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Description and factor analysis of the use of selected practices by Tennessee grade A dairymen in 1970 and 1975

James M. Knight

To the Graduate Council:

I am submitting herewith a thesis written by James M. Knight entitled "Description and factor analysis of the use of selected practices by Tennessee grade A dairymen in 1970 and 1975." 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 Extension.

Cecil E. Carter, Jr., Major Professor

We have read this thesis and recommend its acceptance:

Robert S. Dotson, William M. Miller

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

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

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and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

DESCRIPTION AND FACTOR ANALYSIS OF THE USE OF SELECTED PRACTICES BY TENNESSEE GRADE A DAIRYMEN IN 1970 AND 1975

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

James M. Knight

March 1977

DEDICATION

This thesis is dedicated to a very special friend of mine, my father, whom I love and respect very much. He has kept me "in line" for the past 23 years, and I hope that some day I will be as great a man as he is.

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The author wishes to express his sincere appreciation and gratitude to Dr. Cecil E. Carter, Jr., for his patient guidance, wise counsel, and abundant time given generously throughout this study. Appreciation is also expressed to the other members of his graduate committee, Dr. Robert S. Dotson and Dr. William M. Miller for their assistance and suggestions.

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ABSTRACT

The purpose of this descriptive study was to compare the use of selected dairy production and management practices by Grade A dairymen in 32 major dairy producing counties at two time periods (i.e., FY 1970 and FY 1975) in order to indicate the amount of change in use of recommended production practices during the five year period. Factor-analytic techniques were then employed to determine interrelations between practices used by Grade A dairymen and to reduce the data into smaller sets of factors or components for further analysis. Data were secured through personal interviews by County Extension Leaders in each of the 32 major dairy counties. Each interview was conducted in the same manner following an interview schedule prepared specifically for each survey.

The Statistical Package for Social Sciences computer program was used to analyze the data. Results of the data analysis were organized and summarized in separate tables, each dealing with selected aspects of the study. The approach to summary and interpretation of findings was basically descriptive in nature with emphasis upon comparison of practice use at the two time periods.

Major findings of the study are briefly stated as follows:

1. The average herd size of Grade A dairymen in 1970 was 59 cows and an average of 10,029 pounds of milk per cow was produced. The average income per Grade A dairymen from the sale of milk in 1970 was $29,398.
2. Grade A dairymen in 1975 operated an average of 336 acres

of cropland. It was also observed that the producers had an average of 11,981 pounds of milk and 449 pounds of butterfat produced per cow.

3. Eleven recommended dairy production practices were selected from the two dairy surveys for purposes of comparing the percentage of producers using these practices in 1975 with those in 1970. It was observed that the average percentage of all dairymen using each of the eleven recommended dairy practices had increased for six practices and had decreased for five of the practices between 1970 and 1975.
4. In reviewing the interrelations among dairymen's use of 21 practices in 1970 it was found that four practices were the most highly related to the use of the largest number of other recommended practices. These practices involved, breeding cows to a plus A.I. proof bull; providing of adequate forages; feeding grain according to production; and maintaining adequate milk production records.
5. Three of the 22 practices in 1975 where dairymen's use was measured qualitatively showed a high correlation with a large number of other practices. These practices were: checking the milking machine every six months; feeding grain according to production; and keeping dry cows separate from the herd.
6. Grade A dairymen's use of only one recommended practice was significantly related ($p<.05$ or greater) to their use of

nine or more of the 16 recommended dairy practices measured quantitatively in 1975. This practice was defined as "What percent of your pasture land was limed and fertilized based on soil test at the time of seeding?"

7. Eleven of the 21 recommended practices were found to load most heavily on seven of the factors extracted from the 1970 Grade A Milk Production Practice Checklist Survey.
8. Twelve of the 22 practices were found to be highly related (loading of greater than .40) to the seven factors extracted from the 1975 data measured qualitatively.
9. Ten of the 16 practices factor analyzed were found to be highly related to the seven factors extracted from the quantitatively measured 1975 survey data.
10. The practices of "providing high quality forages," "keeping dry cows separate from the herd," and "the number of times per day the herd was checked for heat," accounted for a higher percentage of the variation in practice use among the dairymen than did any of the other practices included in the two dairy surveys.
11. The seven common factors extracted for the practices studied in 1970 accounted for about 50 percent of the variation in the use of the practices studied. Forty-seven percent and 58 percent, respectively, of the total variance in the use of all practices was accounted for by the common factors

observed in the qualitative and quantitative measures in the 1975 dairy survey.

Conclusions and recommendations are also included.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

BACKGROUND AND PROBLEM

I. INTRODUCTION

The need for accountability in the Cooperative Extension Service (CES) is greater than it has ever been before. The term accountability, for the Cooperative Extension Service, means providing a creditable demonstration of accomplishments towards objectives, stated or implied, in the agency's enabling and subsequent legislation (9:45).* In recent years, the United States Department of Agriculture (USDA), of which the Cooperative Extension Service is a branch, as well as other publically funded agencies, have had to answer to legislative bodies at all levels for justification of existing funds as well as new funds. The Cooperative Extension Service, an organization supported by public funds, must exhibit a high degree of accountability in order to continue to receive support for its on-going programs and for future programs (9:47).

There is a tendency for executive offices at the state and federal levels to establishment requirements for systems of evaluation and accountability. The Office of Management and Budgets (OMB) has made it a requirement that all agencies conduct continuing systematic reviews of all aspects of program management, including the evaluation of program

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*Numbers in parentheses refer to similarly numbered items in the Bibliography; numbers after the colon are page numbers.

effectiveness in accomplishing program objectives.

As a part of this effort, the Cooperative Extension Service (CES) at the National level (ES-USDA) allocated special project funds to support efforts to develop procedures for evaluating progress and establishing Extension educational priorities. This action by the ES-USDA provided an opportunity for the Tennessee Agricultural Extension Service to cooperate with the ES-USDA on such a project. The project was based upon Tennessee's experience with the use of the practice checklist survey and the State Extension Management Information System (SEMIS).

The practice checklist survey is an instrument used for measuring the results of program efforts, and more important as a means of determining the needs of the clientele. The information obtained from these practice checklist surveys can be used to establish benchmarks for use in measuring the progress of the clientele, and to identify the needs of clientele as a basis for establishing educational priorities.

The State Extension Management Information System (SEMIS) is a a reporting system used in each state. In Tennessee, this system is referred to as TEMIS (i.e., Tennessee Extension Management Information System). The purposes of the TEMIS system are: (1) to develop a systematic flow of management information for use in program planning, evaluation, and reporting; (2) to enable each staff member to relate his or her efforts to the total Extension effort; and, (3) to reduce man-hours necessary to accumulate and prepare data for analysis and decision making.

TEMIS and the practice checklist survey were not originally designed to be used in a compatible fashion. However, because of existing possibilities, the need was seen by Extension administrators in Tennessee to study both of these systems in order to: (1) reflect upon and better describe the state's approach to program development and the evaluation process; (2) to analyze the backlog of data already collected; (3) to study the general acceptance of this approach by county staffs; and, (4) to evaluate the effectiveness of this approach in terms of accuracy and usefulness of the data.

The stated purpose of the project agreement between the Cooperative Extension Service, the University of Tennessee, and ES-USDA was to develop procedures for evaluating progress and establishing Extension educational priorities. More specific objectives were: (1) to identify input and output (result) variables needed to measure program efforts, effectiveness and efficiency; (2) to develop procedures for synthesizing benchmark and progress check data to arrive at output (result) measures; and, (3) to develop an approach for utilizing findings in resource allocation and program development (2:1).

Although the project was signed in February, 1973, it was not possible to begin staffing the project until July, 1974. A backlog of data was available for analysis on staff's efforts as measured by TEMIS and results of those efforts as measured by practice checklist surveys. This is the fifth of several studies planned to meet the various objectives of the project previously described. This particular study deals with only a limited part of the total project.

Four studies in the project area have been completed and reported.

In the first study, conducted by Thomas E. Cary, the major concern was to determine the present situation in Tennessee concerning the practice checklist approach to establishing educational priorities and evaluating progress. In Tennessee, there existed a backlog of data regarding staff inputs (TEMIS) and data regarding results of these efforts (outputs) as measured by the practice checklists. Thus, the situation existed where Extension inputs could be related to output, or change, in clientele. Mr. Cary's study included describing and analyzing procedures followed at the time of the study for obtaining benchmarks and progress data for purposes of program planning and evaluating (1).

A second study looked at the TEMIS situation. Ms. Ruth Henderson analyzed the present situation in Tennessee concerning the TEMIS system, specifically the weekly activity report. This included describing and analyzing procedures followed at the time of the study to obtain TEMIS data (8).

A third study by Bahari bin Yatim was concerned with analyzing the Grade A dairy practice checklist survey (PCS) data secured in FY 1970 and TEMIS data on Extension agents inputs made on dairying during FY 1971-1975. This study included describing and analyzing data from each source and determining their relationship. Mr. Yatim further described the situation of Grade A dairy producers in Tennessee for FY 1970, along with the relationship between the average percent of Grade A producers using each recommended production practice in FY 1970 and the number of hours agents spent on associated dairy subjects taught during FY 1971-1975 (22).

A fourth study by Ms. Jane Gault looked at the reliability of

data received from TEMIS, particularly weekly activity reports. This study included the analysis of weekly activity reports in terms of determining the consistency of Tennessee Extension agents' coding of activities on their weekly activity reports (5).

Major concerns in the present study were to characterize Grade A dairy producers included in the 1975 practice checklist survey and to determine the change in percentage of dairy producers using each of 21 recommended dairy production practices between FY 1970 and FY 1975. Then it was desired to study the recommended dairy production practices to determine the common dimension of variation (i.e., factors or distinct patterns of occurance) in usage of the practices in 1970 and in 1975.

II. PURPOSES AND OBJECTIVES OF THE STUDY

The purposes of this study, then, were to analyze data collected by the practice checklist survey of Grade A dairy producers in FY 1975, and compare these data with the FY 1970 survey results to indicate change in the use of recommended production practices during the five year period. Then, factor-analytic techniques were employed to determine some underlying pattern of relationships which existed resulting in a "rearranging" or "reduction" of data into smaller sets of factors or components that might be used as source variables in accounting for observed interrelations between practices included in each of the two dairy surveys.

The specific objectives were as follows:

1. To review the situation of the Grade A dairy producers

in 32 major Tennessee dairy counties in FY 1970 and in FY 1975.

2. To describe the situation of the Grade A dairy producers in 32 major Tennessee dairy counties in FY 1975.
3. To determine the changes in the percentage of Grade A dairymen using selected dairy production practices between 1970 and 1975.
4. To identify and describe the underlying factors, or bundles of practices, which tended to occur together in terms of use by the producers.

III. NEED FOR STUDY

Tennessee Extension workers were concerned with the desire and need to continually improve their educational programs. Governmental agencies at all levels, including the Federal and State Extension Service, in recent years, expressed demands for increased accountability, reliability and validity of information. If Extension programs are to be strengthened, it is clear that adequate information is needed to help establish priorities for the allocation of Extension's resources and for supporting those decisions which are made. Therefore, it is clear that there is a need to improve the quality, as well as the quantity, of data available for the purposes of program planning and evaluation.

Data from the 1970 Grade A Milk Production Practice Checklist Survey and the 1975 Grade A Dairy Farm Management and Production Survey were available. There was an obvious need to analyze the data from the two surveys in order to make comparisons and to determine changes in the situation of Grade A dairy producers over the past five years.

IV. LIMITATIONS OF THE STUDY

This study was limited to the analysis of data available from the two practice checklist surveys of Grade A dairy producers completed in FY 1970 and FY 1975.

With regard to data from the 1970 Grade A Milk Production Practice Checklist Survey, 410 Grade A dairymen in 41 Tennessee dairy counties were interviewed personally by Extension agents. The random sample was limited to Grade A Milk producers in each county that had at least 40 percent of its total agricultural income from dairying, and/or which had an annual income from dairying of at least three-quarters-of-a-million dollars. The present analysis was limited to the data received from dairy producers in 32 of the major dairy counties.

The 1975 Grade A Dairy Farm Management and Production Survey data were secured by Extension agents through personal interviews with 704 dairy producers in 40 Tennessee counties. However, only responses from 621 dairymen in 32 counties were used in the present analysis. Data were not available from two of the original 40 counties and data from six other counties were not usable because the procedures were included in the development and pre-testing of the survey instrument and techniques.

The counties included in this study were located in all of the Tennessee Extension Service's five supervisory districts. Counties included were limited to the following: District I--Gibson, Henry, Obion, and Weakley counties; District II--Bedford, Davidson, Giles,

Lawrence, Lincoln, Marshall, Maury, Rutherford, Williamson, and Wilson counties; District III---Bradley, Coffee, Franklin, Hamilton, Polk, Rhea, and Sequatchie counties; District IV--Smith county; District V--Blount, Cocke, Greene, Hamblen, Hawkins, Jefferson, Knox, Loudon, Sullivan, and Washington counties. Analysis of the data was limited to the recommended dairy practices included in the two surveys which were comparable (i.e., only the dichotomous or yes and no response type practices).

V. DEFINITION OF TERMS

Communality. A value indicating the amount of the variance of a variable that is shared by at least one other variable in the set.

Correlation. An interdependence between mathmetical variables in statistics. Provides a single summary statistic describing the strength of association between two variables.

Correlation Coefficient. A number or function that indicates the degree of correlation between two sets of data or between two random variables and that is equal to their covariance divided by the product of their standard deviation.

County Extension Program. It is the sum total of all Extension work done in the county, including planning, carrying out of 5-year (POWP) and annual (POW) plans, and evaluation and reporting of progress made towards objectives and goals. There is one county Extension program in each county consisting of everything done in all appropriate work areas and with all appropriate audiences.

Dependent Variable. The variable which one wishes to explain as a function of other variables.

Determinant. A square array of numbers bordered on each side by a straight line with a value that is the algebraic sum of all the products that can be formed by taking as factors one element in succession from each row and column and giving to each product a positive or negative sign depending upon whether the number of permutations necessary to place the indices representing each factors position in its row or column in the order of the natural numbers is odd or even.

Evaluation. A process of judging the worth, value, or meaning of something, using relevant information, and relating it to predetermined standards or criteria.

Factor Analysis. The transformation of statistical data into linear combinations of variables.

Factor Variance. The variance (difference between what is expected, or is possible, and what actually occurs) in the variable that can be accounted for by the factor.

Five-year Plan (Plan of Work Projection--POWP). It is a written, end product of 5-year Extension planning, and serves as a basis for the formulation of the county Extension Annual Plan of Work. Major elements of the projection, for all sections excepting 4-H and other youth, include for each work area: (1) the situation, including enough information so that major problems either emerge clearly or are identified; (2) 5-year objectives; and (3) county tasks (teaching objectives).

Independent Variable. The explanatory variable in a statistical analysis.

Annual Plan of Work (POW). The written end product of annual planning. Major elements of the Annual Plan or Work include:

(1) priority objectives and participation goals selected for each work area and audience; (2) a brief statement of facts telling why the priority objective or goal is important; (3) county tasks related to each priority objective or goal; (4) code numbers identifying related state purposes, primary subjects, primary audiences, income characteristics and tasks, and primary teaching methods; (5) starting and completion dates, and total-man days to be allocated; (6) staff responsibility; and (7) evaluative methods to be used in checking progress.

Practice. A research verified and commonly accepted procedure or task which, if performed correctly and on a regular basis, will increase or help insure a desired outcome or return.

Practice Checklist. The term practice checklist refers to lists of Extension recommended practices in selected subject matter fields. The Soybean Practice Checklist for example is a list of key research verified production practices such as planting a recommended variety , controlling insects, controlling weeds, etc., recommended by the Extension Service. Practices contained in checklists have been tested by the University of Tennessee Agricultural Experiment Station and have proven to be the ones that will under normal conditions increase or give optimum yields if followed by a soybean producer. The practices are arranged in a logical order on the list and are designed for use by Extension agents in conducting surveys with a representative sample of agricultural producers or a representative sample from other Extension audiences to determine the extent to which practices are or are not being used.

Practice Checklist Survey. A practice checklist survey refers

to interviews conducted by Extension agents with a randomly selected predetermined number of representative clientele in a specific Extension work or audience area. In performing a survey, the practice checklist is used by agents to record decisions regarding the use of recommended practices by each producer.

Regression. A functional relationship between two or more correlated variables that is often empirically determined from data and is used especially to predict values of one variable when given values of the others.

State Extension Management Information System (SEMIS). The part of the state management information system data base specifically designed for state and local planning units to collect and analyze Extension program data for utilization in program development and program administration.

CHAPTER II

METHODS AND PROCEDURES

I. STUDY ORGANIZATION

The study was divided into four areas for analysis and reporting. The first area consisted of an analysis and description of the 1970 Grade A Milk Production Practice Checklist Survey data. The second area of study consisted of an analysis and description of the 1975 Grade A Dairy Farm Management and Production Survey data. A third area of study was concerned with a comparison of the previous two surveys to indicate changes which occurred in the use of selected recommended dairy production practices. The final area of study involved factor-analytic techniques to determine some underlying patterns of relationship which reduce the data into smaller sets of factors, or components. The resulting factor scores for each producer surveyed will be used in a later study as source variables in accounting for observed interrelations between factor scores of respondents in each county and selected variables regarding characteristics of the county Extension programs.

II. POPULATION AND THE SAMPLE STUDIED

This section was divided into four sub-sections identifying the initial population and the sample size selected to be studied from each of the two dairy surveys.

Population of the 1970 Grade A Milk Production Practice Checklist Survey

The population of the study included all Grade A dairymen in 41 Tennessee counties in each of which had at least 40 percent of the total agricultural income from dairying and/or in which the annual income from dairying was at least three-quarters-of-a-million dollars. With regard to the data collected using the 1970 Grade A Milk Production Practice Checklist Survey, 410 Grade A dairymen in 41 counties were interviewed personally by Extension agents. In the present analysis, data from 316 Grade A dairy producers in 32 of the counties were used.

Population of the 1975 Grade A Dairy Farm Management and Production Survey

The population of the 1975 Grade A dairy survey was the same as for the 1970 survey, except producers in Campbell county were excluded because the county did not meet the criteria of having at least 40 percent of its total agricultural income from dairying, and had less than $250,000 income from the sale of milk. Data collected in the 1975 survey were secured from 704 producers in 40 Tennessee counties through personal interviews by Extension agents. However, only responses from 621 dairymen in 32 counties were used in the analysis. Ninety-four producers in eight counties were excluded from analysis of both the 1970 and the 1975 data. This was necessary because the 1975 data from two counties were received too late and producers in six of the counties were used in the development, testing, and revising of instruments and techniques.

1970 Grade A Milk Production Practice Checklist Survey Sampling Procedures

The Nth number technique was used to obtain a random sample of at least 10 Grade A dairymen from each of the 41 dairy counties in Tennessee (see procedures in Appendix B, "Suggestions for Making the 1970 Dairying Sample Survey"). The sample consisted of 410 Grade A dairymen. Data from 316 of the dairymen were collected and judged to be accurate and complete and were included in the analysis of the study.

1975 Grade A Dairy Farm Management and Production Survey Sampling Procedures

A different random sample selection technique was employed for determining the number of Grade A dairy producers to be surveyed in FY 1975. The sample size for each of the 40 counties was computed by Dr. W. T. Sanders, Statistician, University of Tennessee, Agricultural Experiment Station, using a 95 percent probability level with a .15 variation above or below the true proportion as the guide for computing the sample size. The sample size ranged from eight to 34 per county depending upon the number of Grade A dairy producers in the county (i.e., Macon county had only 10 Grade A dairy producers and eight of these producers were surveyed; whereas, Greene county had 136 Grade A dairy producers and 34 were selected to be surveyed), see Appendix C, "sample Size for the Grade A Dairy Farm Management

and Production Survey, 1975." The sample consisted of 704 Grade A dairy producers. However, data from only 621 Grade A dairy producers were collected and judged to be accurate and complete and were included in the analysis of the study. Reasons for excluding the 92 producers were given previously.

A list was made of the 32 Tennessee counties included in the analysis, showing the Nth number or sample size, and the total number of Grade A dairy Producers per county (see Appendix C, Table X). Following the selection of the sample size to be used in the 1975 Grade A Dairy Farm Management and Production Survey, a letter was sent to each selected dairyman by the county Extension leader requesting his cooperation with the survey. Interviews were scheduled by telephone. Prior to conducting the 1975 survey, Extension agents attended a four hour training session on survey techniques, coding procedures and general instruction (see Appendix D, "General Instructions for Interviewing Grade A Dairy Producers"). Coding instructions accompanied each survey (see "Special Codes for Grade A Dairy Farm Management and Production Survey, 1975, in Appendix D).

