHIPS BETWEEN SELECTED PERSONAL AND FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS AND THE PERCENT OF ROUND BALES OF HAY STORED OUTSIDE, OFF-THE-GROUND, AND COVERED

This section (Table 6) presents data regarding the relationship between the personal and farm characteristics of 69 Tennessee beef producers and the percent of round bale hay they stored outside, off-the-ground, and covered.

**Personal Characteristics**

**Age.** Sixty-five percent (11) of producers under the age of 40, 66 percent (21) of the producers between the ages of 41 to 60, and 83 percent (15) of the producers over 61 years of age stored 50 percent or less of their round bales of hay outside, off-the-ground, and covered. Thirty-five percent (6) of producers under the age of 40, 34 percent (11) of the producers between the ages of 41 to 60 and 17 percent (3) of the producers over the age of 61 stored 51 percent or more of their hay using this method. When the differences were compared using the chi-square test, there was no significant relationship between age and the percent of round bales of hay producers stored outside, off-the-ground, and covered.

**Farming status.** Sixty-eight percent (13) of the full-time producers and 72 percent (36) of the part-time producers stored 50 percent or less of their round bales of hay outside, off-the-ground, and covered. Thirty-two percent (6) of the full-time producers and 28 percent (14) of the part-time producers stored their round bales using this method. When these differences were compared using the chi-square test, there was no significant
TABLE 6. Relationships Between Selected Personal and Farm Characteristics of Tennessee Beef Producers and the Percent of Round Bales Stored Outside, Off-the-Ground, and Covered

<table>
<thead>
<tr>
<th>Selected Personal and Farm Characteristics</th>
<th>Hay Stored Outside, Off-the-Ground, and Covered</th>
<th></th>
<th></th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 Percent of Less</td>
<td>51 Percent or More</td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
</tr>
<tr>
<td>PERSONAL CHARACTERISTICS</td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
</tr>
<tr>
<td>Age</td>
<td>64.7</td>
<td>35.3</td>
<td>17</td>
<td>100.0</td>
</tr>
<tr>
<td>Under 40</td>
<td>11</td>
<td>64.7</td>
<td>6</td>
<td>35.3</td>
</tr>
<tr>
<td>41 to 60</td>
<td>21</td>
<td>65.6</td>
<td>11</td>
<td>34.4</td>
</tr>
<tr>
<td>Over 61</td>
<td>15</td>
<td>83.3</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>Farming Status</td>
<td>68.4</td>
<td>31.6</td>
<td>19</td>
<td>100.0</td>
</tr>
<tr>
<td>Full-Time</td>
<td>13</td>
<td>68.4</td>
<td>6</td>
<td>31.6</td>
</tr>
<tr>
<td>Part-Time</td>
<td>72.0</td>
<td>28.0</td>
<td>14</td>
<td>28.0</td>
</tr>
<tr>
<td>Farm CHARACTERISTICS</td>
<td>76.2</td>
<td>23.8</td>
<td>21</td>
<td>100.0</td>
</tr>
<tr>
<td>Heifers and Cows Exposed to the Bull</td>
<td>88.9</td>
<td>11.1</td>
<td>9</td>
<td>100.0</td>
</tr>
<tr>
<td>25 or Less</td>
<td>10</td>
<td>52.6</td>
<td>9</td>
<td>47.4</td>
</tr>
<tr>
<td>26 to 50</td>
<td>15</td>
<td>75.0</td>
<td>5</td>
<td>25.0</td>
</tr>
<tr>
<td>51 to 100</td>
<td>16</td>
<td>76.2</td>
<td>5</td>
<td>23.8</td>
</tr>
<tr>
<td>101 or More</td>
<td>8</td>
<td>88.9</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>Acres of Permanent Pasture Land</td>
<td>60.9</td>
<td>39.1</td>
<td>23</td>
<td>100.0</td>
</tr>
<tr>
<td>50 or Less</td>
<td>14</td>
<td>60.9</td>
<td>9</td>
<td>39.1</td>
</tr>
<tr>
<td>51 to 150</td>
<td>17</td>
<td>70.8</td>
<td>7</td>
<td>29.2</td>
</tr>
<tr>
<td>151 or More</td>
<td>17</td>
<td>81.0</td>
<td>4</td>
<td>19.0</td>
</tr>
</tbody>
</table>

*Total may not equal N due to missing data.

Statistics $X^2 = 2.047; p = .359$

Statistics $X^2 = .086; p = .770$

Statistics $X^2 = 4.944; p = .176$

Statistics $X^2 = 2.134; p = .344$
relationship between farming status and the percent of round bales of hay producers stored outside, off-the-ground, and covered.

Farm Characteristics

Number of heifers and cows exposed to the bull. Approximately 53 percent (10) of producers owning 25 head or less, 75 percent (15) of the producers owning 26 to 50 head, 76 percent (16) of the producers owning 51 to 100 head, and 89 percent (8) of the producers owning 101 or more stored 50 percent or less of their round bales of hay outside, off-the-ground, and covered. Approximately 47 percent (9) of the producers owning 25 head or less, 25 percent (5) of the producers owning 26 to 50 head, 24 percent (5) of the producers owning 51 to 100 head, and 11 percent (1) of the producers owning 101 or more head stored 51 percent or more of their round bales of hay using this method. When these differences were compared using the chi-square test, there was no significant relationship between number of head of heifers and cows producers owned and the percent of round bales of hay producers stored outside outside, off-the-ground, and covered.

Number of acres permanent pasture land. Sixty-one percent (14) of producers operating 50 acres or less, 71 percent (17) of the producers operating 51 to 150 acres, and 81 percent (17) of the producers operating 151 or more acres stored 50 percent or less of their round bales of hay outside, off-the-ground, and covered. Thirty-nine percent (9) of producers operating 50 acres or less, 29 (7) percent of the producers operating 51 to 150 acres, and 19 percent (4) of the producers operating 151 or more acres stored 51 percent or more of their round bales of hay using this method. When these differences were
compared using the chi-square test, there was no significant relationship between number of acres of permanent pasture land producers operated and the percent of round bales of hay producers stored outside, off-the-ground, and covered.

IV. RELATIONSHIPS BETWEEN SELECTED PERSONAL AND FARM CHARACTERISTICS OF TENNESSEE BEEF PRODUCERS AND THE PERCENT OF ROUND BALES OF HAY STORED INSIDE A PERMANENT STRUCTURE

This section (Table 7) presents data regarding the relationship between the personal and farm characteristics of 242 Tennessee beef producers and the percent of round bales of hay stored inside a permanent structure.

Personal Characteristics

Age. Approximately 42 percent (22) of the producers under the age of 40, 47 percent (53) of the producers between the ages of 41 to 60, and 37 percent (25) of the producers over the age of 61 stored 50 or less of their round bales of hay inside a permanent structure. The remaining 58.5 percent (31) of the producers under the age of 40, 53 percent (60) of the producers between the ages of 41 to 60, and 63 percent (42) of the producers over the age of 61 stored 51 percent or more of their round bales of hay using this method. When the differences were compared using the chi-square test, there was no significant relationship between age and the percent of round bales of hay producers stored inside a permanent structure.

Farming status. Approximately 45 percent (25) of the full-time farmers and 43 percent (77) of the part-time producers stored 50 percent or less of their round bales of
TABLE 7. Relationships Between Selected Personal and Farm Characteristics of Tennessee Beef Producers and the Percent of Round Bales Stored Inside a Permanent Structure

<table>
<thead>
<tr>
<th>Selected Personal and Farm Characteristics</th>
<th>Hay Stored Inside a Permanent Structure</th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50 Percent of Less</td>
<td>51 Percent or More</td>
</tr>
<tr>
<td></td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
</tr>
</tbody>
</table>

PERSONAL CHARACTERISTICS

Age
- Under 40: 22 (41.5%), 31 (58.5%), 53 (100.0%)
- 41 to 60: 53 (46.9%), 60 (53.1%), 113 (100.0%)
- Over 61: 25 (37.3%), 42 (62.7%), 67 (100.0%)

Statistics $X^2 = 1.634; p = .442$

Farming Status
- Full-Time: 25 (44.6%), 31 (55.4%), 56 (100.0%)
- Part-Time: 77 (43.3%), 101 (56.7%), 178 (100.0%)

Statistics $X^2 = .003; p = .855$

FARM CHARACTERISTICS

Heifers and Cows Exposed to the Bull
- 25 or Less: 19 (32.3%), 40 (67.8%), 59 (100.0%)
- 26 to 50: 32 (43.8%), 41 (56.2%), 73 (100.0%)
- 51 to 100: 34 (44.7%), 42 (55.3%), 76 (100.0%)
- 101 or More: 17 (56.7%), 13 (43.3%), 30 (100.0%)

Statistics $X^2 = 5.209; p = .157$

Acres of Permanent Pasture Land
- 50 or Less: 16 (23.2%), 53 (76.8%), 69 (100.0%)
- 51 to 150: 48 (49.0%), 50 (51.0%), 98 (100.0%)
- 151 or More: 37 (52.1%), 34 (47.9%), 71 (100.0%)

Statistics $X^2 = 14.904; p < .001$

*Total may not equal N due to missing data.
hay inside a permanent structure. Fifty-five percent (31) of the full-time producers and 57 percent (101) of the part-time producers stored 51 percent or more of their round bales of hay inside a permanent structure. When the differences were compared using the chi-square test, there was no significant relationship between farming status and the percent of round bales of hay producers stored inside a permanent structure.

Farm Characteristics

Number of heifers and cows exposed to the bull. Thirty-two percent (19) of the producers owning 25 head or less, 44 percent (32) of the producers owning 26 to 50 head, 45 percent (34) of the producers owning 51 to 100 head, and 57 percent (17) of the producers owning 101 or more head stored 50 percent or less of their round bales of hay inside a permanent structure. Sixty-eight percent (40) of the producers owning 25 head or less, 56 percent (41) of the producers owning 26 to 50 head, 55 percent (42) of the producers owning 51 to 100 head, and 43 percent (13) of the producers owning 101 or more head store 51 percent or more of their hay inside a permanent structure. When the differences were compared using the chi-square test, there was no significant relationship between number of heifers and cows exposed to the bull and the percent of hay producers stored inside a permanent structure.

Number of acres of permanent pasture land. Approximately 23 percent (16) of the producers operating 50 acres or less of permanent pasture land, 49 percent (48) of the producers operating 51 to 150 acres, 52 percent (37) of the producers operating 151 or more acres stored 50 percent or less of their round bales of hay inside a permanent structure. The remaining 77 percent (53) of the producers operating 50 acres or less, 51
percent (50) of the producers operating 51 to 150 acres, 48 percent (34) of the producers operating 151 or more stored 51 percent or more of their round bales of hay inside a permanent structure. When the differences were compared using the chi-square test, there was a significant relationship between number of acres of permanent pasture land and the percent of round bales of hay producers stored inside a permanent structure. Producers with 50 acres or less of permanent pasture were more likely to store 51 percent or more of their round bales of hay inside a permanent structure than were producers with 51 or more acres of permanent pasture land.

V. CHAPTER SUMMARY

There were no significant differences between producers’ age, farming status, number of heifers and cows exposed to the bull, and the round bale hay storage methods of: outside, on-the-ground, and uncovered; outside, off-the-ground, and uncovered; outside, off-the-ground, and covered; or inside a permanent structure. There was a significant relationship between the number of acres of permanent pasture land and the percent of round bales producers stored inside a permanent structure.
CHAPTER VI

RELATIONSHIPS BETWEEN THE NUMBER OF CONTACTS TENNESSEE BEEF PRODUCERS HAD WITH EXTENSION AND THEIR USE OF SELECTED ROUND BALE HAY STORAGE METHODS

This chapter presents findings regarding relationships between Tennessee beef producers’ Extension contacts and their use of selected round bale hay storage methods. This chapter compared total Extension contacts to storage methods. The total extension contacts were included: beef cattle meetings attended, office visits to local Extension office, telephone calls made to local Extension office, visits from Extension agent, written materials received. The four storage methods included: 1) outside, on-the-ground, and uncovered; 2) outside, off-the-ground, and uncovered; 3) outside, off-the-ground, and covered; and 4) inside a permanent structure. The percent of hay stored using each method was divided into two categories: 50 percent or less and 51 percent more of round bales stored using each method.

The chi-square test was used to determine the relationship between Extension contacts and the producers’ use of each of the round bale hay storage methods. The 0.05 probability level was used to determine significant relationship.