III. METHODS OF SECURING DATA

The present section (Section III) was divided into three subsections and presents information concerned with the analysis, and development of the 1970 Grade A Milk Production Practice Checklist Survey and the 1975 Grade A Dairy Farm Management and Production Survey instruments.

Development of the 1970 Grade A Milk Production Practice Checklist Survey Instruments

The 1970 Grade A Milk Production Practice Checklist Survey instruments were ceveloped by Extension Dairy Specialists at the University of Tennessee. The Checklist was used to record information concerning milk production levels, numbers of cows in the diary herd, and 21 recommended dairy production practices. The Agricultural Extension Agent in each of 41 Tennessee counties, conducted personal interviews with the selected Grade A dairymen.

Interviews were conducted in March of 1970, and upon completion, the interview schedules were mailed to the Agricultural Extension Education Department at the University of Tennessee. Data were processed and punched on data cards for computer analysis.

Factor Analysis of the 1970 Grade A Milk Production Practice Checklist Survey Instrument and Initial Development of the 1975 Grade A Dairy Farm Management and Production Survey Instrument

Following completion of the 1970 Grade A Milk Production Practice Checklist Survey data were processed and reviewed. Factor analysis was employed to identify the broad areas (i.e., factors) measured by the 1970 survey. This analysis revealed that the practices measured could be classified into four or five broad areas.

A committee, composed of Dairy, Farm Management and Agronomy Specialists, and other Extension Personnel was used to develop additional questions around the factors identified. This was done in an effort to more accurately measure the degree of practice use by dairymen. Both qualitative dichotomous questions and quantitative questions were used. The questionnaire was tested in two counties to determine length of time required to complete the survey and to weed out poorly worded questions. Following results of this test, the survey was then revised and reorganized for further use.

Selection of Test Counties, Training of Interviewers, and Factor Analysis of the Test County Survey

Following analysis of the data from the two previously mentioned pre-test counties, the survey schedule was revised and, again, made ready for use on six selected Tennessee dairy counties for further testing. These test-counties included: Robertson, Sumner, Cannon, Macon, Monroe and McMinn counties. An inservice training session was then held for the purpose of planning the dairy survey in the six pilot (test) counties. This meeting was attended by Associate Supervisors for the districts in which the counties were located, and the Extension Leaders from each of the six test counties (see Appendix D, "Proposal for Inservice Training of Extension Leaders in Dairy Pilot Counties").

Interviewers were then selected and trained for the purpose of interviewing the 212 dairy producers in the six pilot (test) counties

(See Appendix D, "Suggested Criteria for Selecting Interviewers in Pilot Dairy Counties"). They received pay for this effort.

Following the completion of these interviews, the 1975 Grade A Dairy Farm Management and Production Survey (see Appendix E, "Test County Survey") data were analyzed. Again, through the use of factor analysis redundant questions which did not help to discriminate among the producers were removed. Some other questions were added in an effort to further strengthen the measurement of some of the underlying factors being measured by the instrument.

Following revision and reorganization of the test-county survey instrument, the 1975 Grade A Dairy Farm Management and Production Survey (see Appendix F) was conducted in the 34 remaining counties. Interviewers (i.e., county Extension Leaders) in these counties also were given training concerning sampling, surveying and coding techniques. Interviews were conducted between March and November of 1976.

IV. ORGANIZATION OF DATA

This section was divided into three sub-sections involving the organization of the 1970 and 1975 practice checklists surveys.

Organization of the 1970 Grade A Milk Production Practice Checklist Survey Data for Analysis

The 21 recommended milk production practices listed on the 1970 Grade A Milk Production Practice Checklist Survey were classified into the following groups of practices: (1) Herd Management (practice numbers 10, 11, 16, 17, 18, 19, and 20); (2) Breeding Management (practice numbers 1, 2, 3, 12, 13, 14, 15, and 21); (3) Forage Feeding (practice

numbers 4, 5, 6, and 7); and (4) Concentrate Feeding (practice numbers 8 and 9). See Appendix B, "1970 Grade A Milk Production Practice Checklist Survey," for a description of these practices.

Organization of the 1975 Grade A Dairy Farm Management and Production Survey Data for Analysis

The survey was divided into nine subject areas for ease of organization and response to questions. These nine subject areas for analysis consisted of questions involving: (1) General Information; (2) Buildings, Milking, and Feeding Facilities; (3) Forage Production and Management: (4) Dairy Feeding Practices; (5) Dairy Cattle Breeding Practices; (6) Dairy Record Keeping Practices; (7) Dairy Herd Management Practices; (8) Milk Production Level; and (9) Personal Questions (see Appendix F, "1975 Grade A Dairy Farm Management and Production Survey").

The questions and various recommended production practices on the 1975 survey were classified into the following groups of similar practices: (1) Herd Management, (Practice number 9 of Section II, Practice number 6 of Section III, Practice number 5 of Section IV, Practice number 4 of Section VI, Practice numbers 6 and 11 of Section VII, including question 11-e, f, and g, Practice number 3 of Section IX, including questions 3-a, b, c, d, e, and f); (2) Breeding Management, (Practice numbers 1, 2, 3, 8, 12, and 13 of Section V, Practice numbers 1 and 2 of Section VI, and Practice number 1 of Section VII); (3) Forage Feeding and Production (Practice numbers 2 and 6 of Section II, Practice numbers 1 and 8 of Section III); (4) Concentrate Feeding, (Practice numbers 3 and 4 of Section IV).

Organization of the Two Grade A Dairy Surveys for the Initial Comparison

In the comparison of the two surveys, a difficulty existed in comparing the responses of producers to some of the questions asked on the two surveys. Responses to the 1970 Grade A Milk Production Practice Checklist Survey were based on a dichotomy of either "YES" or "NO"; however, responses to questions asked on the 1975 Grade A Dairy Farm Management and Production Survey were based upon both qualitative ("YES" or "NO") responses and quantitative (e.g., number, percent, acres, amount) responses. Therefore, only a limited number of responses to the 1975 survey questions could be compared with the 1970 survey results. The initial comparison was based upon the 21 recommended production practices defined in the 1970 Grade A Milk Production Practice Checklist Survey and the percentage of producers using these recommended practices (i.e., answering "YES" to the questions). In the 1975 Grade A Dairy Farm Management and Production Survey, 11 recommended production practices were compared with the same 11 practices in the 1970 survey.

The 11 recommended production practices selected from the 1970 survey to be compared with the practices defined in the 1975 survey were as follows: Practice 4, Was an adequate amount of stored forage provided so that each cow had all the hay and/or silage that she could consume every day; Practice 7, Was an adequate amount of summer pasture, ¼ to ½ acre per cow, provided; Practice 8, Was an all-grain concentrate mixture, one not containing ground hay, fed to the milking herd; Practice 9, Was grain fed according to production with special attention to assure that high producers got enough grain; Practice 10, Was forage fed last year based on U. T. Forage Testing Laboratory recommendations;

Practice 11; Were adequate herd records, heat, health, identification, maintained; Practice 16, Were separate feeding and loafing areas provided for the milking herd; Practice 17, Was the milking system checked every 6 months to see that it was functioning properly as to pulsation rate and vacuum level; Practice 18, Was each cow prepared properly for milking before the machine was attached; and Practice 19, Was a recommended method of fly control systematically used around barns, loafing, and milking area.

The following questions were similar questions asked on the 1975 Grade A Dairy Farm Management and Production Survey and were used in making the initial comparison: Section II, question 2 (Do you have a silo), and question 6 (Have you increased your silage storage capacity since 1970); Section III, question 8 (Did you have all the pasture you needed last summer); Section IV, question 3 (Are you now feeding an all-grain concentrate mixture to your herd); Section IV, question 4 (Are cows fed grain according to production); Section III, question 6 (Have you ever had your silage or hay tested by a forage testing laboratory); Section VI, question 4 (Do you keep some type of milk production record on each cow in the herd); Section VI, questions 1-a, b, and e (Do you keep each of the following types of breeding record on each cow in your herd? a-Date bred; b-Identity of bull used to breed cows; 3-Calving date); question 2 (Have you changed dairy breeding records kept since 1970); Section IV, question 5 (Is your forage feeding area separate from loafing area); Section II, question 9 (Have you had your milking machine checked for pulsation rate and vacuum level within the last 6 months); Section VII, questions 10-c, e, f, and g (Do you

usually: c-Wash udder with a warm water sanitizing solution; e-Remove several streams of fore-milk from each quarter; f-Begin milking within two minutes after the udder is washed; g-Strip with machine); Section VII, question 6 (Do you have an effective system for controlling flies around the milking and loafing areas).

V. ANALYSIS OF DATA

Data on the situation of Grade A dairy producers for FY 1970 and FY 1975, that were available on data cards, were analyzed and the resulting information was summarized in table form for use by county, district, and state staff members in the planning and evaluating of the Extension program. Responses to questions on the FY 1970 Grade A Milk Production Practice Checklist Survey were summarized in numbers and percents. The variable means and percents for each county were later punched on data cards and further analyzed by Yatim (22) to determine the relationship between agents' inputs (i.e., time spent and contacts made) and producers use of recommended dairy production practices. This study was previously reported by Yatim (22) in 1976.

Responses to questions on the FY 1975 Grade A Dairy Farm Management and Production Survey were also summarized. The means and frequencies of the various recommended management and production practices were computed for each county, and for all 32 counties. This summary, along with a computer printout and the original survey forms were then returned to each county through the various District offices to be reviewed and used by each county staff in planning future dairy

programs and evaluating the dairy programs conducted over the past five years.

The Statistical Package for Social Sciences computer program was used to analyze the data. Simple statistical analysis included descriptive statistics (e.g., mean, variance, range, standard error, standard dieviation), and one-way frequency distribution statistics (e.g., absolute, relative, adjusted and cumulative statistics). The methods of factor analysis employed was principle factoring with interaction with varimax orthogonial rotation. Statistics computed by the factor program included mean and standard deviations, correlation matrix, communalities, eigenvalues and proportion of total and common variance, and factor score coefficient matrix.

CHAPTER III

REVIEW OF LITERATURE AND RELATED STUDIES

I. INTRODUCTION

The purpose of this chapter was to review available related literature concerning practice checklist surveys, the Tennessee Extension Management Information System (TEMIS), the concepts of validity, reliability, accountability, and related studies in practice adoption.

II. HISTORY OF PRACTICE CHECKLIST APPROACH TO PROGRAM DEVELOPMENT IN TENNESSEE

The Tennessee approach to Extension program development is influenced by several conditions. These include the desire and need by Extension workers to strive continually to improve their educational programs; the demands and requests of directors, legislators, tax payers, and others to justify appropriations and expenditures; and increasing number of problems necessitating Extension involvement and assistance (22). The results are the tasks of establishing priorities in the allocation of Extension resources, making allocations themselves, supporting necessary decisions, and evaluating results achieved, have become more and more complex, and yet essential for administrators and unit leaders (22).

During 1960-1961, the Tennessee approach to program development emerged and became policy. The approach consisted of four interrelated phases, namely: (1) five-year planning; (2) annual planning;

(3) Extension teaching; and (4) program evaluation (18).

Preliminary work with practice checklists as a data collecting instrument for use in program planning and evaluation began in the early 1960's. In 1961-1962, Tennessee had an opportunity to participate in a nation-wide study of woodland management. The practice checklist survey procedure developed was rather detailed and lengthy. However, it was soon realized that this type of survey would be very useful in obtaining information in other work or audience areas.

By 1965 the practice checklist was implemented on a state-wide basis in Tennessee. The survey schedules were made available to county Extension staff through District supervisors. Copies of all practice checklist and surveys and summeries of the information obtained were provided to specialists, supervisors, and administrators for use in planning Extension programs. Collected information was then put on IBM cards for easy tabulation and storage.

However, practice checklist surveys did not provide all the situational data needed to develop a five-year plan. Additional kinds of information such as acreage and income were used by county Extension agents in making decisions regarding their five-year plan of work (POWP).

Practice checklist surveys were continued and by 1975 they were available in most work or audience areas of greatest importance in Tennessee. The specific purposes of practice checklist surveys were as follows:

1. To provide agents in local counties with benchmark and progress check data to serve as a strong basis for planning county Extension educational programs with an emphasis on people's needs.
2. To acquaint county staff members with clientele of new audiences and/or former audiences previously or not presently contacted.

3. To provide Extension workers at area, district, and state levels with adequate bases for planning and evaluating educational programs.
4. To provide staff at all levels with opportunities to measure progress made toward objectives, goals, and tasks.
5. To provide state and federal level personnel with data needed (i.e., together with TEMIS data) to justify Extension expenditures and staff allocations.
6. To provide data needed for periodic reports to the general public informing them of Extension activities and accomplishments (3).

In a descriptive study concerned with the problem of determining the present situation in Tennessee regarding the practice checklist approach to establishing educational priorities, Cary (1974) found that the majority of Extension leaders in Tennessee felt that the practice checklist data were useful for purposes of Extension planning and evaluation. Also, a high percentage of the Extension leaders felt that the overall practice checklist approach to planning and evaluation was practical, pertinent, functional, accurate, valid, and reliable (1).

III. BACKGROUND OF THE TENNESSEE EXTENSION MANAGEMENT INFORMATION SYSTEM

Previous to July 1969, Tennessee Extension personnel had been recording and reporting their activities using a Monthly Statistical Report Form 13A, and a Monthly Narrative Report, 13B. At this time, however, they were terminated along with the Annual-Narrative and Statistical Reports. These reports were then replaced by the system set up in Tennessee to be in compliance with the nationally designed computerized Extension Management Information System (EMIS). It was believed that a computerized system had several important advantages over the old reporting system, and therefore, would increase the output of

Extension personnel. Another advantage of the computerized system was increased efficiency and objectivity as to reporting and analysis of the data.

In Tennessee, the state version of SEMIS came to be known as TEMIS (Tennessee Extension Management Information System) and is a system of planning and reporting designed to accumulate, store, and process data on what Extension personnel plan to do, and what they actually do. TEMIS has five major parts: (1) Plan of Work Projection: This is the written end product of 5-year Extension planning and serves as a basis for the formulation of the county Extension Plan of Work; (2) Plan of Work: This is the written end product of annual planning consisting of priority objectives or participation goals, a brief statement of facts telling why the priority objectives or goals are important, county tasks, code numbers identifying related purposes and characteristics, starting and completion dates to be allocated, staff responsibility and evaluative methods for checking progress; (3) Activity Report: This is a tool for monitoring a current record of planned and unplanned activities; (4) Progress Report: This is a narrative report stating the quanitative and qualitative changes which occurred as a result of Extension educational programs; and (5) Personnel Records: These records include data on salary, degree, length of service, major subject, etc., on each professional staff member.

In order to serve its purpose, these data should be understandable and helpful to the Extension Personnel at the county level, where it is most crucial. There must be a two-way communication between data-collectors and data-users to be helpful in the interpretation and

application of data. In a study by Henderson (1975), concerned with determining the present situation in Tennessee regarding the Tennessee Extension Management Information System used for reporting, it was found that a majority of Tennessee Extension leaders felt that the weekly activity report data were useful for purposes of evaluating, planning, and reporting. However, they felt that the data did not show the effectiveness of the Extension programs (8).

IV. RELATED STUDIES

Practice Checklist Surveys

The practice checklist survey is an instrument used to determine clientele use of recommended production and management practices. The adoption of a recommended practice is used as an indicator of changed behavior as a result of acquired new knowledge, skills, and understanding. However, although the practice checklist is an effective device for measuring change, and determining needs of clientele, it fails to determine what is responsible for the change (4:16).

For a device such as the practice checklist survey to be effective, it must meet two important criteria. These criteria are validity and reliability. It is also important that these interrelated concepts be distinguished from one another. Reliability, refers to the consistency of the data, irrespective of what they measure. Validity, refers to the extent to which the questions or items really measure what they are suppose to measure (15:73). However, it is possible for the instrument to be highly reliable without being valid; that is, it may be consistent without measuring what it is suppose to measure. Yet, the

reverse is not true. Data cannot be highly valid without also being reliable (15).

Validity. Validity is concerned with measuring what one wants to measure. Frutchey (1959) stated that a valid instrument actually gets evidence of progress on the teaching objectives or of other desired information. Also, a valid instrument must deal with a particular subject matter as expressed by the teaching objective (4:16). When a device is valid, evidence can be obtained from which to draw conclusions and make recommendations about teaching objectives, methods, or other aspects of the program which are being evaluated or planned.

Reliability. Frutchey explained reliability as the degree to which the sample of people represents and gives results which are like the results that would have been obtained from the whole population of people. It is a measure of whether a sample is large enough to give sufficiently stable results (4:18).

Accountability. As accountability has become increasingly important in the Extension service, the need for accurate and reliable sources of data has grown. The term accountability itself, for the Cooperative Extension Service, means providing a creditable demonstration of accomplishments towards objectives, stated or implied, in the agency's enabling and subsequent legislation (11). The data collection developed and used by Extension at the national level to assist accountability in terms of what Extension is doing (its inputs) is called the Extension Management Information System (EMIS). Its counterpart in Tennessee, as previously mentioned, is referred to as TEMIS.

(Tennessee Extension Management Information Systems).

Extension Management Information Systems

For a SEMIS to be accepted as an instrument of accountability, the input data received on the Weekly Activity Report must be reliable (5). In an analytical study concerned with determining the reliability of data received from TEMIS, Gault (1976) found that in their recording of three Extension activities, Extension Leaders in Tennessee were highly consistent in the weekly activity report fields of audience, and personnel location, each having 94 percent of the codes consistent. Low coding consistency was shown in the number in audience, and time expended fields, having 63 percent and 69 percent, respectively, of the entries coded consistent. Both of these fields required actual numbers to be reported rather than TEMIS codes. Also, when all the fields were considered for coding consistency for the hypothetical activity, a very high coeffieient was obtained. The leaders demonstrated that they could correctly code hypothetical activities when given adequate information and instructions (i.e., the reporting system can produce very consistent data) (11).

Practice Adoption. Numerous researchers suggest that Extension agents' success is positively related to the extent of Extension agent effort (12:103). The degree of success of Extension agents may be measured in terms of the adoption of innovations by members of the clientele system. This measure is frequently used because the objective of much of the Extension work is to secure adoption of new ideas by the clientele. The greatest success in requiring adoption of new ideas by

the clientele has been found to be characterized by Extension agents who contacted more clientele and who spent fewer days in their offices and more in the community (22).

Teaching Methods. Previous studies by Wilson and Gallup (1955) indicate wide differences in the influence of the various Extension teaching methods upon adoption of farm and home practices. Approximately 74 out of 100 practices reported adopted were credited to meetings, farm and home visits, and result demonstrations (13:52). However, only seven percent of the practices adopted were associated with letters, radio, exhibits, and telephone calls. Wilson (1955) also noted that as the result of various Extension teaching methods out of 100 practices, 81 were adopted; of these, 25 were credited to individual contacts, 33 to group contacts, and 23 to mass media methods (13:54).

Adoption of Innovations. Evidence of the relationship between adoption of innovations and the extent of Extension agents efforts comes from an investigation by Deutching and Fals Donda (1962) in a Columbian peasant community. They found that two farm innovations promoted by an Extension agent were adopted much more quickly than two other farm practices which the agent had not emphasized as a part of his program of directed social change (22).

Stone (1952) analyzed the amount of effort 18 Michigan county Extension agents spent from 1943 to 1950 in promoting the adoption of a new idea, the artificial breeding of dairy cattle. In the first four years of the diffusion campaign, the adoption of the innovation roughly paralleled the amount of Extension agents' efforts, as measured by the

number of agent days a year devoted to the innovation. However, after about 30 percent adoption was reached, the Extension agents efforts decreased, whereas, the farmers continued to adopt the new idea at about a constant rate (13:67).

In the very early phase of an innovation adoption, Extension agent activities has little effect on the rate of adoption. Then, when the adoption curve starts to climb (from perhaps 5 to 20 percent adoption) increased inputs of Extension agent activities result in direct gains in rate of adoption. But, after 25 to 30 percent adoption, further change in agents' inputs seem to have little measurable effects on the rate of adoption (12:26).

Factor Analysis. In reviewing and identifying various managerial processes of farmers, Morrow and Keller (1969) employed factor analysis as a means of (1) isolating from observable and relevant management behavior of farm operators, basic mental processes explaining behavior; (2) to discover and develop more useful ways of describing the processes of management for investigation of such behavior, assuming that management as a mental process is manifested in the everyday behavior of farm operators; (3) to develop scores to measure selected processes of management; and (4) to evaluate the extent to which variations in scores were related to variations in related managerial performance criteria (10:8).