I. RELATIONSHIPS OF EXTENSION CONTACTS AND PRODUCERS’ USE OF SELECTED ROUND BALE STORAGE METHODS

Presented in this section are findings regarding relationships between the number of contacts Tennessee beef producers had with Extension and their use of selected round
TABLE 8. Relationships Between the Total Number of Extension Contacts Tennessee Beef Producers had with Extension and Their use of Selected Round Bales of Hay Storage Methods

<table>
<thead>
<tr>
<th>Selected Round Bale Storage Methods</th>
<th>Extension Contacts</th>
<th>Five or Less</th>
<th>Six of More</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Producers</td>
<td>Percent of Producers</td>
<td>Number of Producers</td>
</tr>
<tr>
<td>Outside, On-the-Ground and, Uncovered</td>
<td>50 Percent or Less</td>
<td>39</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>51 Percent or More</td>
<td>72</td>
<td>64.9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>111</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Statistics $X^2 = .136$; $p = .713$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside, Off-the-Ground and, Uncovered</td>
<td>50 Percent or Less</td>
<td>11</td>
<td>68.8</td>
</tr>
<tr>
<td></td>
<td>51 Percent or More</td>
<td>5</td>
<td>31.2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>29</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Statistics $X^2 = .158$; $p = .691$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outside, Off-the-Ground and, Covered</td>
<td>50 Percent or Less</td>
<td>21</td>
<td>67.7</td>
</tr>
<tr>
<td></td>
<td>51 Percent or More</td>
<td>10</td>
<td>32.3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>31</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Statistics $X^2 = .042$; $p = .838$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inside a Permanent Structure</td>
<td>50 Percent or Less</td>
<td>52</td>
<td>49.5</td>
</tr>
<tr>
<td></td>
<td>51 Percent or More</td>
<td>53</td>
<td>50.5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>105</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Statistics $X^2 = 2.439$; $p = .118$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
bale hay storage methods (Table 8). The number of Extension contacts producers had were divided into two categories: producers who had five or less and those who had six or more Extension contacts. The chi-square test was used to determine relationships between the number of Extension contacts and their used of round bale hay storage methods.

**Round Bales Hay Stored Outside, On-the-Ground, and Uncovered**

Thirty-five percent (39) of the producers with five or less Extension contacts compared to 38 percent (49) of the producers with six or more Extension contacts stored 50 percent or less of their round bales of hay outside, on-the-ground, and uncovered. Sixty-five percent (72) of the producers with five or less Extension contacts compared to 62 percent (79) of the producers with six or more contacts stored 51 percent or more of their round bales of hay outside, on-the-ground, and uncovered. When these differences were compared by chi-square test, there were no significant differences between Extension contacts and the amount of hay producers stored outside, on-the-ground, and uncovered. Beef producers with five or less contacts were no more likely to store round bales of hay outside, on-the-ground, and uncovered than producers with six or more Extension contacts.

**Round Bales of Hay Stored Outside, Off-the-Ground, and Uncovered**

Sixty-nine percent (11) of the producers with five or less Extension contacts compared to 58 percent (18) of the producers with six or more Extension contacts stored 50 percent or less of the round bales of hay outside, off-the-ground, and uncovered.
Thirty-one percent (5) of the producers with five and fewer Extension contacts compared to 42 percent (13) of the producers with six or more Extension contacts stored 51 percent or more of their round bales of hay using this method. When these differences were compared by the chi-square test, there were no significant difference between Extension contacts and producers storing their rounds bales of hay outside, off-the-ground, and uncovered. Beef producers with six or more Extension contacts were no more likely to store round bales of hay outside, off-the-ground, and uncovered than producers with five or more less Extension contacts.

**Round Bales of Hay Stored Outside, Off-the-Ground, and Covered**

Approximately 68 percent (21) of the producers having five or less Extension contacts compared to 73 percent (27) of the producers with six or more Extension contacts stored 50 percent or less of their round bales of hay outside, off-the-ground, and covered. Thirty-two percent (10) of the producers with five or less Extension contacts and 27 percent (10) of the producers with six or more Extension contacts stored 51 percent or more their round bales of hay using this method. When these difference were compared by the chi-square test, there were no significant differences between Extension contacts and producers storing their round bales of hay outside, off-the-ground, and covered. Beef producers with six or more Extension contacts were no more likely to store their round bales of hay outside, off-the-ground, and covered than producers with five or less Extension contacts.
Round Bales of Hay Store Inside a Permanent Structure

Approximately 50 percent (52) of the producers with five or less Extension contacts compared to 38 percent (48) of the producers with six or more Extension contacts stored 50 percent or less of their round bales of hay in a permanent structure. The remaining 50.5 percent (53) of the producers having five or Extension contacts compared to 62 percent (77) of the producers having six or more Extension contacts stored 51 percent or more of their round bale of hay using this method. When these differences were compared by the chi-square test, there were no significant difference between Extension contacts and the percent of rounds bales of hay producers stored in a permanent structure. Beef producers with six or more Extension contacts were no more likely to store round bales of hay inside a permanent structure than producers with five or less Extension contacts.

II. CHAPTER SUMMARY

There was no significant relationships between the number of Extension contacts Tennessee beef producers had with Extension and their use of the four surveyed methods of round bale hay storage. A producer with six or more Extension contacts was no more likely to store rounds bales of hay using one of the four storage methods than a producer with five or less Extension contacts.
CHAPTER VII

SUMMARY OF MAJOR FINDINGS

This chapter presents a summary of the major findings of this study. The chapter is divided into sections relating to the purposes and objectives, method of investigation, major findings, implications and recommendations, and recommendations for further study.

I. PURPOSE AND SPECIFIC OBJECTIVES

Purpose

The purpose of this study was to determine if there is a difference in round bale hay storage methods used by Tennessee beef producers based on farm and operator characteristics and producer contacts with The University of Tennessee Agricultural Extension Service.

Specific Objectives

The objectives of the study were:

1. To characterize Tennessee beef producers by selected personal and farm operation characteristics, the number and type of contacts with Extension, and their use of selected round bale hay storage methods.

2. To determine the relationships between selected personal and farm operation characteristics of Tennessee beef producers, the number of Extension meetings attended, and the number of farm visits received from an Extension agent.
3. To determine the relationships between selected personal and farm operation characteristics of Tennessee beef producers and their use of selected round bale hay storage methods.

4. To determine the relationships between the number and type of contacts producers had with Extension and their use of selected round bale hay storage methods.

II. METHOD OF INVESTIGATION

Population and Sample Studies

The sample for this study was drawn from a secondary data source. The original sample of 653 respondents was drawn from the population of all beef producers in Tennessee in the spring of 1996. The sub-sample selected for this study included Tennessee beef producers who completed the 1996 Tennessee Beef Producers Survey and fed 75 percent of their hay in round bales. A total of 543 Tennessee beef producers met these criteria and their responses were used for this study.

Survey Instrument

The 1996 Tennessee Beef Producer Survey was developed by specialists in the Extension Animal Science-Beef and the Agricultural and Extension Education Sections.

Conducting the Survey

The survey's were distributed through The University of Tennessee's Agriculture Extension Service's county offices and at meetings conducted in Tennessee by the Extension Service's beef specialists. The Extension agents in each county determined, at
their own discretion, how to disseminate the surveys. This was done either through mailings, handing them out at meetings, and/or having producers pick them up at the Extension office. When the survey was completed the beef producer was to return it to the local Extension office or if the producer received it at a meeting, it could be returned at the conclusion of the meeting.

Method of Analysis

The University of Tennessee analyzed the data collected. The chi-square test was used to determine if significant relationship existed between dependent and independent variables. Chi-square values which were determined to be the .05 probability level or lower were identified as being statistically significant.

III. MAJOR FINDINGS

Major findings are classified and presented under headings related to the objectives of this study.

Personal and Farm Operation Characteristics of Tennessee Beef Producers, the Number and Type of Extension Contacts and Their Use of Selected Round Bale Hay Storage Methods

Forty-nine percent of Tennessee beef producers surveyed were between the ages of 41 to 60, with the average age of 54 years. Seventy-seven percent of the producers surveyed were part-time producers. Eighty-eight percent of the producers owned 100 or less head of heifers and cows, and 41 percent of the producers operated 51 to 150 acres of permanent pasture land.
Approximately 55 percent of the beef producers attended one to three Extension beef meetings and 44.5 percent received one to three visits from an Extension agent. Forty percent of the producers made telephone calls to a local Extension office, 65 percent of the producers received one to three factsheets or publications, and 68.5 percent received quarterly newsletters.

Approximately 75 percent of the beef producers surveyed stored 100 percent of their hay in round bales. Of the 543 beef producers surveyed, 154 stored 51 percent or more of their round bales of hay outside, on-the-ground, and uncovered, and 140 stored 51 percent or more of their round bales of hay inside a permanent structure.

**Relationships between selected Personal and Farm Operation Characteristics of Tennessee Beef Producers and the Number and Type of Extension Contacts**

There were no significant relationships found between producers’ age, farming status, number of heifers and cows exposed to the bull, number of acres of permanent pasture land, and the number of Extension beef meetings attended. There was also no significant relationship found between the beef producers’ age and the number of visits received from an Extension agent.

There were significant relationships between the beef producers’ farming status, number of heifers and exposed to the bull, number of acres of permanent pasture operated by producers, and the number of visits received from an Extension agent. Full-time beef producers who had 51 or more head of heifers and cows exposed to the bull and operated
151 acres or more were more likely to have received visits from an Extension agent than were part-time, smaller producers.

Relationships Between Tennessee Beef Producers’
Personal and Farm Operation Characteristics and
the Percent of Round Bales Stored using the
Various Round Bales Storage Methods

There were no significant differences between the beef producers’ age, farming status, and number of heifers and cows exposed to the bull, when compared to round hay bale storage methods of outside, on-the-ground, and uncovered; outside, off-the-ground, and uncovered; outside, off-the-ground, and covered.

A significant relationship was reported between the number of acres of permanent pasture land and the percent of round bales of hay producers stored inside a permanent structure. Producers with 50 acres or less of permanent pasture land were more likely to store 51 percent or more of their round bales of hay inside a permanent structure than were producers with 51 or more acres of permanent pasture land.

Relationships Between the Number of Extension Contacts Producers had with Extension and Their Use of Selected Round Bale Hay Storage Methods

There were no significant relationships between the total number of Extension contacts Tennessee beef producers had with Extension and their use of the four methods of storing round bale hay. Beef producers with six or more Extension contacts were no
more likely to store rounds bales of hay using one of the four methods than producers with five or fewer Extension contacts.

IV. IMPLICATIONS AND RECOMMENDATIONS

Tennessee’s climate is unfavorable to store hay outside unprotected as it’s rainfall often exceeds more than 50 inches per year, and freezing and thawing cycles occur frequently during the winter months. Its has been noted in the review of related studies that when hay experiences 15 percent or more loss during storage, it is difficult to identify scenarios where some protection from weather will not be profitable.

During the last few years, The Tennessee Agricultural Extension Service has been recommending that beef producers store their hay using a protected storage method (off-the-ground and covered). Some beef producers, such as those who rent farm(s), may not have an available permanent structure, so storing round bales of hay outside, off-the-ground, and covered may be the best storage method. Recommending this type of round bale storage is a new venture for Extension. Four studies in the review of related literature indicated that Extension plays a key role in producers adoption of recommended practices, however this does not happen over night.

The review of literature has shown the value of covering hay being stored and the importance of Extension in getting producers to adopt practices. Therefore, it is recommended that Extension agents continue to work with local beef producers in promoting the importance of covering their stored hay.

Study data indicated that full-time, larger beef producers had more contact with Extension; therefore, it is suggested that Extension agents implement educational
opportunities so that part-time, smaller beef producers could be informed of the benefits of covering stored hay.

Since this survey was completed in 1996, Extension has conducted demonstrations and additional studies on the impact of various methods of storing hay. The growing cost of hay production has increased the need for efficient hay management. It is important, and therefore recommended, that Extension continue to stress the importance of appropriate hay storage practices in its educational programs. Extension faculty should increase their demonstrations at the local level on new ways of effectively storing round hay bales. Beef producers must understand the cost benefit of this practice and the result of the enhanced nutritional value of properly stored hay.