Factor analysis indicated that 11 processes accounted for the behavior of farm operators, these processes included: (1) observation and analytical ability, (2) off-farm activity participation, (3) self

initiative, (4) systemization of farming operation, (5) attitude toward physical labor, (6) communication with off-farm environment, (7) use of market information as a criterion of operational adjustment, (8) verbal communication ability, (9) detail mindedness, (10) community influence, and (11) orientation towards farming as an occupation.

Correlation Analysis. Correlation analysis provides a single summary statistic describing the strength of association between two variables, therefore, it enables the degree of covariation between two variables to be determined.

Linear correlation analysis has become quite widely used in social science research for describing a number of different types of problems. First, correlation analysis is used to describe the strength of association between a dependent and independent variable; second, it is often used in examining sets of independent and dependent variables in order to determine if they are related in a way which would allow them to be combined into a composite scale or index; and, finally, correlation analysis is often employed as a first step to more complicated data analysis such as regression and factor analysis (16:124).

CHAPTER IV

DESCRIPTION AND ANALYSIS OF THE USE OF VARIOUS RECOMMENDED PRODUCTION PRACTICES DEFINED IN THE 1970 AND 1975 DAIRY SURVEYS

The data presenting findings of this study are presented in nine tables. In order to facilitate analysis of the findings and address them directly to the stated objectives of the study, data were organized and discussed in three chapters. Data presented in Chapter IV were organized into two sections. Section I of this chapter is concerned with results of an earlier analysis of the 1970 Grade A Milk Production Practice Checklist Survey. These data are based on responses of 410 dairy producers in 41 Tennessee counties to 21 recommended dairy production practices defined in the 1970 Grade A dairy survey. Also included in this section is an analysis of the 1975 Grade A Dairy Farm Management and Production Survey based on the responses of 621 Grade A dairy producers in 32 Tennessee dairy counties. Section II compares the percentage of Grade A dairy producers in 32 Tennessee dairy counties who were using each of 11 recommended production practices in FY 1970 with those using the same practices in FY 1975.

Data presented in Chapter V is organized into two sections. Section I presents an analysis of interrelations between the use of selected recommended dairy production practices in 1970 and 1975. Section II of Chapter V presents findings concerned with a description of the items (dairy practices) included in the two surveys and assigning

names to factors identified by these items in the 1970 and 1975 Grade A dairy surveys.

Chapter VI is organized into two sections. Section I is concerned with the communalities exhibited by the dairy practices in the two Grade A dairy surveys as to the total variance of a practice accounted for by the combination of all common factors. Section II presents findings concerned with the amount of variance, in use of practices, and the proportion of variance of practice use that was accounted for by each factor.

I. GENERAL DESCRIPTION OF RESPONDENTS AND CLASSIFICATION OF SELECTED DAIRY PRACTICES DEFINED IN THE 1970 AND 1975 DAIRY SURVEYS

Section I is divided into two sub-sections. The first subsection is a description of Grade A dairymen surveyed in FY 1970 as to size of herd, herd production levels, and income received from the sale of milk. The second sub-section is concerned with the classification of 21 recommended practices into four areas based on the number of practices used per producer in FY 1970.

Description of Grade A Dairymen Surveyed in 1970 as to Size of Herd, Herd Production Levels, and Income From the Sale of Milk

The average herd size of Grade A dairymen in 1970 was 59 cows. Of the 41 counties, 11 counties had more than 59 cows per producer. Thirty counties had less than 59 cows per producer. In that fiscal year, an average of 10,029 pounds of milk per cow per year was produced. Nineteen counties had an average greater than 10,029 pounds of milk per

cow, and 22 counties had an average of less than 10,029 pounds of milk per cow (22).

The average income received from the sale of milk was $29,398.00 per producer. Grade A dairymen in 18 counties received more than $29,389.00 per producer, whereas in 23 counties, the dairymen received less than this amount per producer from the sale of milk. It was observed from the 1970 survey that Tennessee had an average of 55 producers per county. Sixteen counties had more than 55 dairymen, whereas 25 counties had less than 55 dairymen.

Classification of 21 Recommended Dairy Practices into Number of Breeding Management, Forage Feeding, Concentrate Feeding, and Herd Management Practices used per Producer in 1970

This sub-section is divided into four paragraphs, each paragraph involving the use of various production practices in 1970 based on the previous classification of these practices into subject areas.

Breeding management practices (practice numbers 1, 2, 3, 12, 13, 14, 15, and 21). Eight of the 21 recommended dairy practices in 1970 were classified as breeding management practices. Of the eight practices, an average of 6.2 practices were used per Grade A dairyman. Dairymen in 21 of the 41 counties (51 percent) were using more than 6.2 practices per producer, while dairymen in 20 counties (49 percent) were using less than 6.2 practices per producer (22).

Forage feeding practices (practice numbers 4, 5, 6, and 7). Four of the 21 recommended dairy production practices were classified as

forage feeding practices. Of the four practices, an average of 2.6 was used per producer. The dairymen in 32 counties (56 percent) used more than 2.6 forage feeding practices per producer, while the dairymen in 18 counties (44 percent) used less than 2.6 forage feeding practices per producer (22).

Concentrate feeding practices (practice numbers 8 and 9). Two of the 21 recommended production practices were classified as concentrate feeding practices. Of these two concentrate feeding practices, the Grade A dairymen surveyed had an average of 1.5 of these practices used per producer. The average number of these practices used was greater than 1.5 in 21 counties (51 percent), whereas in 20 counties (49 percent) the average was less than 1.5 concentrate feeding practices per producer (22).

Herd management practices (practice numbers 10, 11, 16, 17, 18, 19, and 20). Seven of the 21 recommended practices were classified as herd management practices. Of the seven herd management practices recommended by dairy specialists, an average of 3.5 practices were used per producer. Twenty-two counties (54 percent) had an average of more than 3.5 herd management practices, and 19 counties (44 percent) had less than 3.5 herd management practices used per producer (22).

Description of Grade A Dairymen Surveyed in 1975 as to Acres of Cropland Operated, Herd Production Levels, Cows Bred by Artificial Insemination, and Average Educational Level of Dairy Producers

In reviewing the situation of Grade A dairymen in FY 1975 it was found that an average of 336 acres of cropland was operated per producer

in 1975 among 621 Grade A dairymen in 32 Tennessee counties. It was also observed that the herd average pounds of milk produced per cow in 1975 was 11,981 pounds, with 449 pounds of butterfat produced per cow in 1975. Since 1970, the herd increase in average pounds of milk produced per cow was 1,462 pounds.

A total of 57.8 percent of the cows were bred by artificial insemination in 1975, with 76.6 percent of the cows being bred to bulls with a plus artificial insemination proof. The average age for these 621 dairy producers was 48 years and an average educational level (number of school grades completed) was 11 years.

Classification of Various Recommended Production Practices Defined in the 1975 Dairy Survey into Eight Subject Areas Based on Practice Usage

This sub-section is divided into eight paragraphs, each paragraph representing a previously classified subject area. The content of the paragraphs presents findings concerned with the results obtained from responses to various questions defined in the 1975 Grade A Dairy Farm Management and Production Survey.

General information. During FY 1975 it was observed that 51.9 percent of the producers had not increased the acres of land that they operated since 1970, however, 59.6 percent of the producers had added new buildings or silos since 1970. It was found in 1975 that of the 621 producers, approximately 82.6 percent of the farm income was from the sale of milk.

Buildings, milking, and feeding facilities. Of the 621 producers interviewed in the 1975 dairy survey, 84.9 percent of the producers

had a silo and had had one for an average of 15 years. Only 40.6 percent of the producers had changed their feeding system since 1970 and 52.7 percent of the producers responded that they had had their milking systems checked within the previous six months.

Forage production and management. An average of 75.6 acres of silage was harvested per producer in 1975 with an average yield of 16.3 tons per acre. Sixty-four percent of the producers responded that their average yield per acre had increased since 1970 with 73.4 percent of the producers indicating that they had had their silage tested by a forage testing laboratory.

Dairy feeding practices. Of the 621 Grade A dairymen interviewed in 1975, 83.3 percent responded that they normally had enough silage to feed through the winter months with only 6.8 percent responding that they did not have enough to feed through the winter. It was also observed that 44.4 percent of the dairymen had changed their forage feeding practices since 1970.

Dairy breeding practices. Of the 621 dairymen interviewed in the 1975 dairy survey, 51.2 percent responded that they removed cows in heat from the milking herd and that the herd was checked an average of two times per day for cows in heat. It was also observed that 89.8 percent of all cows had at least a 40 day dry period with 79.1 percent of the cows having at least a 60 day dry period. Fifty-two percent of the producers responded that they had not changed any of their dairy breeding practices since 1970.

Dairy record keeping practices. Sixty-seven percent of the dairy producers in 1975 responded that they had not changed their dairy breeding record keeping systems since 1970. It was also found that 74.3 percent of the producers had not changed their systems of keeping milk production records since 1970 and 73.4 percent of the dairymen had not changed their overall farm record keeping system since 1970.

Dairy herd management practices. In a review of the various herd management practices it was found that Grade A dairymen in 1975 raised approximately 84.9 percent of their herd replacements on the farm and cows about ready to calve were checked an average of two times per day. Eighty-nine percent of the heifer calves were fed grain between the ages of four and ten months while only 60.4 percent of the heifer calves were identified as to sire when they freshen. It was found that about 35.8 percent of the cows culled within the past 12 months were removed from the herd due to low production, and 22.4 percent of the cows were culled resulting from reproductive problems.

Personal questions. When asked how many visits were made to their farms by Agricultural Extension agents, dairymen in 1975 reported that an average of 3.4 visits by Extension agents were made to their farms during the previous 12 months. However, it was observed that the dairymen in 1975 made only an average of 2.8 visits to the Extension offices over the previous 12 months to obtain information and advice.

II. ANALYSIS AND COMPARISON OF THE PERCENTAGE OF PRODUCERS USING 11 RECOMMENDED PRODUCTION PRACTICES IN 1970 AND 1975

Section II is made up of one table. Table I presents findings concerned with the percents of Grade A dairy producers using each of 11 recommended production practices during 1970 and 1975 in 32 of Tennessee's major dairy counties. The 11 practices were chosen for this comparison because each practice was included in both the 1970 and 1975 surveys. Also, response to questions regarding these practices were answered by either "YES" or "NO" thus making it possible to compare responses at the two time periods. Comparisons were in terms of the percentage of producers using each practice. Appendix B presents a copy of the 1970 Grade A Milk Production Practice Checklist Survey Questionnaire.

Providing adequate forages. Table I shows the percentage of producers surveyed in each of the 32 counties who were using each of the 11 recommended practices for the years 1970 and 1975. The first practice shown is concerned with adequate forages for feeding the dairy herd. In 1970, an average of 82 percent of the 306 producers in 31 counties were following this practice (had produced an adequate amount of forages to feed their herd). This percentage had decreased to about 69 percent for the year 1975, a reduction of about 13 percent. Among the 31 counties the range in percentage of producers following this practice was 60 in 1970 (from a low of 40 to a high of 100 percent) and 40 in 1974 (from a low of 43 to a high of 92 percent). Comparing 1975 with 1970, 23 counties showed a decrease, six showed an increase and two had no change in the

TABLE I

PERCENTS OF GRADE A DAIRY PRODUCERS USING EACH OF 11 RECOMMENDED PRODUCTION PRACTICES DURING FY 1970 AND FY 1975 IN 32 MAJOR TENNESSEE DAIRY COUNTIES

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Adequate Forages Provided		
Gibson	(10,8)**	100.0	63.0	-37.0
Henry	(10,15)	70.0	80.0	+10.0
Obion	(10,13)	80.0	65.0	-15.0
Weakley	(9,22)	100.0	70.0	-30.0
Bedford	(10,27)		67.0	
Davidson	(10,8)	80.0	44.0	-36.0
Giles	(10,22)	90.0	55.0	-35.0
Lawrence	(10,23)	70.0	87.0	+17.0
Lincoln	(9,25)	100.0	54.0	-46.0
Marshall	(10,31)	90.0	69.0	-31.0
Maury	(10,27)	90.0	72.0	-28.0
Rutherford	(10,30)	90.0	70.0	-20.0
Williamson	(10,29)	40.0	50.0	+10.0
Wilson	(10,21)	100.0	43.0	-57.0
Bradley	(10,25)	100.0	68.0	-32.0
Coffee	(10,19)	70.0	66.0	- 4.0
Franklin	(10,23)	100.0	63.0	-37.0
Hamilton	(10,15)	80.0	60.0	-20.0
Polk	(10,9)	90.0	78.0	-12.0
Rhea	(10,7)	100.0	57.0	-43.0
Sequatchie	(10,6)	60.0	92.0	+32.0
Smith	(10,7)	80.0	64.0	-16.0
Blount	(10,23)	100.0	74.0	-26.0
Cocke	(10,14)	60.0	64.0	+ 4.0
Greene	(10,34)	90.0	76.0	-14.0
Hamblen	(10,11)	70.0	68.0	- 2.0
Hawkins	(10,15)	80.0	80.0	0.0
Jefferson	(9,22)	100.0	68.0	-32.0
Knox	(10,25)	90.0	68.0	-22.0
Loudon	(10,25)	90.0	90.0	0.0
Sullivan	(10,16)	90.0	75.0	-15.0
Washington	(10,30)	70.0	80.0	+10.0
Totals	(316,621)	82.0	68.6	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Adequate Summer Pasture Provided		
Gibson	(10,8)**	50.0	75.0	+25.0
Henry	(10,15)	40.0	73.0	+33.0
Obion	(10,13)	80.0	69.0	-11.0
Weakley	(9,22)	77.8	77.0	- 0.8
Bedford	(10,27)	50.0	70.0	+20.0
Davidson	(10,8)	40.0	89.0	+49.0
Giles	(10,22)	50.0	82.0	+32.0
Lawrence	(10,23)	90.0	74.0	-16.0
Lincoln	(9,25)	44.4	88.0	+43.6
Marshall	(10,31)	90.0	74.0	-16.0
Maury	(10,27)	70.0	85.0	+15.0
Rutherford	(10,30)	60.0	60.0	0.0
Williamson	(10,29)	40.0	72.0	+32.0
Wilson	(10,21)	60.0	57.0	- 3.0
Bradley	(10,25)	20.0	76.0	+56.0
Coffee	(10,19)	20.0	84.0	+64.0
Franklin	(10,23)	50.0	83.0	+33.0
Hamilton	(10,15)	40.0	60.0	+20.0
Polk	(10,9)	30.0	78.0	+48.0
Rhea	(10,7)	22.2	86.0	+63.8
Sequatchie	(10,6)	40.0	50.0	+10.0
Smith	(10,7)	20.0	71.0	+51.0
Blount	(10,23)	50.0	83.0	+33.0
Cocke	(10,14)	30.0	57.0	+27.0
Greene	(10,34)		29.0	
Hamblen	(10,11)	80.0	36.0	-44.0
Hawkins	(10,15)	90.0	87.0	- 3.0
Jefferson	(9,22)		45.0	
Knox	(10,25)	30.0	58.0	+28.0
Loudon	(10,25)		84.0	
Sullivan	(10,16)	10.0	81.0	+71.0
Washington	(10,30)	20.0	83.0	+63.0
Totals	(316,621)	41.0	71.0	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Feeding of an All-Grain Concentrate		
Gibson	(10,8)**	90.0	100.0	+10.0
Henry	(10,15)	70.0	93.0	+23.0
Obion	(10,13)	90.0	85.0	- 5.0
Weakley	(9,22)	100.0	77.0	-23.0
Bedford	(10,27)	100.0	63.0	-37.0
Davidson	(10,8)	100.0	100.0	0.0
Giles	(10,22)	50.0	77.0	+27.0
Lawrence	(10,23)	90.0	87.0	- 3.0
Lincoln	(9,25)	66.7	96.0	+29.3
Marshall	(10,31)	100.0	94.0	- 6.0
Maury	(10,27)	100.0	100.0	0.0
Rutherford	(10,30)	90.0	80.0	-10.0
Williamson	(10,29)	80.0	86.0	+ 6.0
Wilson	(10,21)	100.0	81.0	-19.0
Bradley	(10,25)	90.0	88.0	- 2.0
Coffee	(10,19)	100.0	79.0	-21.0
Franklin	(10,23)	80.0	96.0	+16.0
Hamilton	(10,15)	100.0	100.0	0.0
Polk	(10,9)	100.0	100.0	0.0
Rhea	(10,7)	88.9	86.0	- 2.9
Sequatchie	(10,6)	70.0	100.0	+30.0
Smith	(10,7)	100.0	100.0	0.0
Blount	(10,23)	90.0	91.0	+ 1.0
Cocke	(10,14)	90.0	93.0	+ 3.0
Greene	(10,34)	90.0	94.0	+ 4.0
Hamblen	(10,11)	90.0	46.0	-44.0
Hawkins	(10,15)	100.0	87.0	-13.0
Jefferson	(9,22)	100.0	77.0	-23.0
Knox	(10,25)	90.0	80.0	-10.0
Loudon	(10,25)	100.0	100.0	0.0
Sullivan	(10,16)	90.0	94.0	+ 4.0
Washington	(10,30)	100.0	93.0	- 7.0
Totals	(316,621)	91.0	88.1	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Grain Fed According to Production		
Gibson	(10,8)**	50.0	38.0	-12.0
Henry	(10,15)	20.0	53.0	+33.0
Obion	(10,13)	50.0	54.0	+ 4.0
Weakley	(9,22)	44.4	36.0	- 8.4
Bedford	(10,27)	30.0	44.0	+14.0
Davidson	(10,8)	70.0	63.0	- 7.0
Giles	(10,22)	70.0	32.0	-38.0
Lawrence	(10,23)	80.0	4.3	-75.7
Lincoln	(9,25)	22.2	64.0	+41.8
Marshall	(10,31)	80.0	55.0	-25.0
Maury	(10,27)	20.0	37.0	+17.0
Rutherford	(10,30)	40.0	50.0	+10.0
Williamson	(10,29)	50.0	59.0	+ 9.0
Wilson	(10,21)	80.0	48.0	-32.0
Bradley	(10,25)	40.0	60.0	+20.0
Coffee	(10,19)		26.0	
Franklin	(10,23)	70.0	57.0	-13.0
Hamilton	(10,15)	90.0	60.0	-30.0
Polk	(10,9)	80.0	78.0	- 2.0
Rhea	(10,7)	100.0	43.0	-57.0
Sequatchie	(10,6)	80.0	17.0	-63.0
Smith	(10,7)	40.0	14.0	-26.0
Blount	(10,23)	70.0	65.0	- 5.0
Cocke	(10,14)	40.0	50.0	+10.0
Greene	(10,34)	20.0	9.0	-11.0
Hamblen	(10,11)	90.0	64.0	-26.0
Hawkins	(10,15)	90.0	47.0	-43.0
Jefferson	(9,22)	33.3	50.0	+16.7
Knox	(10,25)	100.0	68.0	-32.0
Loudon	(10,25)	50.0	100.0	+50.0
Sullivan	(10,16)	60.0	38.0	-22.0
Washington	(10,30)	70.0	47.0	-23.0
Totals	(316,621)	55.0	48.0	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Use of U. T. Forage Testing Lab		
Gibson	(10,8)**	30.0	15.0	-15.0
Henry	(10,15)		80.0	
Obion	(10,13)	10.0	100.0	+90.0
Weakley	(9,22)	11.1	73.0	+61.9
Bedford	(10,27)		63.0	
Davidson	(10,8)	30.0	88.0	+58.0
Giles	(10,22)		40.9	
Lawrence	(10,23)	40.0	83.0	+43.0
Lincoln	(9,25)		68.0	
Marshall	(10,31)	100.0	61.0	-39.0
Maury	(10,27)		85.0	
Rutherford	(10,30)	20.0	60.0	+40.0
Williamson	(10,29)	10.0	69.0	+59.0
Wilson	(10,21)		33.3	
Bradley	(10,25)	10.0	68.0	+58.0
Coffee	(10,19)		74.0	
Franklin	(10,23)	10.0	91.0	+81.0
Hamilton	(10,15)	10.0	87.0	+77.0
Polk	(10,9)	30.0	78.0	+48.0
Rhea	(10,7)	11.1	43.0	+31.9
Sequatchie	(10,6)	30.0	67.0	+37.0
Smith	(10,7)	10.0	86.0	+76.0
Blount	(10,23)	40.0	39.0	- 1.0
Cocke	(10,14)	20.0	14.0	- 6.0
Greene	(10,34)	30.0	91.0	+61.0
Hamblen	(10,11)	10.0	100.0	+90.0
Hawkins	(10,15)	10.0	60.0	+50.0
Jefferson	(9,22)		68.0	
Knox	(10,25)		79.0	
Loudon	(10,25)		96.0	
Sullivan	(10,16)	20.0	88.0	+68.0
Washington	(10,30)	30.0	93.0	+63.0
Totals	(316,621)	14.0	73.4	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Milk Production Records		
Gibson	(10,8)**	40.0	36.0	- 4.0
Henry	(10,15)	20.0	67.0	+47.0
Obion	(10,13)	30.0	39.0	+ 9.0
Weakley	(9,22)	33.3	50.0	+16.7
Bedford	(10,27)	20.0	26.0	+ 6.0
Davidson	(10,8)	30.0	75.0	+45.0
Giles	(10,22)	40.0	68.0	+28.0
Lawrence	(10,23)	80.0	61.0	-19.0
Lincoln	(9,25)	33.0	40.0	+ 7.0
Marshall	(10,31)	30.0	57.0	+27.0
Maury	(10,27)	60.0	63.0	+ 3.0
Rutherford	(10,30)	40.0	40.0	0.0
Williamson	(10,29)	20.0	38.0	+18.0
Wilson	(10,21)	10.0	38.0	+28.0
Bradley	(10,25)	30.0	40.0	+10.0
Coffee	(10,19)	10.0	21.0	+11.0
Franklin	(10,23)	70.0	57.0	-13.0
Hamilton	(10,15)	20.0	7.0	-13.0
Polk	(10,9)	50.0	44.4	- 5.6
Rhea	(10,7)		14.0	
Sequatchie	(10,6)	40.0	17.0	-23.0
Smith	(10,7)		43.0	
Blount	(10,23)	70.0	57.0	-13.0
Cocke	(10,14)	10.0	21.0	+11.0
Greene	(10,34)	30.0	21.0	- 9.0
Hamblen	(10,11)	20.0	55.0	+35.0
Hawkins	(10,15)	80.0	80.0	0.0
Jefferson	(9,22)	22.2	82.0	+59.8
Knox	(10,25)	30.0	37.0	+ 7.0
Loudon	(10,25)	70.0	60.0	-10.0
Sullivan	(10,16)	60.0	50.0	-10.0
Washington	(10,30)	70.0	57.0	-13.0
Totals	(316,621)	31.0	44.1	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Maintained Adequate Herd Records		
Gibson	(10,8)**	90.0	78.0	-12.0
Henry	(10,15)	90.0	68.0	-22.0
Obion	(10,13)	60.0	75.0	+15.0
Weakley	(9,22)	33.3	78.0	+44.7
Bedford	(10,27)	40.0	66.0	+26.0
Davidson	(10,8)	100.0	66.0	-34.0
Giles	(10,22)	80.0	89.0	+ 9.0
Lawrence	(10,23)	100.0	73.0	-27.0
Lincoln	(9,25)	66.7	67.0	+ 0.3
Marshall	(10,31)	50.0	86.0	+36.0
Maury	(10,27)	70.0	69.0	- 1.0
Rutherford	(10,30)	60.0	71.0	+11.0
Williamson	(10,29)	60.0	78.0	+18.0
Wilson	(10,21)	100.0	85.0	-15.0
Bradley	(10,25)	40.0	80.0	+40.0
Coffee	(10,19)	80.0	33.0	-47.0
Franklin	(10,23)	70.0	82.0	+12.0
Hamilton	(10,15)	50.0	70.0	+20.0
Polk	(10,9)	10.0	78.0	+68.0
Rhea	(10,7)	33.3	75.0	+41.7
Sequatchie	(10,6)	70.0	92.0	+12.0
Smith	(10,7)	50.0	89.0	+39.0
Blount	(10,23)	90.0	79.0	-11.0
Cocke	(10,14)	60.0	84.0	+24.0
Greene	(10,34)	10.0	74.0	+64.0
Hamblen	(10,11)	80.0	77.0	- 3.0
Hawkins	(10,15)	80.0	80.0	0.0
Jefferson	(9,22)	55.6	61.0	+ 5.4
Knox	(10,25)	100.0	74.0	-26.0
Loudon	(10,25)	30.0	72.0	+42.0
Sullivan	(10,16)	60.0	77.0	+17.0
Washington	(10,30)	100.0	83.0	-17.0
Totals	(316,621)	64.0	88.3	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Separate Feeding and Loafing Areas		
Gibson	(10,8)**	90.0	100.0	+10.0
Henry	(10,15)	70.0	27.0	-43.0
Obion	(10,13)	80.0	39.0	-41.0
Weakley	(9,22)	100.0	59.0	-41.0
Bedford	(10,27)	20.0	68.0	+48.0
Davidson	(10,8)	70.0	88.0	+18.0
Giles	(10,22)	40.0	68.0	+28.0
Lawrence	(10,23)	30.0	26.0	- 4.0
Lincoln	(9,25)	33.3	80.0	+46.7
Marshall	(10,31)	20.0	48.0	+28.0
Maury	(10,27)	70.0	74.0	+ 4.0
Rutherford	(10,30)	80.0	60.0	-20.0
Williamson	(10,29)	30.0	52.0	+22.0
Wilson	(10,21)	20.0	33.0	+13.0
Bradley	(10,25)	50.0	72.0	+22.0
Coffee	(10,19)	20.0	47.0	+27.0
Franklin	(10,23)	20.0	52.0	+32.0
Hamilton	(10,15)	40.0	67.0	+27.0
Polk	(10,9)	30.0	78.0	+48.0
Rhea	(10,7)	66.7	57.0	- 9.7
Sequatchie	(10,6)	40.0	83.0	+43.0
Smith	(10,7)	30.0	57.0	+27.0
Blount	(10,23)	80.0	57.0	-23.0
Cocke	(10,14)	40.0	94.0	+54.0
Greene	(10,34)	80.0	94.0	+14.0
Hamblen	(10,11)	60.0	27.0	-33.0
Hawkins	(10,15)	100.0	73.0	-27.0
Jefferson	(9,22)	55.6	36.0	-19.6
Knox	(10,25)	40.0	53.0	+13.0
Loudon	(10,25)	40.0	92.0	+52.0
Sullivan	(10,16)	80.0	44.0	-36.0
Washington	(10,30)	60.0	60.0	0.0
Totals	(316,621)	51.0	60.0	