V. RECOMMENDATIONS FOR FURTHER STUDY

This study should serve as a base line study of beef producers’ use of round bale hay storage methods. It is recommended that another study be conducted within five years to identify characteristics of Tennessee beef producers, their contacts with Extension, and their use of round bale hay storage methods. A new study, conducted seven to eight years after this one, would help determine if Extension’s educational efforts are aiding beef producers in increasing their practice of effectively storing round hay bales. This information is necessary to help Extension agents plan and implement educational programs that meet the needs of their county beef producers.
BIBLIOGRAPHY


APPENDIX
TO: Extension Leaders
Extension Agents in Adult Agriculture

FROM: James B. Neel
Professor and Leader
Extension Animal Science-Beef, Sheep, Horse

DATE: December 18, 1995

SUBJECT: 1996 Tennessee Beef Producer Survey

Survey of clientele is a time proven method of collecting information to use in evaluating, planning and carrying out Extension educational programs. Surveys also provide objective data that can be used to document impact of Extension educational programs.

We need to conduct an Extension Beef Cattle Survey. The information collected from a survey would be beneficial to you in planning, carrying out and evaluating your Extension educational programs. Most counties in the state have beef as a priority program and information would be beneficial in your work.

In addition, several counties are in the process of developing programs in Agricultural Productive Efficiency and Sustainability. Data that could be collected from the survey will be of great benefit in this effort as well.

There are also questions that should provide some "bench marks" in marketing and management, water quality and environmental stewardship. This should be helpful to you in educational efforts in these areas. As a result the survey is several pages in length. However, questions can be quickly and easily answered.

I would like to ask you for your help in conducting this survey. I would suggest that you do it this winter and spring when you have a group of beef producers together at your winter meetings, cattlemen’s association or any other educational activity where local beef producers would be. It would probably take around 30 minutes or less to complete the questions.

The survey should be conducted between January 1, 1996 to May 1, 1996.

Attempt to secure a minimum of 25 respondents from your county. The maximum number is left up to you. The more producers involved, the more meaningful the data on the county, district and state level. Counties that have larger beef industries should secure a greater number of respondents.
We will send you the number of copies needed. Contact us a week to 10 days before you need the surveys.

After you complete the survey, send the individual surveys to our section for analysis.

The data and analysis should be helpful to you and to the specialist staff in Extension educational programs.

We would like to repeat the process in 4 years to see if any progress has been made.

Your cooperation and assistance would be greatly appreciated.

Attachment
INSTRUCTIONS TO EXTENSION AGENTS FOR CONDUCTING
THE TENNESSEE BEEF PRODUCER SURVEY

1. Read over the questionnaire prior to administering it. If you have questions, contact any
member of the Beef, Sheep, Horse Section.

2. The questionnaire can be conducted at any educational event you may have this winter
or early spring where beef producers would be in attendance. Several of you already
have beef cattle winter meetings scheduled. In addition, meetings on beef cattle
marketing, forage production and other topics that would have beef producers in
attendance would also be appropriate times to conduct the survey.

3. You should secure a minimum of 25 respondents from your county. The greater the
number of producers that respond to the survey, the more meaningful will be the data.
Those counties that have a larger number of cattle operations, should secure a greater
number of respondents.

4. If you execute the survey at more than one event, omit those producers that have
previously completed it.

5. Ask the respondents to write the name of the county at the top of the page.

6. As the questionnaire is completed and turned in to you, number them consecutively. If
you administer the survey at more than one meeting, continue the numbering.

7. Encourage producers to complete all the questions.

8. You will need to have pencils available.

9. Following completion of the surveys, return them to the Extension Animal Science-Beef,
Sheep, Horse Section or they can be forwarded to any of the specialists.

10. Thank you for your cooperation in securing data that will be beneficial to you, the
Extension Animal Science-Beef, Sheep, Horse Section and several of the Priority Teams
in Extension educational programs.
Dear Tennessee Beef Producer:

The Agricultural Extension Service, of the University of Tennessee, needs your help in developing educational programs that will be beneficial to you and other Tennessee beef producers. We need your help by you completing the attached survey.

To develop relevant educational programs, we need as much information as we can gather about the needs of the producers and the status of the industry. A survey is one of the methods that information can be compiled.

Would you take a few minutes and complete the survey to the best of your knowledge about your operation? Your responses will be compiled with producers from your county and across the state and used to develop educational programs in beef production. Please complete or reply to all the questions. Your replies should be based on your last calf crop weaned.

Your identity is not requested nor is it needed as part of the survey. There are some questions that ask your age, farming status and percent of income derived from farming. This information will indicate if producers with different characteristics and farming situations have different needs.

If you have questions about the survey, direct them to your county Agricultural Extension Service agent. A list of definitions is included at the end of the survey to help clarify some of the questions.

When you complete the survey, return it to your Agricultural Extension Service agent.

Thank you for your help in providing information that will be used to plan and carryout educational programs beneficial to you and other beef producers in your county and Tennessee.
1996 TENNESSEE BEEF COW-CALF PRODUCER SURVEY

PART I: GENERAL BEEF CATTLE SITUATION

For your most recently weaned calf crop give the:

1. NUMBER OF COWS AND HEIFERS OF BREEDING SIZE EXPOSED TO BULL(S)?

2. NUMBER OF CALVES LOST AT BIRTH OR DIED WITHIN TWO DAYS AFTER BIRTH?

3. NUMBER OF CALVES WEANED?

4. NUMBER OF BULLS USED?

PART II: MANAGEMENT SITUATION AND PRACTICES

Note: Use the most recently weaned calf crop in answering the following questions in Part II.

A. Calving Management

1. LENGTH OF CALVING SEASON IN MONTHS? _____

2. PLEASE CHECK THE SEASON OF THE YEAR THAT MOST OF YOUR CALF CROP WAS BORN
   ____ Jan., Feb., Mar;
   ____ Apr., May, June;
   ____ July, Aug., Sept;

B. Breeding Management

1. ARE YOUR COW(S) AND BULL(S) OF THE SAME OR OF DIFFERENT BREEDS?  (CHECK ONE THAT APPLIES)
   ____ Different breeds
   ____ Same breed

2. ARE YOUR COWS CROSSBRED OR STRAIGHTBRED?  (CHECK ONE THAT APPLIES)
   ____ Crossbred
   ____ Straightbred
   ____ Both

3. WERE BULLS EVALUATED FOR BREEDING SOUNDNESS 30-45 DAYS BEFORE BREEDING SEASON BEGAN?  ____ Yes
   ____ No
4. WERE PERFORMANCE TESTED BULLS USED TO BREED COWS?
   - Yes
   - No

5. WERE COWS AND HEIFERS PREGNANCY CHECKED?
   - Yes
   - No

6. WERE OPEN FEMALES CULLED FROM HERD?
   - Yes
   - No

7. AVERAGE AGE OF REPLACEMENT HEIFERS WHEN BRED? (PLEASE INDICATE IN MONTHS)
   __________ Mos.

8. AVERAGE WEIGHT OF REPLACEMENT HEIFERS WHEN BRED? (PLEASE INDICATE IN POUNDS)
   __________ Pounds

9. DO YOU HAVE A RECORDS PROGRAM THAT YOU USE TO MAKE MANAGEMENT AND BREEDING DECISIONS WITH YOUR COW HERD?
   - Yes
   - No

10. DO YOU USE ARTIFICIAL INSEMINATION TO BREED PART OF YOUR COW HERD?
    - Yes
    - No

C. Feeding Management

1. KIND(S) OF HARVESTED FORAGES FED LAST WINTER? (CHECK THE ONE THAT APPLY)
   - Hay
   - Silage
   - Both

2. WAS COW HERD GROUPED LAST WINTER BY AGE AND STAGE OF PRODUCTION AND FED SEPARATELY?
    - Yes
    - No

3. DID YOU FEED DRY PREGNANT COWS LOWER QUALITY FORAGES EARLY IN WINTERING PERIOD?
    - Yes
    - No

4. WHAT KIND OF CROP RESIDUE WAS FED TO BROOD COWS LAST WINTER? (CHECK THOSE THAT APPLY)
   - None fed
   - Corn
   - Soybeans
   - Other
5. **DID YOU STOCKPILE FESCUE FOR LATE FALL AND WINTER GRAZING?**
   - Yes
   - No

6. **DID YOU TEST YOUR HAY AND/OR SILAGE BEFORE WINTER FEEDING?**
   - Yes
   - No

7. **WHAT KIND(S) OF SUPPLEMENT (NOT MINERAL) DID YOU FEED DURING WINTERING PERIOD? (CHECK THOSE THAT YOU FED)**
   - None
   - Cottonseed meal
   - Soybean meal
   - Blocks or cubes
   - Liquid supplement
   - Corn
   - Commercial feeds
   - Other (Write in)

8. **WHAT PERCENTAGE OF HAY DID YOU FEED AS LARGE PACKAGE BALES?**
   - 100%
   - 75%
   - 50%
   - 25%
   - Less than 25%

9. **WHAT PERCENTAGE OF HAY DID YOU FEED AS CONVENTIONAL BALES?**
   - 100%
   - 75%
   - 50%
   - 25%
   - Less than 25%

10. **ESTIMATE THE PERCENTAGE OF LARGE BALES STORED BY ONE OF THE FOLLOWING METHODS: (WRITE IN YOUR BEST ESTIMATE)**
    - Outside, on ground, uncovered
    - Outside, off ground, uncovered
    - Outside, off ground, covered
    - Inside permanent structure

11. **ESTIMATE THE PERCENTAGE OF LARGE BALES THAT WERE FED BY ONE OF THE FOLLOWING METHODS:**
    - Rings placed around bales
    - Bales unrolled
    - Cattle access to bales was unrestricted

   **D. Health Management** (during past 12-months)

1. **Vaccination**
   2. WERE COWS AND REPLACEMENT HEIFERS VACCINATED FOR
LEPTOSPIROSIS?
___ Yes
___ No

b. WERE COWS VACCINATED FOR IBR, BVD AND PI3?
___ Yes
___ No

c. WERE CALVES VACCINATED FOR IBR, BVD, BRSV AND PI3?
___ Yes
___ No

d. WERE CALVES VACCINATED FOR CLOSTRIDIAL INFECTIONS (BLACKLEG)?
___ Yes
___ No

e. WERE REPLACEMENT HEIFERS VACCINATED FOR BRUCELLOSIS?
___ Yes
___ No

2. WHERE WERE VACCINATIONS GIVEN? (CHECK ALL THAT APPLY)
___ In the neck
___ In the rump
___ In lower round
___ Behind the forearm

3. WERE CALVES IMPLANTED WITH GROWTH PROMOTANTS? (CHECK THE ONE THAT APPLIES)
___ No
___ Implanted once
___ Implanted twice

4. NUMBER OF CATTLE (COWS, CALVES, ETC.) THAT DIED THE PAST 12 MONTHS?
___ (Indicate the number)

5. NUMBER OF CATTLE SENT TO THE DIAGNOSTIC LAB OR OTHER LOCATIONS FOR AUTOPSY IN THE PAST 12 MONTHS?
___ (Indicate the number)

6. DEWORMING (DURING PAST 12 MONTHS)

a. SEASON WHEN COWS AND BULLS DEWORMED? (CHECK ONES THAT APPLY)
___ Not dewormed
___ Dewormed only in fall
___ Dewormed only in spring
___ Dewormed both in fall and spring
___ Other __________________ (Specify)
b. CALVES DEWORMED? (Most recent calf crop)
   ___ Yes
   ___ No

7. FLY CONTROL
   a. PRIMARY METHOD USED TO CONTROL HORN AND FACE FLIES?
      ___ Backrubbers
      ___ Dustbags
      ___ Backrubbers with flaps
      ___ Ear tags
      ___ Oral larvicide
      ___ Pour on

   b. MONTH BEGAN TREATMENT FOR HORN AND FACE FLIES? (CHECK MONTH CONTROL STARTED)
      ___ April ___ June
      ___ May ___ July

8. DID YOU TREAT CATTLE FOR LICE AND GRUBS? (CHECK THE ONE THAT APPLIES)
   ___ Did not treat
   ___ Treated by November 1
   ___ Treated by Nov. 1 And again by Feb. 1
   ___ Did not treat until lice build up was evident

9. CHECK THE WAYS IN WHICH A VETERINARIAN WAS USED THE PAST YEAR IN CATTLE OPERATION.
   a. ___ Pregnancy checked cows.
   b. ___ Post-mortems or autopsies.
   c. ___ Castrating, vaccinating, dehorning and Implanting of calf crop.
   d. ___ Processing and treatment of newly weaned and/or purchased calves.
   e. ___ Developed or reviewed overall health program
   f. ___ Purchased vaccine or other supplies
   g. ___ Emergency care
   h. ___ Did not use a veterinarian the past year.