TABLE I (continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Milking System Checked Every 6 Months		
Gibson	(10,8)**	90.0	100.0	+10.0
Henry	(10,15)	90.0	13.0	-77.0
Obion	(10,13)	80.0	69.0	-11.0
Weakley	(9,22)	33.3	55.0	+21.7
Bedford	(10,27)	10.0	52.0	+42.0
Davidson	(10,8)	60.0	63.0	+ 3.0
Giles	(10,22)	50.0	86.0	+36.0
Lawrence	(10,23)	50.0	26.0	-24.0
Lincoln	(9,25)	77.8	52.0	-25.8
Marshall	(10,31)	80.0	29.0	-51.0
Maury	(10,27)	80.0	63.0	-17.0
Rutherford	(10,30)	10.0	47.0	+37.0
Williamson	(10,29)	60.0	72.0	+12.0
Wilson	(10,21)	20.0	57.0	+37.0
Bradley	(10,25)	50.0	56.0	+ 6.0
Coffee	(10,19)	70.0	68.0	- 2.0
Franklin	(10,23)	50.0	52.0	+ 2.0
Hamilton	(10,15)	40.0	40.0	0.0
Polk	(10,9)	60.0	56.0	- 4.0
Rhea	(10,7)	88.9	43.0	-45.9
Sequatchie	(10,6)	70.0	17.0	-53.0
Smith	(10,7)	10.0	29.0	+19.0
Blount	(10.23)	50.0	48.0	- 2.0
Cocke	(10,14)	50.0	57.0	+ 7.0
Greene	(10,34)	50.0	35.0	-15.0
Hamblen	(10,11)	20.0	27.0	+ 7.0
Hawkins	(10,15)	80.0	47.0	-33.0
Jefferson	(9,22)	55.6	36.0	-19.6
Knox	(10,25)	80.0	16.0	-64.0
Loudon	(10,25)	100.0	96.0	- 4.0
Sullivan	(10,16)	100.0	63.0	-37.0
Washington	(10,30)	80.0	67.0	-13.0
Totals	(316,621)	56.0	52.0	

TABLE I (Continued)

		Recommended Production Practices*		
		% or Producers Using Practice		
		1970	1975	Difference
		Use of Strip Cup Before Applying Milkers		
Gibson	(10,8)**	20.0	84.0	+64.0
Henry	(10,15)	20.0	77.0	+57.0
Obion	(10,13)	50.0	88.0	+38.0
Weakley	(9,22)	89.9	78.0	-10.9
Bedford	(10,27)	20.0	79.0	+59.0
Davidson	(10,8)	20.0	81.0	+61.0
Giles	(10,22)	40.0	98.0	+58.0
Lawrence	(10,23)	20.0	73.0	+53.0
Lincoln	(9,25)	44.4	81.0	+36.6
Marshall	(10,31)	50.0	64.0	+14.0
Maury	(10,27)		81.0	
Rutherford	(10,30)	30.0	78.0	+48.0
Williamson	(10,29)	40.0	95.0	+55.0
Wilson	(10,21)	30.0	74.0	+44.0
Bradley	(10,25)		61.0	
Coffee	(10,19)	70.0	75.0	+ 5.0
Franklin	(10,23)	20.0	91.0	+71.0
Hamilton	(10,15)	20.0	73.0	+53.0
Polk	(10,9)	10.0	72.0	+62.0
Rhea	(10,7)		68.0	
Sequatchie	(10,6)	40.0	83.0	+43.0
Smith	(10,7)		64.0	
Blount	(10,23)	30.0	83.0	+53.0
Cocke	(10,14)	30.0	75.0	+45.0
Greene	(10,34)	40.0	66.0	+26.0
Hamblen	(10,11)	20.0	64.0	+44.0
Hawkins	(10,15)	90.0	97.0	+ 7.0
Jefferson	(9,22)	33.3	81.0	-47.7
Knox	(10,25)	20.0	71.0	+51.0
Loudon	(10,25)	70.0	100.0	+30.0
Sullivan	(10,16)	50.0	80.0	+30.0
Washington	(10,30)	20.0	72.0	+52.0
Totals	(316,621)	32.0	81.0	

TABLE I (Continued)

		Recommended Production Practices*		
		% of Producers Using Practice		
		1970	1975	Difference
		Adequate Methods of Fly Control		
Gibson	(10,8)**	100.0	100.0	0.0
Henry	(10,15)	40.0	80.0	+40.0
Obion	(10,13)	90.0	54.0	-36.0
Weakley	(9,22)	88.9	68.0	-20.9
Bedford	(10,27)	100.0	82.0	-18.0
Davidson	(10,8)	100.0	100.0	0.0
Giles	(10,22)	80.0	100.0	+20.0
Lawrence	(10,23)	70.0	91.0	+21.0
Lincoln	(9,25)	77.8	60.0	-17.8
Marshall	(10,31)	100.0	48.0	-52.0
Maury	(10,27)	60.0	63.0	+ 3.0
Rutherford	(10,30)	80.0	93.0	+13.0
Williamson	(10,29)	100.0	79.0	-21.0
Wilson	(10,21)	90.0	86.0	- 4.0
Bradley	(10,25)	90.0	88.0	- 2.0
Coffee	(10,19)	60.0	74.0	+14.0
Franklin	(10,23)	100.0	91.0	- 9.0
Hamilton	(10,15)	100.0	87.0	-13.0
Polk	(10,9)	90.0	78.0	-12.0
Rhea	(10,7)	88.9	100.0	+11.1
Sequatchie	(10,6)	100.0	100.0	0.0
Smith	(10,7)	60.0	43.0	-17.0
Blount	(10,23)	100.0	87.0	-13.0
Cocke	(10,14)	100.0	71.0	-29.0
Greene	(10,34)	100.0	94.0	- 6.0
Hamblen	(10,11)	70.0	100.0	+30.0
Hawkins	(10,15)	100.0	80.0	-20.0
Jefferson	(9,22)	88.9	91.0	+ 2.1
Knox	(10,25)	100.0	84.0	-16.0
Loudon	(10,25)	100.0	100.0	0.0
Sullivan	(10,16)	100.0	50.0	-50.0
Washington	(10,30)	100.0	47.0	-53.0
Totals	(316,621)	89.0	79.2	

*The Recommended Production Practices are those used on the 1970 Grade A Milk Production Practice Checklist Survey.

**Numbers in parenthesis represent numbers of producers surveyed in 1970 and 1975 respectively.

percentage of dairymen who produced an adequate amount of forage for their herd.

Data in Table I regarding the practice of providing an adequate amount of forages revealed that all counties showing high practice use (e.g., 80 percent or above) in 1970 had a lower percentage of practice use in 1975. Conversely, most counties with low practice use in 1970 (e.g., 70 percent or less) had an increase in the percentage of producers using the practice in 1975.

Providing adequate summer pasture. The second practice shown in Table I is concerned with the amount of adequate summer pasture which was provided for the herd. In 1970, an average of 41 percent of the 287 producers in 29 counties were following this practice (had provided an adequate amount of summer pasture for their herds). This percentage had increased to 71 percent among 621 producers in 1975, an increase of 30 percent. Among the 29 counties, the range in percentage of producers following this practice was 70 in 1970 (from a low of 20 to a high of 90 percent) and 44 in 1975 (from a low of 45 to a high of 89 percent). Comparing 1975 with 1970, 21 counties showed an increase, seven counties a decrease and one county had no change in the percentage of dairymen who were providing adequate summer pasture.

Data in Table I regarding the practice of providing adequate summer pasture revealed that all counties showing low practice use (e.g., less than 60 percent) in 1970 had increased in percentage of practice use in 1975. Conversely, those counties which had decreased in practice use only decreased an average of 13 percent among the seven counties. Yet,

one county decreased in the number of producers using this practice by 44 percent over the five year period.

Feeding of an all-grain concentrate. The third practice as shown in Table I is concerned with the feeding of an all-grain concentrate to the herd. In 1970, an average of 91 percent of 316 producers in 32 counties were following this practice. This percentage had decreased to about 88 percent in 1975, a reduction of 3 percent. Among the 32 counties in 1970, the range in percentage of producers using this practice was 50 (from a low of 50 to a high of 100 percent). In 1975, the range in percentage of producers using this practice was 54 (from a low of 46 to a high of 100 percent). Comparing 1975 with 1970, 10 counties showed an increase, 16 counties a decrease and six counties had no change at all in the percentage of producers feeding an all-grain concentrate to their herds.

Data in Table I regarding the practice of feeding an all-grain concentrate revealed that of the 14 counties in 1970 with 100 percent of their producers following this practice, seven counties decreased in the percentage of producers following the practice while the other seven counties exhibited no change. Conversely, in 1975, only eight counties indicated 100 percent participation of its producers feeding an all-grain concentrate. However, the practice of feeding an all-grain concentrate was found to have the highest percentage of producers using this practice in 1970, and third highest in 1975, of all other 11 recommended production practices indicated in Table I.

Grain fed according to production. The fourth practice shown in Table I is concerned with the feeding of grain according to production. In 1970, an average of 55 percent of the producers in 31 counties were following this practice (had fed grain according to production). This percentage had decreased to 48 percent in 1975, a reduction of 7 percent. Among the 31 counties the range in percentage of producers using this practice was 80 in 1970 (from a low of 20 to a high of 100 percent) and 91 in 1975 (from a low of 9 to a high of 100 percent). Comparing 1975 with 1970, 20 counties showed a decrease, 11 counties an increase and no data was available for one county, in the percentage of producers feeding grain according to production.

Data in Table I regarding the practice of feeding grain according to production revealed that only two counties in 1970 and one county in 1975 had 100 percent participation of all of its producers in the use of this practice. Also, all counties showing a high practice use (e.g., 70 percent or above) in 1970 had a lower percentage of practice use in 1975. Conversely, most counties with low practice use in 1970 (e.g., 50 percent of less) had an increase in the percentage of producers using the practice in 1975.

Use of U. T. Forage Testing Laboratory. The fifth practice shown (P-10, see Table I, page 42) is concerned with the use of the University of Tennessee Forage Testing Laboratory. In 1970, an average of 14 percent of the 218 producers in 22 counties were following this practice. This percentage had increased to about 73 percent in 1975, an increase of 59 percent. Among the 22 counties the range in percentage of

producers following this practice was 90 in 1970 (from a low of 10 to a high of 100 percent) and 86 in 1975 (from a low of 14 to a high of 100 percent). Comparing 1975 with 1970, 19 counties showed an increase, 3 counties a decrease, and 10 counties in which no data was available in the precentage of producers using the U. T. Forage Testing Laboratory.

Data in Table I, page 42, regarding the practice of use of the forage testing lab revealed that only one county in 1970, and two counties in 1975 indicated 100 percent practice use by its producers. Also, those three counties reporting a decrease in the percentage of producers using this practice in 1975 indicated a decrease of only seven percent over the five year period.

Milk production records. The sixth practice shown is concerned with milk production records. In 1970 an average of 31 percent of 296 producers in 30 counties were following the practice of maintaining milk production records. This percentage had increased to about 44 percent in 1975, an increase of 13 percent. Among the 30 counties the range in percentage of producers following this practice was 70 in 1970 (from a low of 10 percent to a high of 80 percent) and 75 in 1975 (from a low of 7 to a high of 82 percent). Comparing 1975 to 1970, 17 counties showed an increase and 11 counties a decrease with 2 counties remaining unchanged in the percentage of producers using this practice.

Data in Table I, page 42, regarding the maintaining of milk production records indicated that all counties showing high practice use in 1970 (e.g., 70 percent or above) had a lower percentage of practice use

in 1975. Conversely, most counties with low practice use in 1970 (e.g., 50 percent of less) had an increase in the percentage of producers using this practice in 1975.

Maintained adequate herd records. The seventh practice shown is concerned with the maintaining of adequate herd records. In 1970 an average of 64 percent of 316 producers in 32 counties were following this practice (were maintaining adequate herd records). This percentage had increased to about 83 percent in 1975, an increase of 24 percent. Among the 32 counties the range in percentage of producers following this practice was 90 in 1970 (from a low of 10 to a high of 100 percent) and 59 in 1975 (from a low of 32 to a high of 92 percent). Comparing 1975 with 1970, 20 counties showed an increase, 11 counties a decrease, and one county was unchanged in the percentage of producers maintaining adequate herd records.

Data in Table I, page 42, regarding the practice of maintaining adequate herd records revealed that five counties in 1970 had 100 percent of its producers following this practice, whereas in 1975, no counties had 100 percent participation. It was also found that all counties showing low practice use (e.g., 70 percent or below) in 1970 had a higher percentage of practice use in 1975. Conversely, most counties with high practice use in 1970 (e.g., 90 percent or above) tended to decrease in practice use in 1975.

Separate feeding and loafing areas. The eighth practice shown is concerned with the providing of separate feeding and loafing areas for the herd. In 1970, an average of 51 percent of the 316 producers

in 32 counties were following this practice. This percentage had increased to 60 percent in 1975, an increase of 9 percent. Among the 32 counties the range in percentage of producers using this practice was 80 in 1970 (from a low of 20 to a high of 100 percent) and 73 in 1975 (from a low of 27 to a high of 100 percent). Comparing 1975 with 1970, 21 counties showed an increase, 10 counties a decrease, and one county remained unchanged in the percentage of producers using this practice.

Data in Table I, page 42, regarding the practice of providing separate feeding and loafing areas for the herd revealed that most counties showing high practice use (e.g., 80 percent or above) in 1970 had a lower percentage of practice use in 1975. Conversely, most counties with low practice use in 1970 (e.g., 70 percent or below) had an increase in the percentage of producers using the practice in 1975.

Milking system checked every six months. The ninth practice shown is concerned with having the milking system checked every six months. In 1970 an average of 56 percent of the 316 producers in 32 counties were following the practice of having their milking systems checked every six months. This percentage had decreased to about 52 percent in 1975, a reduction of 4 percent. Among the 32 counties the range in percentage of producers following this practice was 90 in 1970 (from a low of 10 to a high of 100 percent) and 87 in 1975 (from a low of 13 to a high of 100 percent). Comparing 1975 with 1970, 14 counties showed an increase, 17 a decrease, and one county unchanged in the percentage of producers using this practice.