   PART III: FORAGE PRODUCTION

1. ACRES OF PERMANENT PASTURE LAND? (PROVIDE BEST ESTIMATE)
   ______

2. ACRES OF FESCUE PASTURE? (PROVIDE BEST ESTIMATE)
   ______

3. ACRES OF FUNGUS-FREE FESCUE PASTURE? (PROVIDE BEST ESTIMATE) ______

4. ACRES OF ORCHARDGRASS PASTURE? (PROVIDE BEST ESTIMATE) ______
5. ACRES OF BERMUDAGRASS PASTURE? (PROVIDE BEST ESTIMATE) ______

6. OTHER GRASS SPECIES USED? (CHECK THE OTHER GRASS SPECIES USED)
   _ _ Bermuda
   _ _ Summer annuals
   _ _ Warm-season perennial (bluestem, switchgrass)
   _ _ Matua
   _ _ Winter annual
   _ _ Other

7. ESTIMATED PERCENT OF PERMANENT PASTURE THAT HAD 30 PERCENT OR MORE LEGUME IN 1995? (PROVIDE BEST ESTIMATE)
   _ _ Percent

8. WHAT LEGUMES DO YOU UTILIZE IN YOUR PASTURES? (CHECK THE ONES USED IN GRAZING PROGRAM)
   _ _ Ladino clover
   _ _ Red Clover
   _ _ Annual lespedeza
   _ _ Crimson clover
   _ _ Alfalfa
   _ _ Other

9. DO YOU PRACTICE ROTATIONAL GRAZING?
   _ _ Yes
   _ _ No

10. DO YOU SOIL TEST PASTURES AT LEAST EVERY 2 YEARS?
    _ _ Yes
    _ _ No

PART IV: CATTLE HANDLING FACILITIES

1. CATTLE HANDLING FACILITIES THAT YOU USE TO WORK CATTLE.
   (CHECK THOSE THAT APPLY)
   _ _ Do not have facilities to work cattle
   _ _ Borrow headgate and holding chute
   _ _ Have handling facilities on the farm to work cattle

2. IF YOU HAVE HANDLING FACILITIES, PLEASE INDICATE WHAT YOU HAVE AVAILABLE TO WORK CATTLE.
   _ _ Headgate only
   _ _ Headgate, holding chute
   _ _ Headgate, holding chute and working chute
   _ _ Headgate, holding chute, working chute and crowding pen
   _ _ Headgate, holding chute, working chute, crowding pen and holding pens
3. IF YOU CONSTRUCTED HANDLING FACILITIES THE PAST YEAR, WHERE DID YOU OBTAIN THE PLANS FOR CONSTRUCTING THE FACILITIES?

___ Extension service only
___ Extension service and other sources
___ Other sources

PART V: MARKETING OF CATTLE

1. NUMBER OF FEEDER CALVES SOLD AT WEANING?
   ___ Number (Provide best estimate)

2. AVERAGE WEIGHT OF FEEDER CALVES MARKETED AT WEANING?
   ___ Pounds (Provide best estimate)

3. AVERAGE AGE OF CALVES MARKETED AT WEANING.
   ___ Months (Provide best estimate in months)

4. METHOD USED TO MARKET THE MAJORITY OF THE MOST RECENTLY MARKETED FEEDER CALF CROP? (Check those that apply)

___ Weekly auction
___ Organized feeder calf sale
___ Order buyer
___ Direct to backgrounder or feeder
___ Video sale (Board Sale)
___ Did not sell calf crop at weaning but backgrounded to heavier weight

PART VI: BACKGROUNDING

1. DO YOU BACKGROUND ANY CALVES (OTHER THAN REPLACEMENT HEIFERS) TO HEAVIER WEIGHTS? (Check those that apply)

___ Did not background any calves (If you checked this answer, do not reply to questions 2-7 and answer 8.)
___ Calves from calf crop weaned
___ Calves purchased from feeder calf sales
___ Calves from both calf crop and purchased
___ Calves purchased from other sources

2. IF YOU BACKGROUNDED CALVES, INDICATE THE PRIMARY FORAGE USED TO BACKGROUND CALVES?

___ Fescue and clover
___ Small grain pasture
___ Silage
___ Hay
___ Combination of forage resources
3. WHAT SUPPLEMENTAL FEEDS WERE USED, IN ADDITION TO FORAGE, TO BACKGROUND CALVES? (CHECK THOSE THAT APPLY)
   ____ Corn
   ____ Grain by-products
   ____ Protein supplements
   ____ None used

4. NUMBER OF TIMES PER YEAR A VETERINARIAN WAS CONSULTED OR UTILIZED IN YOUR BACKGROUNDING OPERATION? (PROVIDE YOUR BEST ESTIMATE)
   ___

5. CHECK THE PERCENTAGE OF CATTLE THAT YOU BACKGROUNDED THAT WERE:
   ____ Marketed as feeders
   ____ Retained and custom fed to slaughter
   ____ Fed on your farm to slaughter

6. WHAT WAS THE TIME OF YEAR WHEN BACKGROUNDED CALVES ARE MARKETED? (CHECK THOSE THAT APPLY)

7. WHAT WAS MOST FREQUENTLY USED METHOD TO MARKET BACKGROUNDED CATTLE? (CHECK THOSE THAT APPLY)
   ____ Organized feeder sales
   ____ Order buyer
   ____ Local auction market
   ____ Video sale

8. IF YOU DID NOT BACKGROUND CALVES, WHICH OF THE FOLLOWING REASONS BEST STATE WHY YOU DID NOT?
   ____ Too risky
   ____ Lack of feed and forage resources
   ____ Lack of management skills
   ____ Lack of capital and/or financing
   ____ Lack of knowledge about marketing alternatives
   ____ Operation too small
   ____ Thought I could make more money by selling as weaned feeder calves

PART VII. ENVIRONMENT

1. WHICH OF THE FOLLOWING IS A SOURCE OF WATER FOR YOUR CATTLE? (CHECK THOSE THAT APPLY)
   ____ Pond?
   ____ Stream?
   ____ Spring?
   ____ Cistern?
   ____ Well?
   ____ Public Water?
2. DO CATTLE HAVE UNLIMITED ACCESS TO FREE FLOWING STREAMS?
   ___ Yes
   ___ No