Data in Table I, page 42, regarding the practice of having the milking system checked every six months revealed that only two counties

in 1970 and one county in 1975 indicated 100 percent participation of its producers in the use of this practice. Also, it was found that all counties showing high practice use (e.g., 80 percent or above) in 1970 had a lower percentage of practice use in 1975.

Use of a strip cup before applying milkers. The tenth practice shown in Table I, page 42, is concerned with the procedure of using a strip cup before applying milkers. In 1970 an average of 32 percent of 276 producers in 28 counties were following this practice. This percentage had increased to 81 percent in the year 1975, an increase of 49 percent. Among the 28 counties the range in the percentage of producers using this practice in 1970 was 80 (from a low of 10 to a high of 90 percent) and 36 in 1975 (from a low of 64 to a high of 100 percent). Comparing 1975 with 1970, it was found that 26 counties increased and 2 counties decreased in the number of producers following this practice. Data from four counties were not available for analysis.

Data in Table I, page 42, regarding the practice of using a strip cup before applying milkers revealed that no county in 1970, and only one county in 1975 had 100 percent participation of its producers in the use of this practice. Also, all counties in 1970 with low practice use (e.g., 60 percent or below) increased in the percentage of producers using this practice in 1975.

Adequate methods of fly control. The last practice shown is concerned with the ability of dairymen to maintain adequate methods of fly control. In 1970 an average of 89 percent of the 316 producers in 32 counties did have effective systems of fly control. However, this

percentage had decreased in 1975 to about 79 percent, a reduction of 10 percent. Among the 32 counties the range in the percentage of producers following this practice was 60 in 1970 (from a low of 40 to a high of 100 percent) and 57 in 1975 (from a low of 43 to a high of 100 percent). Comparing 1975 with 1970, 10 counties increased, 19 counties decreased and 3 counties remained unchanged in the percentage of producers using a strip cup before applying milkers.

Data in Table I, page 42, regarding the use of a strip cup before applying milkers, were observed that 16 counties in 1970 indicated 100 percent participation of their producers in the use of this practice. However, in 1975 only seven counties had 100 percent of its producers using this practice. It was found that most of the counties showing low practice use (e.g., 70 percent or less) increased in practice use in 1975. Conversely, most counties with high practice use in 1970 (e.g., 90 percent or above) decreased in the percentage of producers using this practice in 1975.

Many factors may have influenced the large variation in percentage of producers using the various practices shown in Table I. Some of these factors include the relatively small number of dairymen interviewed in each county, variations in the numbers interviewed at the two time periods (i.e., 1970 and 1975), and influence of weather and other uncontrolled variables. In view of these factors, the variation in use of the practice regarding the provision of an adequate amount of forages for the herd are not altogether unexpected and may not indicate severe changes in the forage production program of dairymen in Tennessee.

Another factor which would tend to reduce the validity of

comparing percentages of dairymen using each of the 11 practices shown in Table I, page 42, concerns the different approaches used in 1970 and in 1975 to determine whether or not each dairyman was in fact following the recommended practices. In 1970 the person conducting the interview made the decision as to whether or not each dairyman was following each practice. This decision was based upon a series of questions used as a guide for the interview. In 1975, the questions were arranged and worded so that the dairyman's response classified him as using or not using each of these 11 practices. Therefore, differences regarding percentage of producers using each recommended practice at the two time periods may also be reflecting variation in procedures used to secure the data.

CHAPTER V

INTERRELATIONS BETWEEN THE USE OF SELECTED RECOMMENDED DAIRY PRODUCTION PRACTICES IN FY 1970 AND FY 1975 AND A DESCRIPTION OF THE DAIRY PRACTICES SELECTED TO IDENTIFY 21 FACTORS OBSERVED IN AN ANALYSIS OF THE 1970 AND THE 1975 DAIRY SURVEYS

The following chapter is divided into two sections. Section I involves the interrelationships between Grade A dairymen's use of 21 dairy production practices as measured in the 1970 Grade A Milk Production Practice Checklist Survey, and interrelationships between items (practices) defined in the 1975 Grade A Dairy Farm Management and Production Survey. Section II presents findings concerned with items used to identify 21 factors, their factor loadings, subject areas to which initially assigned, and item content observed from 59 items (dairy practices) defined in the two dairy surveys.

I. INTERRELATIONS BETWEEN THE USE OF SELECTED RECOMMENDED DAIRY PRODUCTION PRACTICES IN FY 1970 AND FY 1975

Section I is divided into three sub-sections and presents findings concerned with the interrelations between 59 dairy production practices defined in the two dairy surveys, based upon the correlation coefficients exhibited by these items. These correlation coefficients were computed in the process of factor analysis of the data. Correlation (r) values which achieved a $p < .05$ or greater were considered significant.

Interrelationships Between the Use of Each of the 21 Dairy Production Practices by 316 Grade A Dairymen in 32 Tennessee Counties During FY 1970

Table II shows the interrelationship (correlation coeffieients) between the scores regarding the use of each of 21 recommended dairy production and management practices, in 1970 by the 316 Grade A dairymen in 32 of Tennessee's major dairy counties. The purpose of this analysis was to determine which of the practices tended to be used in combination with other practices.

Results of the analysis of the practice of breeding cows to a plus A. I. proof bull (Item 13) showed that this practice was used more in combination with larger number of practices than was any of the other 20 practices. Use of this practice was significantly related ($p<.05$ or greater) to the use of 13 of the recommended practices. Each of these relationships was in a positive direction. Dairymen who were using the practice of breed cows to a plus A. I. proof bull also tended to be using 13 of the other 20 practices studied.

The seven practices (i.e., score on their use) which were not significantly related to the use of the practice of breeding cows to a plus A. I. proof bull were as follows (coefficients also given): providing adequate amounts of improved pasture (-.054); providing adequate amounts of summer pasture (-.027); allowing cows a 60 day dry period (-.027); allowing a 12 to 14 month calving interval (.030); checking milking system every six months (.037); use of a strip cup before applying milkers (.030); and effective methods of fly control (-.002). It was found that four of these seven practices which were not significantly related to the use of a plus A. I. proof bull and had a negative coefficient.

TABLE II

INTERRELATIONSHIPS BETWEEN THE USE OF EACH OF 21 DAIRY PRODUCTION PRACTICES BY 316 GRADE A DAIRYMEN IN 1970

	Item 13	Item 14	Item 15	Item 16	Item 17	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24	Item 25	Item 26	Item 27	Item 28	Item 29	Item 30	Item 31	Item 32
Item 13	1.000																			
Item 14	0.118*	1.000																		
Item 15	0.182*	0.084	1.000																	
Item 16	0.146*	0.054	0.014	1.000																
Item 17	0.131*	-0.020	0.000	0.401*	1.000															
Item 18	-0.054	0.044	-0.026	0.085	0.097	1.000														
Item 19	-0.027	0.019	0.005	0.019	0.025	0.143*	1.000													
Item 20	0.106*	0.074	0.030	0.109*	-0.015	-0.095	0.024	1.000												
Item 21	0.212*	0.055	0.036	0.111*	0.090	0.024	0.096	0.057	1.000											
Item 22	0.152*	0.123*	0.044	0.151*	0.156*	-0.124*	0.023	0.048	0.094	1.000										
Item 23	0.275*	0.010	0.082	0.142*	0.070	-0.073	0.106*	0.110*	0.249*	0.236*	1.000									
Item 24	-0.027	0.162*	0.184*	0.080	-0.015	-0.007	0.022	0.124*	0.098*	0.065	0.120*	1.000								
Item 25	0.030	0.057	0.144*	0.133*	0.089	-0.026	-0.185*	0.065	0.107*	0.070	0.074	0.138*	1.000							
Item 26	0.118*	-0.042	0.058	0.136*	0.231*	0.056	0.007	-0.059	0.132*	0.015	0.078	0.105*	0.037	1.000						
Item 27	0.255*	0.126*	0.045	0.140*	0.158*	0.052	0.094	0.028	0.220*	0.063	0.250*	0.066	0.095	0.126*	1.000					
Item 28	0.123*	0.006	0.078	0.193*	0.165*	-0.178*	0.047	0.052	0.113*	0.209*	0.222*	0.010	-0.062	0.019	0.144*	1.000				
Item 29	0.017	0.004	0.002	0.150*	0.117*	0.045	0.046	0.012	0.134*	-0.015	0.157*	0.032	0.132*	0.080	0.156*	0.168*	1.000			
Item 30	0.010	0.063	0.022	0.070	-0.020	-0.007	0.018	0.098*	0.078	0.071	0.032	0.016	0.082	0.050	0.112*	0.097	0.115*	1.000		
Item 31	-0.002	0.098	-0.055	0.028	0.071	0.055	-0.022	0.008	0.123*	0.070	0.004	0.016	0.167*	-0.024	0.129*	0.082	0.052	0.133*	1.000	
Item 32	0.124*	0.148*	0.055	0.145*	0.191*	-0.087	-0.010	0.027	0.261*	0.188*	0.252*	0.097	0.158*	0.038	0.164*	0.200*	0.115*	0.024	0.088	1.000
Item 33	0.112*	0.088	0.082	0.105*	0.039	0.001	-0.001	0.016	-0.002	-0.000	0.068	0.044	0.125*	0.051	0.063	0.007	0.007	0.057	0.093	0.108*

*Coefficients are significant at $p < .05$ or greater. Degrees of freedom = 315. Significant values were .098 at $p < .05$ and .128 at $p < .01$ level.

**The following presents item numbers and their content as defined in the 1970 dairy survey. Item 13--Cows bred to a plus A. I. proof bull; Item 14--Heifers freshening at 24 to 27 months of age; Item 15--Cows allowed 60 days after calving before breeding; Item 16--Adequate forages provided last year; Item 17--High quality forages provided last year; Item 18--Adequate amount of improved pasture; Item 19-- Adequate summer pasture provided; Item 20--Feeding of an all-grain concentrate; Item 21--Grain fed according to production; Item 22--Use of the U. T. Forage Testing Lab; Item 23--Adequate milk production records maintained; Item 24--Sixty day dry period; Item 25--Twelve to 14 month calving interval; Item 26--Raise at least 75% of herd replacements; Item 27--Adequate herd records maintained; Item 28--Provide separate feeding and loafing areas; Item 29--Milking system checked every six months; Item 30--Use of strip cup before applying milkers; Item 31--Effective methods of fly control; Item 32--Obtained professional advice; and Item 33--Seventy-five percent of cows freshening in the fall.

Breeding cows to a plus A. I. proof bull was most highly related, in a positive direction, to use of the practice of maintaining adequate milk production records, Item 23 (r=.275). Some of the other practices having the highest correlation coefficients with breeding cows to a plus A. I. proof bull were: Item 27--maintaining adequate herd records (.225); Item 15--allowing cows 60 days after calving before breeding (.182); and, Item 22--use of the University of Tennessee Forage Testing Lab (.152).

In reviewing the practice of having heifers freshen at 24 to 27 months of age (Item 14), use of this practice was significantly related to the use of four other recommended production practices. Each of these relationships was in a positive direction. Dairymen who were using the practice of having heifers freshen at 24 to 27 months of age, also, tended to be using the following four practices (coefficients are also given): Item 22--use of the University of Tennessee Forage Testing Lab (.123); Item 24--maintaining a 60 day dry period (.162); Item 27--maintaining adequate herd records (.126); and Item 32--obtained professional advice (.148).

Results of the analysis of the practice of allowing cows 60 days after calving before breeding (Item 15), showed that this practice was used less in combination with any of the other 20 recommended practices, except for practice 21 (see Table II). Use of this practice was significantly related ($p<.05$ or greater) to the use of three of the other recommended production practices. Each of these related practices was in a positive direction.

Allowing cows 60 days after calving before breeding was most

highly related to use of the practice maintaining a 60 day dry period, Item 24 (r=.184). The other two practices having a high correlation with the practice of allowing 60 days after calving before breeding were: Item 16--adequate forages provided last year (r=.146); and Item 25--12 to 14 month calving interval (r=.144).

In reviewing the practice of providing adequate forages for the herd, Item 16, (see Table II) it was found that this practice was significantly related to the use of 13 of the other recommended practices with all of these relationships being in a positive direction.

The seven practices (i.e., score on their use) which were not significantly related to the use of the practice of providing adequate forages for the herd were as follows (coefficients are also given): heifers freshening at 24 to 27 months of age (-.020); cows allowed 60 days after calving before breeding (.000); providing adequate amounts of improved pasture (.085); providing adequate summer pasture (.019); maintaining a 60 day dry period (.080); use of a strip cup before applying milkers (.070); and maintaining effective methods of fly control (.028).

Providing adequate forages for the herd was most highly related to the use of the practice of providing high quality forages for the herd, Item 17 (r=.401). Some of the other practices having the highest correlation coefficients with providing adequate forages for the herd were: Item 28--providing separate feeding and loafing areas (.193); Item 22--use of the U. T. Forage Testing Lab (.151); Item 32--obtaining professional advice (.145); and Item 23--maintaining adequate milk production records (.142).

Table II indicates that the use of Item (practice) 17, defined as providing high quality forages for the herd, was significantly related to the use of six other recommended practices and each of these relationships was in a positive direction.

The providing of high quality forages for the herd was highly related to the practices of raising at least 75 percent of the herd replacements (r=.231) and, also, to Item 32--obtaining professional advice (r=.191). Some of the other practices having high correlation coefficients with providing quality forages for the herd were: Item 22--use of the University of Tennesssee Forage Testing Lab (.156); Item 27--maintaining adequate herd records (.158); and, Item 28--providing separate feeding and loafing areas (.165).

Results of the analysis of the practice of providing adequate amounts of improved pasture for the herd (Item 18) indicated that this practice was used in combination with only three other practices and the use of two of these three practices, as determined by the sign of its correlation coefficients, were in a negative direction. The two practices which were related to the practice of providing an adequate amount of improved pasture for the herd, but in a negative direction were: Item 28--providing separate feeding and loafing areas (r=.178); and, Item 22--use of the University of Tennessee Forage Testing Lab. Item 19, providing adequate summer pasture for the herd, was also significantly related to Item 18, but in a positive direction and exhibited a coefficient of .143. It is interesting to note that eight of the 20 items (practices) classified as being correlated with Item 18, providing adequate amounts of improved pasture for the herd, had negative coefficients.

The use of only four practices were found to be significantly related to the practice of providing adequate summer pasture for the herd (Item 19). All but one of these practices indicated a relationship in a positive direction. Use of this practice was significantly related to the use of the following practices: Item 16--adequate forages provided last year (.109); Item 13--cows bred to a plus A. I. proof bull (.106); Item 23--maintaining adequate milk production records (.106); and; each of these relationships was in a positive direction. However, one other practice was observed as being the most highly related practice to the use of practice 19. This was Item 25, defined as the allowing of a 12 to 14 month calving interval (r=.185). Yet, its relationship to the practice of providing adequate summer pasture for the herd was in a negative direction.

Results of the analysis of the practice of feeding of an all-grain concentrate (Item 20) showed that this practice was used in combination with the use of five other recommended practices and each of these relationships was in a positive direction. Feeding of an all-grain concentrate was most highly related, in a positive direction, to the practice of breeding cows to a plus A. I. proof bull (r=.212), and the practice of allowing cows a 60 day dry period (r=.124). This practice was also significantly related to three other practices: Item 16, Item 23, and Item 30.

In reviewing Item 21--the feeding of grain according to production, it was found that this practice was used more in combination with a larger number of practices than all but two of the 20 other practices. Use of this practice was significantly related ($p \leq .05$ or greater)

to the use of 14 of the other recommended practices. All but one of these relationships was in a positive direction.

The six practices which were not significantly related to the use of the practice of feeding grain according to production were as follows (coefficients are also given): allowing cows 60 days after calving before breeding (.044); providing adequate summer pasture (.023); feeding of an all-grain concentrate (.048); use of the University of Tennessee Forage Testing Lab (.094); use of a strip cup before applying milkers (.078); and having 75 percent of the cows freshening in the fall (.002).

Feeding grain according to production was most highly related to the use of three of the 14 remaining recommended practices. These were: obtaining professional advice (r=.261); maintaining adequate milk production records (r=.249); and maintaining adequate herd records (r=.220). Also, a negative relationship was found between the practice of feeding grain according to production and the practice of maintaining adequate amounts of improved pasture (r=.124).

Eight of the 20 recommended production practices were found to be significantly related in their use to the use of Item (practice) 22--use of the University of Tennessee Forage Testing Lab, and each of these eight relationships was in a positive direction. Four of these eight practices were highly related (i.e., score on their use) to the use of the practice of using the University of Tennessee Forage Testing Lab. These four highly related practices were (coefficients also given): breeding cows to a plus A.I. proof bull (.275); feeding grain according to production (.249); maintaining adequate milk production records (.236); and providing separate feeding and loafing areas (.209). The

other four significantly related practices were: Item 16--providing adequate forages; Item 19--providing adequate summer pasture; Item 20--feeding of an all-grain concentrate; and Item 32--obtaining professional advice.

In reviewing Table II, page 64, it was observed that the practice of maintaining adequate milk production records (Item 23) was significantly related to the use of nine of the other recommended practices. Each of these relationships was in a positive direction. This practice of maintaining adequate milk production records was found to be most highly related, in a positive direction, to the use of the practice of obtaining professional advice (r=.292); maintaining adequate herd records (r=.250); and providing separate feeding and loafing areas (r=.222).

Dairymen who were using the practice of maintaining adequate milk production records also tended to be using the practices of having heifers freshen at 24 to 27 months of age (Item 14); allowing cows 60 days after calving before breeding (Item 15); and having the milking system checked every six months.

The use of the practice of allowing cows a 60 day dry period was found to be significantly related to the use of only two other practices (see Table II). The use of the practice of maintaining a 12 to 14 month calving interval; and raising at least 75 percent of the herd replacements were found to be significantly related to the use of the practice of allowing cows a 60 day dry period. Each of these two practices exhibited a relationship in a positive direction and had coefficients of .138 and .105, respectively.

The use of three recommended practices were found to be significantly related to the use of Item 25--maintaining a 12 to 14 month calving interval; with each of these three relationships being in a positive direction. The use of the practice of maintaining a 12 to 14 month calving interval was found to be significantly related to the use of the practice of obtaining professional advice (r=.158); maintaining effective methods of fly control (r=.167); and having the milking system checked every six months (.132). However, the use of the practice of raising at least 75 percent of the herd replacements was found to be significantly related, and in a positive direction, to only the use of one other practice, Item 27, defined as maintaining adequate herd records and exhibiting a coefficient of .126.

Results of the analysis of the practice of maintaining adequate herd records (Item 27; see Table II, page 64) showed that this practice was used in combination with five other recommended practices and that each of these relationships was in a positive direction. Dairymen who were using the practice of maintaining adequate herd records also tended to be using the practices of obtaining professional advice (r=.164); having the milking system checked every six months (r=.156); providing separate feeding and loafing areas (.144); maintaining effective methods of fly control (.129); and the use of a strip cup before applying milkers (.112).

The use of Item 28--providing separate feeding and loafing areas was found to be significantly related ($p<.05$ or greater) to the use of four other recommended practices and each of these four relationships was in a positive direction. Providing separate feeding and loafing areas

was most highly related to the use of the practice of obtaining professional advice, coefficient of .200 (see Table II, page 64) and to the use of the practice of having the milking system checked every six months, coefficient of .168.

The practice of using a strip cup before applying milkers (Item 30) was found to be significantly related, and in a positive direction, to the use of each of three other recommended practices. The use of these three practices having high correlation coefficients with the use of the practice of using a strip cup before applying milkers involved the practices of maintaining a 12 to 14 month calving interval (.167); maintaining effective measures of fly control (.133); and maintaining adequate herd records (.129).

The practice of maintaining effective methods of fly control (Item 31) was found to be significantly related, $p < .05$ or greater, to the use of four of the other recommended production practices. Each of these relationships was in a positive direction. Maintaining effective methods of fly control was most highly related to the use of the practice of providing separate feeding and loafing areas (r=.200).

Dairymen who were using the practice of maintaining effective methods of fly control also tended to be using the practices of: maintaining a 12 to 14 month calving interval; maintaining adequate herd records; and having the milking system checked every six months (see Table II).

The use of Item 32--obtaining professional advice, was found to be significantly related to the use of only two other recommended practices. Dairymen who were using the practice of obtaining professional

advice also tended to use the practice of maintaining a 12 to 14 month calving interval (.129), and having at least 75 percent of their cows freshening in the fall (.108).