3. ARE STREAM BANKS MANAGED TO PREVENT EROSION AND MAINTAIN WATER QUALITY?
   ___ Yes
   ___ No

4. ARE MANAGEMENT DECISIONS MADE WITH THE GOAL OF ENCOURAGING WILDLIFE ON YOUR FARM?
   ___ Yes
   ___ No

PART VIII: EXTENSION CONTACTS

1. NUMBER OF BEEF CATTLE EDUCATIONAL MEETINGS YOU ATTENDED THE PAST YEAR? ________

2. WHAT WERE THE NUMBER OF OFFICE VISITS YOU MADE TO THE LOCAL EXTENSION OFFICE THE PAST YEAR REGARDING BEEF CATTLE? ________

3. WHAT WERE THE NUMBER OF TELEPHONE CALLS YOU MADE TO THE LOCAL EXTENSION OFFICE REGARDING BEEF CATTLE THE PAST YEAR? ________

4. WHAT WERE THE NUMBER OF VISITS MADE BY THE EXTENSION AGENTS REGARDING BEEF CATTLE TO YOUR FARM THE PAST YEAR? ________

5. HOW MANY EXTENSION FACT SHEETS OR PUBLICATIONS DID YOU RECEIVE THE PAST YEAR? ________

6. DO YOU RECEIVE THE QUARTERLY NEWSLETTER "BEEF CATTLE TIME?"
   ___ Yes
   ___ No

PART IX: RESPONDENT AND FARM SITUATION

1. WHAT IS YOUR FARMING STATUS? (CHECK THE ONE THAT APPLIES)
   ___ Full-time farmer
   ___ Part-time
   ___ Retired and farm

2. WHAT IS YOUR AGE?
   ___ (In years)

3. MAJOR SOURCE OF FARM INCOME? (CHECK THOSE THAT APPLY)
   ___ Sale of Cattle
   ___ Sale of row crops
   ___ Tobacco
   ___ Livestock other than beef cattle
   ___ Other
4. WHAT IS THE PERCENT OF FAMILY INCOME RECEIVED FROM FARMING? _____; FROM OFF-FARM EMPLOYMENT? _____

5. ARE YOU A MEMBER OF TENNESSEE CATTLEMEN'S ASSOCIATION?
   ____ Yes
   ____ No

6. HAS THE BEEF PROMOTION AND RESEARCH PROGRAM (THE $1.00 CHECK-OFF ON EACH CATTLE SOLD) BENEFITTED THE BEEF INDUSTRY?
   ____ Very much
   ____ Some
   ____ Very little
   ____ None at all

7. DO YOU OWN A COMPUTER?
   ____ Yes
   ____ No

8. IF YOU OWN A COMPUTER, DO YOU SECURE INFORMATION ON BEEF PRODUCTION OR MARKETING WITH IT?
   ____ Yes
   ____ No

PART X: APPLICATION OF INFORMATION

What practices have you adopted the past four(4) years that have helped you improve your beef operation? (Note: Briefly list practices below; some examples might be crossbreeding, implanting, pregnancy checking, cooperative marketing, constructed handling facilities, etc.)
PART XI: ISSUES OR PROBLEMS FACING THE BEEF INDUSTRY

What are some problems that you think that the Tennessee beef producer faces and must overcome to be profitable?

Thank you very much for your help.

DEFINITIONS

Agricultural Extension Service - The University of Tennessee at work to help Tennesseans.

Artificial Insemination (A.I.) Breeding cows by mechanical methods.

Autopsy (necropsy, post-mortem) - Diagnosis procedures performed by veterinarians on dead animals.

B.V.D. - Bovine Virus Diarrhea.

Backrubbers - A method of External parasite control.

Backgrounding - Growing weaned calves to heavier weights (Example: 400 pounds to 700 pounds).

Board Sale - Cattle auction with animals remaining on the farm. Bidders typically see grades, description and video of cattle during sale.

Breeding Soundness Examination (B.S.E.) - An examination conducted by a veterinarian, to evaluate reproductive potential of bull.

Byproducts - Feedstuffs derived from the processing or manufacture of other primary products (examples: corn gluten feed, distiller’s grains, cottonseed meal).

Cow - Female bovine which has calved at least once.

Crop Residue - Plant material left in the field after harvest, portion of which is typically suitable for consumption by cattle.
Crossbred - Animals with two or more breeds in their ancestry.

Crowding Pen - The part of a handling facility from which cattle are forced into the holding chute.

Fungus-free Fescue - A variety of fescue with less than 5 percent contamination with the fungus.

Headgate - The part of a handling facility that holds the head.

Heifer - A young female bovine which has not had a calf.

Holding Chute - The part of a handling facility between the working chute and the crowding pen.

IBR - Infectious Bovine Rhinotracheitis

Implant - A growth promoting product placed under the skin of the calf’s ear.

Large Package Bale (A.K.A. Large Round Bale) - Hay in bales typically 800 to 1200 pounds.

PI3 - Parainfluenza strain 3.

Performance Tested - An animal which has qualified for and been subjected to evaluation of production capabilities (example: a bull performance-tested in one of the University of Tennessee and/or has information on him, EPDS, to provide an indication of performance.

Replacement heifers - Young female cattle designated to be introduced into the breeding herd.

Rotational Grazing - Dividing pastures into submits to control grazing by cattle.

Stockpiling - Removing cattle from a fescue pasture in late summer, fertilizing and allowing to grow for grazing in late fall and winter.

Straightbred - Animal with one breed in its ancestry.

Supplement - A feed or feed mixture used with another to improve performance or efficiency.

Video - Sale - See Board Sale.

Working Chute - The part of a cattle handling facility where cattle are restrained for
VITA

Nathan H. Peery was born December 13, 1964 in Maury County. He was active in 4-H and FFA programs and graduated from Culleoka High School in 1983. He received a Bachelor of Science degree with a major in Agriculture and a minor in Vocational Agricultural Education in 1987 from Middle Tennessee State.

He married Elizabeth in May 1989. They were blessed with two daughters, Janie and Katie. Janie will be three and Katie will be one in June of 1999. They enjoy their friends and family.

He was employed by the Tennessee Agricultural Extension Service on February 16, 1989 and was appointed to Assistant Extension Agent with responsibility in 4-H and adult livestock programs for Lincoln County. He was promoted to Associate Extension Agent in 1998.

He was the 1993 TAAA&S District II Young Agent, 1994 TAAA&S District II Agent of the Year for Youth, 1994 Tennessee Cattleman Association Outstanding Youth Agent, 1994 Achievement Award NACAA State Winner, and the 1997 Tennessee Cattleman Association Outstanding Adult Agent.