Interrelationships Between the Use of Each of 22 Qualitative Dairy Production Practices by 621 Grade A Dairymen in 32 Tennessee Counties During FY 1975

Table III shows the interrelationship (correlation coefficients, r) between the use of each of the 21 recommended dairy production and management practices in 1975 by the 621 Grade A dairymen in 32 of Tennessee's major dairy counties. The purpose of this analysis was to determine which of the practices tended to be used in combinations with other practices.

Results of the analysis of the practice of having a silo (Item 21) showed that this practice was used in combination with four other recommended practices. Each of the four practices significantly related to the practice of having a silo, indicated a relationship in a positive direction. These practices included (coefficients also given): Item 32--do you double crop corn and small grains for silage (.120); Item 34--are silage and hay tested by a lab (.136); Item 47--were cows fed grain according to production (.122); and Item 101--is fore-milk removed from each quarter before milkers are applied (.137). It is also interesting to note that nine of the 22 practices not significantly related to the use of the practice of having a silo had negative coefficients.

In reviewing Table III and the practice of having the milking machine checked every six months for pulsation and vaccine (Item 28), it

TABLE III

INTERRELATIONSHIPS BETWEEN THE USE OF EACH OF 22 QUALITATIVE DAIRY PRODUCTION PRACTICES BY 621 GRADE A DAIRYMEN IN 1975

	Item 21	Item 28	Item 32	Item 34	Item 36	Item 37	Item 45	Item 46	Item 47	Item 57	Item 59	Item 82	Item 89	Item 97	Item 98	Item 99	Item 100	Item 101	Item 102	Item 103	Item 104
Item 21	1.000																				
Item 28	0.035	1.000																			
Item 32	0.120*	0.117*	1.000																		
Item 34	0.136*	0.114*	0.141*	1.000																	
Item 36	-0.003	0.065	-0.031	0.053	1.000																
Item 37	-0.033	0.041	0.050	0.035	0.024	1.000															
Item 45	0.039	0.165*	0.047	0.120*	0.121*	0.000	1.000														
Item 46	-0.019	0.070	-0.034	0.154*	0.091*	0.044	0.094*	1.000													
Item 47	0.122*	0.086	0.105*	0.148*	-0.028	0.059	-0.037	0.070	1.000												
Item 57	0.052	0.170*	-0.054	-0.046	0.074	0.057	0.071	0.017	0.221*	1.000											
Item 59	0.012	0.156*	0.042	0.085	0.141*	-0.029	0.159*	0.071	0.093*	0.174*	1.000										
Item 82	-0.035	0.101*	0.008	0.088*	0.119*	-0.015	0.080	-0.002	0.128*	0.230*	0.475*	1.000									
Item 89	-0.041	0.063	-0.066	-0.002	-0.000	0.014	-0.012	-0.013	0.058	0.138*	0.025	0.064	1.000								
Item 97	-0.034	0.073	0.052	0.042	0.043	-0.000	-0.047	0.096*	0.004	0.005	-0.003	0.068	0.131*	1.000							
Item 98	-0.062	0.138*	0.040	-0.101*	0.082	0.096*	-0.006	0.047	0.165*	0.145*	0.048	0.074	0.102*	0.000	1.000						
Item 99	-0.013	0.140*	-0.026	-0.078	0.016	0.027	0.060	-0.014	0.072	0.199*	0.072	0.063	0.035	0.104*	0.119*	1.000					
Item 100	0.024	0.132*	-0.044	-0.012	0.079	0.096*	0.090*	0.008	0.184*	0.172*	0.119*	0.124*	0.166*	0.035	0.306*	0.084	1.000				
Item 101	0.137*	0.172*	0.041	0.004	0.057	0.142*	0.015	0.028	0.183*	0.211*	0.054	0.125*	0.111*	-0.008	0.250*	0.101*	0.318*	1.000			
Item 102	-0.010	0.033	0.084	-0.006	-0.002	0.084	0.023	-0.008	0.035	-0.040	-0.022	-0.042	0.045	0.036	0.005	-0.002	0.052	0.054	1.000		
Item 103	0.005	0.061	0.028	-0.006	0.125*	0.007	0.097*	0.043	0.039	0.040	0.095*	0.058	0.048	-0.038	0.016	0.025	-0.059	0.000	-0.059	1.000	
Item 104	0.028	0.136*	0.070	0.025	0.040	0.035	0.124*	0.079	0.129*	0.114*	0.156*	0.167*	0.102*	0.038	0.076	0.068	0.098*	0.158*	0.097*	-0.027	1.000
Item 105	0.051	0.157*	0.075	0.131*	0.018	0.079	0.093*	0.040	0.182*	0.205*	0.192*	0.152*	0.046	0.046	0.052	0.018	0.056	0.164*	0.098*	-0.021	0.309*

*Coefficients are significant at $p<.05$ or greater. Degrees of Freedom = 620. Significant values were .088 at $p<.05$ level and .115 at $p<.01$ level.

**The following presents qualitative item numbers and their item content as defined in the 1975 survey. Item 21--Do you have a silo; Item 28--Is milking machine checked for pulsation and vacuum; Item 32--Do you double crop corn and small grains for silage; Item 34--Are silage and hay tested by a lab; Item 36--Did you have all the pasture needed last summer; Item 37--Is one acre of supplemental pasture provided per four cows; Item 45--Were cows fed all the hay and silage they could eat; Item 46--Was an all-grain concentrate fed; Item 47-- Were cows fed grain according to production; Item 57--Are cows in heat removed from the herd; Item 59--Are dry cows kept separate from the herd; Item 82--Are cows ready to calve kept separate from the herd; Item 89--Do you have an effective system for fly control; Item 97--Do you milk at regular hours; Item 98--Are cows with mastitis milked last; Item 99--Is udder washed with a warm sanitizing solution; Item 100--Do you dry each udder with an individual service towel; Item 101--Is fore-milk removed from each quarter before milkers are applied; Item 102--Do you begin milking at least two minutes after washing; Item 103--Do you strip cows with the machine; Item 104--Do you dip each teat in a sanitizing solution after milking; Item 105--Do you treat each quarter with a history of mastitis.

was found that this practice, and Item 57 (removing cows in heat from the herd), were used more in combination with a larger number of practices than were any of the other 22 practices. Use of this practice (Item 28) was significantly related ($p<.05$ or greater) to the use of 13 of the other recommended practices. Each of these relationships was in a positive direction.

The nine practices (i.e., score on their use) which were not significantly related to the practice of having the milking machine checked every six months were as follows (coefficients are also given): having all the pasture needed last summer (.065); providing one acre of supplemental pasture per four cows (.041); feeding of an all-grain concentrate (.070); feeding grain according to production (.086); maintaining an effective system of fly control (.063); milking at regular hours (.073); beginning to milk at least two minutes after washing (.033); and stripping cows with machine (.061).

Having the milking machine checked every six months was most highly related to the use of the practice of removing fore-milk from each quarter before applying milkers ($r=.172$). Some of the other practices having the highest correlation coefficients with the practice of having the milking machine checked every six months were: removing cows in heat from the herd (.170); feeding all the hay and silage cows could eat (.;65); and keeping dry cows separate from the herd (.156).

Item 32--double cropping corn and small grains for silage was found to be significantly related in use to the use of four other recommended practices. Each of these relationships was in a positive direction. The practice of double cropping corn and small grains for silage

was found to be related to, and in combination with, the use of the practices of: having the milking machine checked every six months (.114); having silage and hay tested by a lab (.141); and the feeding of grain according to production (.105).

In reviewing the use of the practice of having silage and hay tested by a lab (Item 34, Table III) it was found that dairymen who used this practice also tended to be using 6 other recommended practices as well. Two practices, of the six, were highly significant to the use of the practice of having silage and hay tested by a lab, and each relationship was in a positive direction. These were the use of the practices of feeding an all-grain concentrate (r=.154), and feeding grain according to production (r=.148). Also, the use of one practice was significantly related to the practice of having hay and silage tested by a lab, yet, in a negative direction. This was the practice of milking cows with mastitis last (-.103).

The practice of having all the summer pasture needed for the herd (Item 36) was found to be significantly related in use to the use of five other recommended practices. These significantly related ($p < .05$ or greater) practices were: feeding all the hay and silage cows could eat (.121); feeding of an all-grain concentrate (.091); keeping dry cows separate from the herd (.141); keeping cows ready to calve separate from the herd (.119); and stripping cows with the machine (.125). Each of these relationships was in a positive direction.

Results of the analysis of the practice of providing one acre of supplemental pasture per four cows (Item 37, Table III) showed that the use of this practice was used in combination with the use of six other

practices with all relationships being in a positive direction. Dairymen using the practice of providing one acre of supplemental pasture per four cows also tended to use the practices of: having the milking machine checked every six months (r=.165); keeping dry cows separate from the herd (r=.141); and stripping cows with the machine (r=.125).

Eight of the 22 recommended practices were found to be related in use to the use of the practice of feeding cows all the hay and silage they could eat (Item 45). Of these eight significantly related practices, the use of three practices was most highly related (based on their correlation coefficients) to the use of the practice of feeding all the hay and silage the cows could eat. These practices were: Item 59--keeping dry cows separate from the herd (.159); Item 34--having silage and hay tested by a lab (.154); and Item 104--dipping each teat in a sanitizing solution after milking (.124).

It was found that the practice of feeding an all-grain concentrate (Item 46) and the practice of milking at regular hours (Item 97), each were significantly related ($p < .05$ or greater) to the use of only one other of the 22 recommended practices. The practice of feeding an all-grain concentrate to the herd was found to be significantly related in use to the practice of milking at regular hours (r=.096). However, the use of the practice of milking at regular hours (Item 97) was found to be related, and in a positive direction, to the use of the practice of washing the udder with a warm sanitizing solution (Item 99, r=.104).

Dairymen using the practice of feeding grain according to production (Item 47) also tended to be using a combination of nine of the other recommended practices, each in a positive direction (see Table III).

Of the nine significantly related practices to the use of the practice of feeding grain according to production, three practices were observed to be highly related in use to this practice (i.e., score on their use). These four highly related practices involved the use of removing cows in heat from the herd (r=.221); drying each udder with an individual service towel (r=.184); removal of fore-milk from each quarter before applying milkers (r=.183); and treating each quarter with a history of mastitis (r=182).

Results of the analysis of the practice of removing cows in heat from the herd (Item 47) showed that this practice, and Item 28, were used more in combination with a larger number of practices than was any of the other 22 practices. Use of this practice was significantly related ($p < .05$ or greater) to the use of 13 of the other recommended practices. Each of these relationships was in a positive direction.

The nine practices (i.e., score on their use) which were not significantly related to the use of the practice of removing cows in heat from the herd were as follows (coefficients are also given): having a silo (.012); double cropping corn and small grains for silage (.042); having silage and hay tested by a lab (.085); providing one acre of supplemental pasture per four cows (-.029); feeding an all-grain concentrate (.071); milking at regular hours (.005); beginning to milk at least two minutes after washing (-.040); and stripping cows with the machine (.040).

Removing cows in heat from the herd was most highly related to the use of the practice of keeping cows ready to calve separate from the herd (r=.230).

Table III indicates that the use of the practice of keeping dry cows separate from the herd (Item 59) was found to be significantly related to the use of 10 other practices, and these relationships were all in a positive direction. The two highest related practices of keeping dry cows separate from the herd were the practices of keeping cows ready to calve separate from the herd (r=.475) and the practice of removing cows in heat from the herd (r=.230).

Item 82--keeping cows ready to calve separate from the herd was found to be significantly related in use to the use of four other practices, and each of these four relationships were in a positive direction. These four significantly related practices to the practice of keeping cows ready to calve separate from the herd were: Item 100--drying each udder with an individual service towel (.124); Item 101--removal of fore-milk from each quarter before applying milkers (.125); Item 104--dipping each teat in a sanitizing solution after milking (.167); and Item 105--treating each quarter with a history of mastitis (.152).

However, it was found that the practice of maintaining effective methods of fly control (Item 89) was used in combination with the use of five other significantly related practices (see Table III). The most highly related, and in a positive direction, practice to the use of the practice of maintaining effective methods of fly control was the practice of drying each udder with an individual service towel (Item 100, r=.166).

Dairymen using the practice of milking cows with mastitis last (Item 98) also tended to be using four other recommended practices. Of the use of these four significantly related practices, two practices, as

seen by their correlation coefficients, were highly related to the practice of milking cows with mastitis last. These practices were drying each udder with an individual service towel (r=.306) and removal of fore-milk from each quarter before applying milkers (r=.250).

In reviewing Table III, page 74, it was found that the practice of washing the udder in a warm sanitizing solution (Item 99) was significantly related, and in a positive direction, to the use of four other practices. These practices, and their coefficients, included the use of the practice of keeping cows ready to calve separate from the herd (.124); maintaining effective methods of fly control (.166); milking cows with mastitis last (.306); and the removal of fore-milk from each quarter before applying milkers (.101).

It was also found that the use of six recommended practices were significantly related to the use of the practice of drying each udder with an individual service towel (Item 100). Of these six significantly related practices, two practices were highly related in use, and in a positive direction, to the practice of drying each udder with an individual service towel. These two practices, and their coefficients were: milking cows with mastitis last (.250) and removal of fore-milk from each quarter before applying milkers (.338).

Dairymen using the practice of removing fore-milk from each quarter before applying milkers were also found to be using two other recommended practices (see Table III). The practice of dipping each teat in a sanitizing solution after milking and the practice of treating each quarter with a history of mastitis were found to be significantly related, and in a positive direction, to the use of the practice of removing

fore-milk from each quarter before applying milkers. The correlation coefficients for these two related practices were .097 and .098, respectively.

Results of the analysis of the practice of stripping cows with the machine (Item 103) showed that this practice was used in combination with five of the 22 recommended practices. The two highest related practices to the use of the practice of stripping cows with the machine were Items 101--removal of fore-milk before applying milkers (r=.164) and Item 82--keeping of cows ready to calve separate from the herd (r=.152).

It was also observed that the practice of dipping each teat in a sanitizing solution (Item 104) after milking was significantly related in use of four other practices. Those four practices related to the practice of dipping each teat in a sanitizing solution after milking, and related in a positive direction, were the practices of: keeping cows ready to calve separate from the herd (r=.152); removal of fore-milk from each quarter before applying milkers (r=.164); beginning to milk at least two minutes after washing (r=.098); and treating each quarter with a history of mastitis (r=.309).

Interrelationships Between the Use of Each of 16 Quanitative Dairy Production Practices by 621 Grade A Dairymen in 32 Tennessee Counties During FY 1975

Table IV shows the interrelationship (correlation coefficients, r) between the scores regarding the use of each of the 16 recommended dairy production and management practices in 1975 by the 621 Grade A

TABLE IV

INTERRELATIONSHIPS BETWEEN THE USE OF EACH OF 16 QUANTITATIVE DAIRY PRODUCTION PRACTICES BY 621 GRADE A DAIRYMEN IN 1975

	Correlation Coefficients Between Items (Practices)**														
	Item 33	Item 39	Item 40	Item 41	Item 51	Item 56	Item 60	Item 61	Item 62	Item 63	Item 81	Item 83	Item 84	Item 85	Item 86
Item 33	1.000														
Item 39	0.056	1.000													
Item 40	0.139*	0.111*	1.000												
Item 41	0.075	0.058	0.169*	1.000											
Item 51	0.039	0.102*	0.047	0.094*	1.000										
Item 56	0.093*	0.105*	0.649*	0.085	0.295*	1.000									
Item 60	0.031	-0.051	0.041	0.035	0.038	0.072	1.000								
Item 61	-0.075	-0.042	-0.099*	-0.070	-0.080	0.037	-0.026	1.000							
Item 62	0.002	0.077	0.055	0.045	0.264*	0.126*	0.177*	-0.099*	1.000						
Item 63	0.178*	0.054	0.044	0.017	-0.017	0.104*	0.028	0.034	0.034	1.000					
Item 81	0.050	0.009	0.056	0.160*	0.094*	0.385*	0.088*	0.064	0.045	-0.005	1.000				
Item 83	0.089*	0.023	0.014	0.219*	0.150*	0.189*	-0.005	-0.064	0.062	-0.022	0.066	1.000			
Item 84	-0.059	-0.023	-0.008	0.066	0.111*	0.012	0.001	-0.007	0.057	-0.026	0.009	0.119*	1.000		
Item 85	-0.004	0.073	0.064	0.137*	0.118*	0.069	-0.034	-0.017	0.099*	0.068	-0.078	0.145*	0.242*	1.000	
Item 86	0.060	0.066	0.084	0.013	0.100*	0.095*	-0.027	-0.013	0.068	0.049	0.084	0.053	0.014	0.017	1.000
Item 87	0.031	0.043	0.020	0.115*	0.260*	0.123*	0.039	-0.073	0.077	-0.043	0.086	0.188*	0.040	0.085	0.151*

*Coefficients are significant at $p < .05$ or greater. Degrees of Freedom = 620. Significant values were .088 at $p < .05$ level and .115 at $p < .01$ level.

**Quantitative items and their contents are defined as follows: Item 33--What percent of silage is cut in the dent stage of maturity; Item 39--What percent of the pasture is grazed rotationally; Item 40--What percent of the pasture is clipped each year; Item 41--What percent of the pasture is limed and fertilized according to soil test; Item 51--What percent of the herd is bred by A. I.; Item 56--Times per day herd is checked for heat; Item 60--What percent of the cows have at least a 40 day dry period; Item 61--What percent of the cows have at least a 60 day dry period; Item 62--What percent of the cows have at least 60 days after calving before breeding; Item 63--What percent of the heifers freshen at 24 to 27 months of age; Item 81--Times per day cows ready to calve are checked; Item 83--What percent of heifers are treated at birth with a navel disinfectant; Item 84--What percent of the heifers are fed milk replacer; Item 85--What percent of the heifers are fed calf starter until 4 months of age; Item 86--What percent of the heifers are fed grain between the ages of 4 and 10 months of age; Item 87--What percent of the heifers are identified to sire at birth.

dairymen in 32 of Tennessee's major dairy counties. The purpose of this analysis was to determine which of the practices tended to be used in combination with other practices.

Results of the analysis of the practice of what percent of one's silage is cut in the dent stage of maturity (Item 33) showed that this practice was used in combination with four other recommended practices. The use of this practice was significantly related ($p<.05$ or greater) to the four other practices and each relationship was in a positive direction. Dairymen who were using the practice of cutting their silage while in the dent stage of maturity, also tended to be using the practices of (coefficients also given) having heifers freshen at 24 to 27 months of age (.178); clipping a certain percent of the pasture (.139); times per day herd is checked for heat (.093); and treating heifers at birth with a navel disinfectant (.089).

The use of the practice of grazing pasture rotationally (Item 39) was found to be significantly related to the use of four of the 16 other recommended practices. Grazing pasture rotationally was found to be highly related, and in a positive direction, to the use of the practices of: clipping pasture ($r=.111$); cutting silage while in the dent stage of maturity ($r=.139$); the percentage of the herd bred by artificial insemination ($r=.102$); and the number of times per day the herd was checked for heat ($r=.105$).

Likewise, Item 40, defined as the use of the practice of clipping pasture, was observed to be significantly related to the use of only three of the 16 recommended practices, and the relationships between these practices were positive and negative. Item 61, defined as the

percentage of cows with at least a 60 day dry period, was found to be significantly related to the use of the practice of clipping pasture, but was in a negative direction (r=-.099).

However, the practice of clipping pasture was found to be positive in direction and significantly related to the use of two practices. These were: Item 41--percent of pasture limed and fertilized according to soil test; and Item 56--times per day herd is checked for heat. Item 56 was observed to be highly significantly related to the use of the practice of clipping pasture by exhibiting a correlation coefficient of .649.

In reviewing Table IV, it was found that the use of the practice of having pasture limed and fertilized according to soil test (Item 41) was significantly related, and in a positive direction, to the use of six other recommended practices. The use of the practice of having pasture limed and fertilized according to soil tests was found to be highly significant with the use of the practice of treating heifers at birth with a navel disinfectant (Item 83, r-.219).

Dairymen who were using the practice of liming and fertilizing pasture according to soil tests also tended to be using the practices of: grazing pasture rotationally (.102); having a percent of the herd bred by A. I, (.094); checking cows ready to calve (.160); feeding heifers calf starter between the ages of four and ten months (.137); and identifying heifers to sire at birth (.115).

Results of the analysis of the practice of what percentage of the herd is bred by artificial insemination (Item 51) showed this practice was used more in combination with a larger number of the other

practices than was any of the other 16 practices. Use of this practice was significantly related ($p<.05$ or greater) to the use of 11 of the other recommended practices. Each of these relationships was in a positive direction.

The four practices (i.e., score on their use) which were not significantly related to the use of the practice of breeding cows in the herd by artificial insemination were as follows (coefficients are also given): percentage of pasture limed and fertilized based on soil tests (.085); percentage of cows with at least a 40 day dry period (.038); percentage of cows with at least a 60 day dry period (-.080); and the percentage of heifers freshening at 24 to 27 months of age (-.017).

Breeding cows in the herd by artificial insemination was most highly related to use of the practice of clipping pasture each year (Item 40, r=.649). Some of the other practices having the highest correlation coefficients with breeding cows by artificial insemination were: times per day herd is checked for heat (.295); percent of heifers identified to sire at birth (.260); and percent of cows with at least 60 days after calving before breeding (.264).

In reviewing Table IV, it was found that the use of the practice of checking the herd daily for heat (Item 56) was significantly related to the use of six other practices, and each relationship was in a positive direction. It was observed that the use of the practice of checking the herd daily for cows ready to calve (Item 81, r=.385) was the most highly related of six other practices to the practice of checking the herd daily for heat. The other practices significantly related

in their use to the practice of checking the herd daily for heat were as follows: percent of heifers treated at birth with a navel disinfectant; percent of cows with at least 60 days after calving before breeding; percent of heifers freshening at 24 to 27 months of age; percent of heifers fed grain according to production; and the percent of heifers identified to sire at birth.

Only the use of two recommended practices were found to be significantly related, in a positive direction, to the practice of allowing cows at least a 40 day dry period (Item 60). These significantly related practices were defined as allowing cows at least a 60 day dry period (.177) and times per day cows ready to calve are checked (.088).

However, nine of the 16 practices related to the use of allowing cows at least a 40 day dry period were observed as being in the negative direction, and not significantly related to the use of this practice. Yet, one practice, Item 40, defined as the clipping of pasture each year was related to the practice of allowing cows at least a 40 day dry period, but was in a negative direction based upon its correlation coefficient (-.099).

The use of four practices were found to be in combination with the use of the practice of allowing cows at least a 60 day dry period. However, only one of these four practices was highly related, and in a positive direction, in use to the practice of allowing cows a 60 day dry period. This was the practice of breeding cows by artificial insemination (r=.264). Also, it was found that the use of one practice was significantly related to the practice of allowing cows a 60 day dry

period, but in a negative direction. This practice was Item 62, defined as allowing cows at least 60 days after calving before breeding, with a coefficient of -.099.

Only the use of two practices was found to be in combination with the use of the practice of allowing cows at least 60 days after calving before breeding (Item 62, see Table IV, page 82). These significantly related practices, both in a positive direction were: cutting silage in the dent stage of maturity (.178) and checking the herd daily for heat (.104).

The practice of having heifers freshen at 24 to 27 months of age was found to be significantly related in use to five other recommended practices, all in a positive direction. Having heifers freshen at 24 to 27 months of age (Item 63) was most highly related to the use of the practice of checking the herd daily for heat (r=.385). Dairymen who were using the practice of having heifers freshen at 24 to 27 months of age, also tended to be using the practices of liming and fertilizing pasture based on soil tests; breeding cows by artificial insemination; and allowing cows at least a 40 day dry period.

The use of four recommended practices, all in a positive direction, were found to be significantly related to the use of the practice of checking cows ready to calve daily (Item 81, see Table IV). The practice of liming and fertilizing pasture based on soil tests (r=.219) was the most highly related practice in use to the practice of checking cows ready to calve daily. Also, three other practices were significantly related ($p<.05$ or greater) to the practice of checking cows ready to calve daily. These were Items 33--cutting silage in the dent stage

of maturity (.089), and Item 56--checking the herd daily for heat (.189).

On the other hand, the practice of treating heifers at birth with a navel disinfectant (Item 83) was found to be significantly related in use to the use of four other recommended practices, and in a positive direction. These practices included (coefficients also given) breeding cows by A. I. (.111); feeding heifers milk replacer (.119); feeding heifers calf starter until four months of age (.145); and identifying heifers to sire at birth (.188).

Results of the analysis of the practice of feeding heifers milk replacer (Item 84) showed that this practice was used in combination with five other recommended practices. Each of these relationships was in a positive direction (see Table IV, page 82). However, the most highly related practice to the use of the practice of feeding heifers milk replacer was the practice of feeding heifers calf starter until four months of age (r=.242).

The use of the practice of feeding calf starter until four months of age (Item 85) was found to be significantly related to only one of the 16 recommended practices and this was the practice of checking the herd daily for cows in heat (Item 56, r=.095). On the other hand, the use of the practice of feeding grain to heifers between the ages of four and 10 months (Item 86) was found to be used in combination with five other practices.

Dairymen using the practice of feeding heifers grain between the ages of four and ten months of age also tended to use the practices of (coefficients also given) identifying heifers to sire at birth (.191);

treating heifers at birth with a navel disinfectant (.188); checking the herd daily for cows in heat (.126); and breeding cows by artificial insemination (.260).

II. DESCRIPTION AND INTERPRETATION OF 21 FACTORS IDENTIFIED BY FACTOR ANALYSIS OF DATA ON GRADE A DAIRYMEN'S USE OF RECOMMENDED DAIRY PRACTICES IN FY 1970 AND IN FY 1975

Results of factor analysis of data regarding the use of 21 recommended dairy practices in FY 1970 and in FY 1975 by Grade A dairymen in 32 major dairy counties in Tennessee are presented in this section. The purpose of this analysis was to determine which measured characteristics varied together as a basis for reducing the number of practices with which to operate. Another purpose was to make an interpretation of common factors underlying the use of practices by taking note of practices which had substantial loadings in common in each factor in contrast to other practices which had low loadings.

Items Used to Identify Seven Factors, Their Factor Loadings, Subject Area to Which Initially Assigned, and Item (Practice) Content Observed From Whether or Not Producers Were Using Each of 21 Practices in FY 1970

Table V shows the practices loaded most heavily on each of the seven factors. Table XIV in Appendix G shows the factor loadings of all 21 of the practices for each of the seven factors.

Factor I. Practices which showed the lowest loading on this factor were: use of strip cup (.003); feeding an all-grain concentrate

TABLE V

ITEMS USED TO IDENTIFY 7 FACTORS, THEIR FACTOR LOADINGS, SUBJECT AREAS TO WHICH INITIALLY ASSIGNED, AND ITEM CONTENT OBSERVED FROM 21 ITEMS DEFINED IN THE 1970 GRADE A DAIRY MILK PRODUCTION PRACTICE CHECKLIST SURVEY

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
	Factor I--General Herd Management*			Factor II--Breeding Management and Record Keeping*			
17	.770	Forage Production	High quality forages provided last year.	13	.818	Use of A. I.	Cows bred to a plus A. I. proof bull.
16	.525	Forage Production	Adequate forages provided last year.	27	.175	Record Keeping	Adequate herd records maintained.
26	.282	Herd Management	Raise at least 75% of herd replacements.	23	.151	Record Keeping	Adequate milk production records maintained.
28	.176	Herd Management	Provide separate feeding and loafing areas.	15	.147	Breeding Management	Cows allowed 60 days after calving before breeding.
18	.174	Pasture Management	Adequate amount of improved pasture.	24	-.127	Herd Management	60 day dry period.

TABLE V (Continued)

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
	Factor III--Forage Feeding Practices*				Factor IV--Length of Calving Interval*		
28	.483	Herd Management	Provide separate feeding and loafing areas.	25	.616	Herd Management	12 to 14 month calving interval.
18	-.479	Pasture Management	Adequate amount of improved pasture.	19	-.397	Pasture Management	Adequate summer pasture provided.
22	.358	Forage Production	Use of the U. T. forage testing lab.	18	-.164	Pasture Management	Adequate amount of improved pasture.
32	.263	Herd Management	Obtained professional advice.	31	.146	Herd Management	Effective measures of fly control.
23	.253	Record Keeping	Adequate milk production records maintained.	32	.131	Herd Management	Obtained professional advice.

TABLE V (Continued)

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
	Factor V--Herd and Breeding Management*				Factor VI--Herd Management and Record Keeping*		
24	.558	Herd Management	60 day dry period.	21	.496	Feeding Practices	Grain fed according to production.
15	.323	Breeding Management	Cows allowed 60 days after calving before breeding.	23	.479	Record Keeping	Adequate milk production records maintained.
19	.199	Pasture Management	Adequate summer pasture provided.	32	.439	Herd Management	Obtained professional advice.
25	.197	Breeding Management	12 to 14 month calving interval.	27	.377	Record Keeping	Adequate herd records maintained.
14	.180	Breeding Management	Heifers freshening at 24 to 27 months of age.	29	.250	Milking Practices	Milking system checked every 6 months.

TABLE V (Continued)

Item	Loading**	Subject Area	Item Content
		Factor VII--Heifer Management*	
14	.501	Breeding Management	Heifers freshening at 24 to 27 months of age.
31	.259	Herd Management	Effective methods of fly control.
32	.224	Herd Management	Obtained professional advice.
22	.181	Forage Production	Use of the U. T. forage testing lab.
33	.136	Breeding Management	75% of cows freshening in the fall.

*The name assigned to each factor is an interpretation, based upon the content of items which showed the highest loadings on the factor in contrast to other practices which have low loadings.

**Factor loadings are approximately equivalent to a correlation between a measure (practice score) and the underlying factor. The square of any particular loading indicates the proportions of variation in practice use that was accounted for by the factor.

(-.099); allowing cows 60 days after calving before breeding (.022); heifers freshen at 24 to 27 months of age (-.025); and control of flies in the milking area (see Table XIV in Appendix G). The following practices showed the highest loadings on this factor (Table V): high quality forages provided last year (.770); adequate forages provided last year (.525); raised at least 75 percent of herd replacements (.282); provided separate feeding and loafing areas (.176).

Factor I accounted for 88 percent of the variance in the use of the two highest loaded practices (providing high quality and adequate amounts of forages). The following of these two recommended practices would seem to require a great deal of general management ability. The other two highest loaded practices were initially assigned to the subject area of herd management which suggest that the common factor underlying these practices may be interpreted as general management. Some of the practices which showed very low loadings on the factor lends further support to this hypothesis. These weak loadings appear to be more specific types of herd management. For these reasons, the common variance underlying this factor was interpreted as General Herd Management.

Factor II. Six practices showed low loadings on this factor and these six relationships were all in a negative direction (see Table XIV, Appendix G). These low practices were identified as maintaining adequate amounts of improved and summer pasture; 60 day dry period; maintaining a 12 to 14 month calving interval; raising at least 75 percent of the herd replacements; maintaining adequate herd records, having the

milking system checked every six months; maintaining effective means of fly control and obtaining professional advice. The following practices showed the highest loadings on this factor (Table V): cows bred to a plus A. I. proof bull (.818); adequate herd records maintained (.175); and adequate milk production records maintained (.151).

Factor II accounted for 69 percent of the variance in the use of the highest loaded practice (breeding cows to a plus A. I. proof bull). This practice also contained the highest overall loadings of any of the 35 items loaded on the seven factors. The other three highest loaded practices were initially assigned to the subject areas of record keeping and breeding management which suggest that the common factor underlying these practices may be interpreted as a combination of these two subject areas. The simularity of the two practices assigned to the subject areas of record keeping and the simularity of the practice of breeding cows to a plus A. I. proof bull being considered as a type of breeding management practice, this factor was interpreted as Breeding Management and Record Keeping.

Factor III. Factor III did not present the ease of identification so apparent in the previous factors. The items used to identify this factor are shown in Table V. A review of the three highest loaded items on this factor suggest that these items were measuring some type of feeding practices.

Factor III accounted for 45 percent of the variance in the use of the two highest loaded practices (providing separate feeding and loafing areas and maintaining adequate amounts of improved pasture). The next highest loaded practice was initially assigned to the subject area

of forage production which suggest that the common factor underlying these practices may be interpreted as generally involving some type of forage production. Due to the content of these three practices, Factor III was identified as Forage Feeding Practices.

Factor IV. Three of the seven significantly loaded practices on this factor were found to indicate relationships in a negative direction (see Table XIV, Appendix G). These practices were: providing adequate amounts of improved pasture (-.164); providing adequate amounts of summer pasture (-.397); and providing separate feeding and loafing areas (-.134). However, it was found that three practices, loaded significantly on Factor IV (see Table V), were initially assigned to the subject area of herd management which suggests that the common factor underlying these practices may be interpreted as some type of management procedure.

One practice (maintaining a 12 to 14 month calving interval) indicated a higher loading on the factor itself than any of the other five significantly loaded practices, and a review of the item content suggested that a management procedure was under question. This practice (Item 25) seemed to constitute an ability to plan the herd calving interval around a three or four month period. Therefore, due to the high loading of this practice on the factor, Factor IV was interpreted as Length of Calving Interval.

Factor V. The practices used to identify Factor V are shown in Table V. The content of these items seemed to possess the common

characteristic of measuring some type of herd management or breeding management procedures.

The first three highest loaded practices on Factor V accounted for 49.8 percent of the variance accounted for by the factor. The practices were: allowing a 60 day dry period (.558); allowing cows 60 days after calving before breeding (.323); and providing adequate summer pasture (.199). The two other highest loaded practices were initially assigned to the subject area of breeding management which suggests that the common factor underlying these practices may be interpreted as herd and breeding management. For these reasons, the common variance underlying this factor was interpreted as Herd and Breeding Management.

Factor VI. Table V shows the practices loaded most heavily on Factor VI. It was found that all five of these practices were heavily loaded on the factor as judged from the size of the loading coefficients. Subject areas initially assigned to the three highest loading practices were distinctly different, yet all suggested the underlying interpretation of herd management. In reviewing the content of these three highly loaded practices (grain fed according to production; maintaining adequate milk production records; and obtaining professional advice) it was suggested also that a common characteristic of the use of various herd management practices was being observed.

The subject areas initially assigned to two of the five highest loading practices were similar in that they both pertained to the area of record keeping. The two practices, in content, classified by the subject area of record keeping indicated loadings on Factor VI of .479

and .377. All five of these practices seemed to indicate the observation of keeping herd records, obtaining professional advice, and as observed from Table XIV, Appendix G, some of the practices were significantly related to feeding and milking practices. This factor, therefore, implied the ideas of Herd Management and Record Keeping, and was identified as such.

Factor VII. Five practices, their item content, loading, and subject area to which initially assigned used to identify Factor VII are found in Table V, page 89. One practice, the practice of having heifers freshening at 24 to 27 months of age, was the most highly loaded (.501) of the five practices significantly loaded on Factor VII.

In reviewing the subject areas initially assigned to these five practices, it was found that two practices were classified as to the subject area of breeding management and two practices were classified to the subject area of herd management suggesting some underlying characteristic of management techniques.

For this reason, and the high loading of one practice (heifer freshening at 24 to 27 months of age) the common variance underlying this factor was interpreted as Heifer Management.

Summary and Interpretation of Factor Loadings for Items Defined in the 1970 Grade A Dairy Survey

The purpose of this sub-section is to identify various recommended dairy production practices which were highly, and significantly, loaded on seven factors (identified in the previous sub-section) as to their ability to measure practice use and subject area content for

questions involving dairy production and management concepts.

One of the initial objectives of this study was the observations of practices as to their use among dairymen and the interrelationships between the use of a practice resulting in the use of other significantly related practices, and the direction of this relationship. In reviewing Table V, page 89, the use of a particular practice can be identified by its factor loading. Therefore, if a measure of practice use was needed for the area of General Herd Management, Factor I, and only one practice could be indicated as most accurately measuring concepts of general herd management, then the practice of providing high quality forages (Item 17, r=.770) would be the best measure (see Table V, Factor I). Likewise, Factor II as seen in Table V was identified as Breeding Management and Record Keeping. Therefore, if only one question could be asked which would indicate that dairymen were using some type of breeding management and record keeping concepts, the practice of breeding cows to a plus A. I. proof bull would be the most accurate measure. In other words, dairymen who were using the practice of breeding cows to a plus A. I. proof bull would also tend to be using other breeding management and record keeping concepts.

This same idea can be used for each of the seven factors previously defined in the 1970 Grade A dairy survey to determine practices which would accurately measure practice use. Two practices which would best measure the concepts of Forage Feeding Practices (Factor III) would be the practices of providing separate feeding and loafing areas and maintaining adequate amounts of improved pasture.

The use of practices which would accurately measure the use of

the concepts of Length of Calving Interval (Factor IV) and Herd and Breeding Management (Factor V) would be defined as maintaining a 12 to 14 month calving interval, and maintaining a 60 day dry period, respectively. Practices identified as to measuring use of practices in the area of Herd Management and Record Keeping and Heifer Management (Factors VI and VII, respectively) would be identified as the use of the practice of feeding grain according to production and having heifers freshen at 24 to 27 months of age, respectively.

A second characteristic observed from Table V, page 90, and the use of factor analysis to reduce data, would involve the concept of choosing four or five practices (rather than 15 or 20) which would provide an adequate, and reliable, measure of content for various subject areas in dairy production and management techniques. In other words, if only five questions could be asked which would cover enough content to adequately and reliably measure the area of General Herd Management (Factor I, Table V), which practices (out of 21 recommended practices) would be used? Factor loadings are those correlation coefficients, previously computed for each of the 21 practices. These coefficients indicate the significance with which practices are related in use to one another, and also their relationship to the factors. Therefore, the five highest loaded practices, as seen by their correlation coefficients, would be the most highly related practices grouped together to help in describing and identifying a factor name.

In other words, if five practices had to be selected, out of 21 practices, to describe the content of concepts making up the area of General Herd Management, these practices would involve: providing high

quality forages, providing adequate forages for the herd; raising at least 75 percent of the replacement heifers; providing separate feeding and loafing areas; and providing adequate amounts of improved pasture.

This concept, could in turn, be used to develop "content" questions to describe subject areas identified by each of the factor names.

Items Used to Identify Seven Factors, Their Factor Loadings, Subject Area to Which Initially Assigned and Item (Practices) Content Observed from Whether of Not Producers Were Using Each of 22 Qualitative Practices in FY 1975

Table VI shows the practices loaded most heavily on each of the seven factors. Table XV in Appendix G shows the factor loadings of all 22 of the practices for each of the seven factors.

Factor I. The practices which showed the lowest loadings on this factor were: double cropping corn and small grains for silage (.010); milking at regular hours (-.028); treating each quarter with a history of mastitis (.037); and stripping cows with the machine (-.038), see Table XV, Appendix G. The following practices showed the highest loadings on this factor (Table VI): drying each udder with an individual service towel (.706); milking cows with mastitis last (.504); and removal of fore-milk from each quarter before applying milkers (.467).

Factor I accounted for 75 percent of the variance in the use of the two highest loaded practices (drying each udder with an individual service towel and milking cows with mastitis last). The following of

TABLE VI

ITEMS USED TO IDENTIFY 7 FACTORS, THEIR FACTOR LOADINGS, SUBJECT AREAS TO WHICH INITIALLY ASSIGNED, AND ITEM CONTENT OBSERVED FROM 22 QUALITATIVE ITEMS DEFINED IN THE 1975 GRADE A DAIRY FARM MANAGEMENT AND PRODUCTION SURVEY

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
		Factor I--Milking Management*				Factor II--Breeding Management*	
100	.706	Milking Management	Dry each udder with an individual service towel.	82	.710	Raising Replacement Heifers	Are cows ready to calve kept separate from herd.
98	.504	Milking Management	Are cows with mastitis milked last.	59	.645	Breeding Management	Are dry cows kept separate from herd.
101	.467	Milking Management	Fore-milk removed from each quarter before applying milkers.	57	.204	Breeding Management	Are cows in heat removed from herd.
47	.257	Feeding Practices	Cows fed grain according to production.	105	.156	Milking Management	Treat each quarter with a history of mastitis.
57	.187	Breeding Management	Cows in heat removed from the herd.	36	.149	Pasture Management	Have all the pasture needed last year.

TABLE VI (Continued)

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
		Factor III--Milking Procedures*				Factor IV--Feeding Practices for the Milking Herd*	
97	.691	Milking Management	Milk at regular hours.	45	.536	Feeding Practices	Cows fed all the hay and silage they wanted.
89	.173	Sanitation & Disease Control	Effective system for fly control.	28	.239	Milking Facilities	Milking equipment checked every 6 months.
99	.114	Milking Management	Wash udder with a warm sanitizing solution.	36	.208	Pasture Management	Have all the pasture needed last year.
100	.112	Milking Management	Dry each udder with an individual service towel.	59	.177	Breeding Management	Are dry cows kept separate from herd.
102	.051	Milking Management	Begin milking at least 2 minutes after washing.	100	.566	Milking Management	Dry each udder with an individual service towel.

TABLE VI (Continued)

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
		Factor V--Milking Management*				Factor VI--Forage Feeding, Production and Facilities*	
105	.566	Milking Management	Treat each quarter with a history of mastitis.	34	.427	Forage Production	Are silage and hay tested by lab.
104	.467	Milking Management	Dip each teat in a sanitizing solution after milking.	21	.405	Feeding Facilities	Do you have a silo.
102	.239	Milking Management	Begin milking at least 2 minutes after washing.	47	.293	Feeding Practices	Cows fed grain according to production.
101	.167	Milking Management	Fore-milk removed before applying milkers.	32	.181	Forage Production	Double crop corn and small grains for silage.
28	.149	Milking Management	Milking machine checked every 6 months.	101	.145	Milking Management	Fore-milk removed before applying milkers.

TABLE VI (Continued)

Item	Loading**	Subject Area	Item Content
		Factor VII--Breeding and Milking Management*	
57	.521	Breeding Management	Are cows in heat removed from the herd.
99	.362	Milking Management	Wash udder with a warm sanitizing solution.
28	.226	Milking Facilities	Milking equipment checked every 6 months.
101	.178	Milking Management	Fore-milk removed from each quarter before applying milkers.
105	.128	Milking Management	Treat each quarter with a history of mastitis.

*The name assigned to each factor is an interpretation, based upon the content of items which showed the highest loadings on the factor in contrast to other practices which have low loadings.

**Factor loadings are approximately equivalent to a correlation between a measure (practice score) and the underlying factor. The square of any particular loading indicates the proportions of variation in practice use that was accounted for by the factor.

these two practices would seem to require a great deal of milking management ability. The other two high loaded practices were initially assigned to the subject areas of milking management and feeding practices which suggests that the common factor underlying these practices may be interpreted as herd management. Some of the other practices which showed very low loadings on this factor lends further support to this hypothesis. The weak loadings appear to be more specific types of herd and milking management and for these reasons, the common variance underlying this factor was interpreted as Milking Management.

Factor II. Factor II accounted for 92 percent of the variance in the use of the two highest loaded practices (Are cows ready to calve kept separate from the herd and are dry cows kept separate from the herd?). The following of these two practices would require some type of breeding management ability. The practice of keeping cows ready to calve separate from the herd (r=.710) also contained the highest overall loading of any of the 35 other items loaded on the seven factors.

The other three highest loaded practices were initially assigned to the subject areas of breeding management, milking management, and pasture management, suggesting that the common factor underlying these practices may be interpreted as a combination of various management practices. However, the high loadings of the first two items and the similarity in content of these practices to the aspects of breeding management resulted in this factor being identified as Breeding Management.

Factor III. Only six practices were found to be significantly loaded on this factor, yet in observing the relationship and loadings of

all 22 practices on Factor III, it was found that 10 practices were loaded on this factor in a negative direction as compared to the remaining 12 practices (Table XV, Appendix G). Although only one item (Do you milk at regular hours?) was highly loaded on this factor (.691). Four of the five significantly loaded practices, as seen from the subject areas to which initially assigned, suggest that they were measuring some form of milking management and milking procedures.

In observing the item content of the five items (Table VI) it was found that four of the items exhibited a common underlying characteristic involved with the ways in which cows in the herd are milked. These four items (practices) implied an active involvement in milking practices and this simularity resulted in the naming of Factor III as Milking Procedures.

Factor IV. Factor IV did not present the ease of identification as apparent in the previous factors. The items used to identify Factor IV are shown in Table VI. A review of the five items suggested that the items (practices) were measuring feeding, cow management, and milking equipment. However, only two items were significantly loaded on this factor with the other three items exhibiting relatively low loadings.

Factor IV accounted for 35 percent of the variance in the use of the two highest loaded practices (cows fed all the hay and silage they wanted and checking of the milking equipment every six months). Due to the strength of the loadings of the first three items on Factor IV and the item contents of these three items (practices) suggesting a common underlying characteristic in the areas of feeding and management;

Factor IV was interpreted as Feeding Practices for the Milking Herd.

Factor V. In reviewing Table XV, Appendix G, it was found that ten items were significantly loaded on Factor V, and all but one item indicated a relationship in a positive direction. The five highest loaded items on Factor V are shown in Table V, page 90. All five of these items were initially assigned to the subject area of milking management.

Factor V accounted for 60 percent of the variance in the use of the first three highest loaded practices (treat each quarter with a history of mastitis; dip each teat in a sanitizing solution after milking; and beginning to milk at least two minutes after washing) exhibiting loadings of .566; .467; and .239, respectively. The following of these three recommended practices would seem to require a great deal of milking management ability. The other two highest loaded practices were initially assigned to the subject area of milking management which suggests that the common factor underlying these practices may be interpreted as milking management ability. Therefore, identification of this factor, as observed from the common variance underlying these items and subject areas, was interpreted as Milking Management.

Factor VI. The practices which showed the lowest loading on this factor were: strip cows with the machine (-.030); begin milking at least two minutes after washing (-.034); wash udder with a warm sanitizing solution (-.048); milk at regular hours (-.033); and providing one acre of supplemental pasture per four cows (-.017), see Table XV, Appendix G. The following practices showed the highest loading on this factor (Table VI): are silage and hay tested by a lab (.427); having a silo (.405)

and the feeding of grain according to production (.293).

Factor VI accounted for 34 percent of the variance in the use of the two highest loaded practices (testing silage and hay by the lab and having a silo). The following of these two recommended practices would seem to require a great deal of forage management ability. The other two highest loaded practices were initially assigned to the subject areas of feeding practices and forage production suggesting that the common factor underlying these practices may be interpreted as general forage management. However, due to the specific nature of the item content and subject areas of these five practices, Factor VI was interpreted as Forage Feeding, Production and Facilities.

Factor VII. The subject areas initially assigned to items (practices) in Factor VII were all related to various management techniques. The items used to identify this factor are shown in Table VI. However, only two items were highly loaded on the factor and their subject areas defined them as pertaining to breeding and milking management.

Factor VII accounted for 40 percent of the variance in the use of the two highest loaded practices (Are cows in heat removed from the herd and is the udder washed in a warm sanitizing solution?). The following of these two practices would seem to require a great deal of management ability. The highly significant loading of the first item on the factor (.521) and the fact that three of the five subject areas to which the items were initially assigned involved milking management, the common factor underlying these practices was interpreted as Breeding and Milking Management and Factor VII was identified as such.

Summary and Interpretation of Factor Loadings for Qualitative Items Defined in the 1975 Grade A Dairy Survey

The purpose of this sub-section is to identify various recommended dairy production practices which were significantly loaded on seven factors, identified in the previous sub-section, as to their ability to measure practice use and subject area content for questions involving dairy production and management concepts.

One of the initial objectives of this study was the observation of practices as to their use among dairymen and the interrelationships between the use of a practice resulting in the use of other significantly related practices, and the direction of this relationship. In reviewing Table VI, page 102, the use of a particular practice can be identified by its loading upon the factor. Therefore, if a measure of practice use was needed for the area of Milking Management, and only one practice could be indicated as most accurately measuring concepts of Milking Management, then the practice of drying each udder with an individual service towel (Item 100, r=.706) would be the best measure (see Table VI, Factor I). Likewise, Factor III, as seen in Table VI, was identified as Milking Procedures. Therefore, if only one question could be asked which would indicate that dairymen were using some type of milking management concepts, the practice of milking at regular hours would be the most accurate measure. In other words, dairymen who were using the practice of milking at regular hours would also tend to be using other milking management concepts.

This same idea can be used for each of the seven factors previously defined in the 1975 Grade A dairy survey to determine practices

which would accurately measure practice use. Two practices which would best measure the concepts of Breeding Management (Factor II, Table VI, page 102) would be the practices of keeping cows ready to calve separate from the herd and keeping dry cows separate from the herd.

The use of practices which would accurately measure the use of the concepts of Feeding Practices (Factor IV) and Forage Feeding, Production and Facilities (Factor VI) would be defined as feeding cows all the hay and silage they wanted and having silage and hay tested by a lab.

A second characteristic observed from Table VI, and the use of factor analysis to reduce data, involves the concept of chosing four or five practices (rather than 15 or 20) which would provide an adequate, and reliable, measure of content for various subject areas in dairy production and management techniques. In other words, if only five questions could be asked which would cover enough content to adequately and reliably measure the area of Milking Management (Factor I, Table VI), which practices, out of 22 recommended practices, could be used?

Factor loadings are those correlation coefficients, previously computed for each of the recommended dairy production practices. These coefficients indicate the significance with which practices are related in use to one another, and also their relationship to the factors. Therefore, the five highest loaded practices would be the most highly related practices, grouped together, to help in describing and identifying a factor name. So, if five practices had to be selected, out of 22 practices, to describe the content of concepts making up the area of Milking Management, these practices would be: drying each udder with an individual

service towel; milking cows with mastitis last; removal of fore-milk from each quarter before applying milkers; and feeding grain according to production. This concept, could in turn, be used to develop "content" questions to describe subject areas identified by each of the factor names.

Items Used to Identify Seven Factors, Their Factor Loadings, Subject Area to Which Initially Assigned and Item (Practice) Content Observed from Whether or Not Producers Were Using Each of 16 Quantitative Practices in FY 1975

Table VII shows the practices loaded most heavily on each of the seven factors. Table XVI in Appendix G, shows the factor loadings of all 16 of the practices for each of the seven factors.

Factor I. The practices which showed the lowest loading on this factor were: what percent of the silage is cut in the dent stage of maturity (-.001); what percent of the heifers are fed milk replacer (.007); what percent of the pasture is grazed rotationally (.013); and what percent of the heifers are identified to sire at birth (.016). The following practices showed the highest loadings on this factor (Table VII): times per day cows ready to calve are checked (.649); and times per day herd is check for heat (.548).

Factor I accounted for 72 percent of the variance in the use of the two highest loaded practices. The following of these two recommended practices would seem to require a great deal of herd observation. The other two highest loaded practices (percent of pasture limed and fertilized based on soil tests and percent of herd bred by artificial

TABLE VII

ITEMS USED TO IDENTIFY 7 FACTORS, THEIR FACTOR LOADINGS, SUBJECT AREAS TO WHICH INITIALLY ASSIGNED AND ITEM CONTENT OBSERVED FROM 16 QUANTITATIVE ITEMS DEFINED IN THE 1975 GRADE A DAIRY FARM MANAGEMENT AND PRODUCTION SURVEY

Item	Loading**	Subject Area	Item Content
		Factor I--Herd Observation*	
81	.649	Raising Replacement Heifers	Times per day cows ready to calve are checked.
56	.548	Breeding Management	Times per day herd is checked for heat.
41	.112	Pasture Management	% of pasture limed and fertilized based on soil tests.
51	.084	Breeding Management	% of herd bred by A. I.
83	.056	Raising Replacement Heifers	% heifers treated at birth with navel disinfectant.
		Factor II--Raising Replacement Heifers*	
85	.622	Raising Replacement Heifers	% of heifers fed calf starter until 4 months of age.
84	.384	Raising Replacement Heifers	% heifers fed milk replacer.
83	.172	Raising Replacement Heifers	% heifers treated at birth with navel disinfectant.
51	.153	Breeding Management	% of herd bred by A. I.
41	.142	Pasture Management	% pasture limed and fertilized based on soil test.

TABLE VII (Continued)

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
		Factor III--Pasture Management*				Factor IV--Breeding Management*	
40	.534	Pasture Management	% of pasture clipped each year.	63	.509	Breeding Management	% of heifers freshening at 24 to 27 months of age.
39	.318	Pasture Management	% of pasture grazed rotationally.	33	.278	Silage Production	% of silage cut in the dent stage of maturity.
86	.111	Raising Replacement Heifers	% heifers fed grain between the ages of 4 and 10 months.	56	.177	Breeding Management	Times per day herd is checked for heat.
85	.097	Raising Replacement Heifers	% heifers fed calf starter until 4 months of age.	85	.117	Raising Replacement Heifers	% heifers fed calf starter until 4 months of age.
62	.093	Breeding Management	% cows with 60 days after calving before breeding.	40	.076	Pasture Management	% pasture clipped each year.

TABLE VII (Continued)

Item	Loading**	Subject Area	Item Content	Item	Loading	Subject Area	Item Content
Factor V--Breeding and Raising Replacement Heifers*				Factor VI--Herd and Pasture Management*			
51	.577	Breeding Management	% of herd bred by A. I.	41	.432	Pasture Management	% pasture limed and fertilized based on soil tests.
87	.392	Raising Replacement Heifers	% heifers identified to sire at birth.	81	.411	Raising Replacement Heifers	Times per day cows ready to calve are checked.
56	.365	Breeding Management	Times per day herd is checked for heat.	87	.221	Raising Replacement Heifers	% heifers identified to sire at birth.
62	.262	Breeding Management	% cows with 60 days after calving before breeding.	83	.159	Raising Replacement Heifers	% heifers treated at birth with a navel disinfectant.
83	.256	Raising Replacement Heifers	% heifers treated at birth with a navel disinfectant.	40	.153	Pasture Management	% of pasture clipped each year.

TABLE VII (Continued)

Item	Loading**	Subject Area	Item Content
		Factor VII--Breeding Management*	
62	.475	Breeding Management	% cows with 60 days after calving before breeding.
60	.413	Breeding Management	% cows with at least a 40 day dry period.
51	.188	Breeding Management	% of herd bred by A. I.
81	.097	Raising Replacement Heifers	Times per day cows ready to calve are checked.
40	.068	Pasture Management	% of pasture clipped each year.

*The name assigned to each factor is an interpretation, based upon the content of items which showed the highest loadings on the factor in contrast to other practices which have low loadings.

**Factor loadings are approximately equivalent to a correlation between a measure (practice score) and the underlying factor. The square of any particular loading indicates the proportions of variation in practice use that was accounted for by the factor.

insemination) were initially assigned to the subject areas of pasture management and breeding management, respectively. In reviewing the item contents for all five practices observed for Factor I a common factor underlying these practices may be interpreted as herd observation and management. Factor I was identified as Herd Observation.

Factor II. Observation of Factor II indicated that three of the five items were initially assigned to the subject area of raising replacement heifers. It was also found that Factor II accounted for 57 percent of the variance in the use of the three highest loaded practices (percent of heifers fed calf starter; percent of heifers fed milk replacer; and percent of heifers treated at birth with a navel disinfectant). These three items (practices) suggested that the common factor underlying their content, as well as their subject areas to which initially assigned, may be interpreted as Raising Replacement Heifers and the factor was identified as such.

Factor III. Eight of the 22 recommended practices were significantly loaded on Factor III (see Table XVI, Appendix G). Of these eight significantly loaded practices, Factor III accounted for 39 percent of the variance in the use of the two highest loaded practices (percent of pasture clipped each year, and percent of pasture grazed rotationally). The subject area to which these two highly loaded practices were initially assigned was pasture management suggests that the common factor underlying these practices may be interpreted as pasture management techniques. For this reason the common variance underlying this factor was Pasture Management.

Factor IV. The loading of the items on Factor IV were not significant in aiding in the identification of the factor (Table VII). Four separate subject areas were initially assigned to these five practices. These were: breeding management, silage production, raising of replacement heifers, and pasture management. However, only one item was highly loaded on the factor (percent of heifers freshening at 24 to 27 months of age, r=.509), yet the content of two other items (times per day herd is checked for heat; and the percent of heifers fed calf starter) involves some type of breeding management aspects. For these reasons, Factor IV was interpreted as Breeding Management.

Factor V. The items used to identify Factor V presented the highest overall loadings on the factor of any of the seven factors presented. The items used to identify Factor V are presented in Table VII. Factor V accounted for 61 percent of the variance in the use of the three highest loaded practices (percent of herd bred by A. I.; percent of heifers identified to sire at birth; and times per day herd was checked for heat).

Of the five highest loaded practices, only two subject areas were initially assigned. These were the subject areas of breeding management and raising of replacement heifers. The common factor underlying these practices may be interpreted as heifer and breeding management. Due to these reasons, Factor V was identified as Breeding and Raising of Replacement Heifers.

Factor VI. Factor VI accounted for 36 percent of the variance in the use of the two highest loaded practices (percent of pasture limed

and fertilized based on soil tests and times per day cows ready to calve are checked). The following of these two recommended practices would seem to require a great deal of general management ability. The other three highly loaded practices were initially assigned to the subject areas of raising replacement heifers and pasture management. The item contents of these practices suggests that the common underlying characteristic present here involves the concepts of Herd and Pasture Management and the factor was identified as such.

Factor VII. Items used to identify Factor VII are shown in Table VII. Two items, the percent of cows with 60 days after calving before breeding and the percent of cows with at least a 60 day dry period, exhibited high loadings on this factor and were initially assigned to the subject area of breeding management.

Four of the items (practices), judged from their content, involved breeding management concepts while a fourth item, loading of .068, was concerned with pasture management. Due to the similarity in content, and subject area, of four of the items, Factor VII was interpreted as Breeding Management.

Summary and Interpretation of Factor Loadings for Quantitative Items Defined in the 1970 Grade A Dairy Survey

One of the initial objectives of this analysis was to identify various recommended dairy production practices which were highly, and significantly, loaded on seven factors, identified in the previous subsection, as to their ability to measure practice use and subject area content for questions involving dairy production and management concepts.

In reviewing Table VII, the use of a particular practice can be identified by its factor loading. Therefore, if a measure of practice use was needed for the area of Herd Observation, and only one practice could be indicated as most accurately measuring concepts of herd observation, then the practice of checking cows daily ready to calve (r=.649) would be the best measure. Likewise, Factor II as seen in Table VII was identified as the Raising of Replacement Heifers. Therefore, if only one question could be asked which would indicate that dairymen were adequately managing the raising of their replacement heifers, the question of finding out what percent of replacement heifers were fed calf starter until four months of age would be the most accurate measure. In other words, dairymen who were using this practice of feeding heifers calf starter until four months of age would also tend to be using other management practices related to the concepts of raising replacement heifers.

A second characteristic observed from Table VII, and the use of factor analysis to reduce data, would involve the concept of choosing four or five practices (rather than 15 or 20) which would provide an adequate and reliable measure of content for various subject areas in dairy production and management techniques. In other words, if only five questions could be asked which would cover enough content to adequately and reliably measure the area of Raising Replacement Heifers (Factor II, Table VII) which practice would be used?

Factor loadings are those correlation coefficients previously computed for each of the 16 quantitative practices. These coefficients indicate the significance with which practices are related in use to one

another, and also their relationship to the factors. Therefore, the five highest loaded practices would be the most highly related practices to help in subscribing and identifying a factor. Therefore, if four practices had to be selected to describe various concepts of the raising of replacement heifers, these practices would be: the percent of heifers fed calf starter; percent of heifers fed milk replacer; percent of heifers treated at birth with a navel disinfectant; and the percent of the herd bred by artificial insemination. This concept, could in turn, be used to develop "content" questions to describe subject areas identified by each of the factor names.

CHAPTER VI

VARIANCE IN THE USE OF EACH OF THE PRACTICES ACCOUNTED FOR BY THE SEVEN COMMON FACTORS (COMMUNALITY) AND ACCOUNTED FOR BY EACH FACTOR (EIGENVALUE)

The data presented in this chapter is divided into two sections. Section I presents findings concerned with the communalities (the total variance in the use of a practice accounted for by the combination of all common factors) of the various dairy production practices defined in each of the Grade A dairy surveys (FY 1970 and FY 1975). Section II is concerned with the amount of variance in the use and proportion of variance accounted for by each of the 21 factors observed and identified in the previous chapter.

I. THE TOTAL VARIANCE IN DAIRYMEN'S USE OF EACH OF THE 59 RECOMMENDED DAIRY PRODUCTION PRACTICES DEFINED IN THE 1970 AND 1975 GRADE A DAIRY SURVEYS ACCOUNTED FOR BY SEVEN COMMON FACTORS

Section I is divided into three sub-sections. Each sub-section presents finding concerned with the communalities observed for various recommended dairy production practices defined in the two Grade A dairy surveys.

Communalities Observed for 21 Recommended Dairy Production Practices Defined in the 1970 Grade A Milk Production Practice Checklist Survey

Table VIII presents the total variance of each of the 21 recommended production practices accounted for by the combination of all seven

TABLE VIII

TOTAL VARIANCE IN THE USE OF EACH OF THE 59 RECOMMENDED DAIRY PRODUCTION PRACTICES DEFINED IN THE 1970 AND 1975 GRADE A DAIRY SURVEYS ACCOUNTED FOR BY ALL SEVEN FACTORS EXTRACTED FROM EACH FACTOR ANALYSIS**

1970 Grade A Milk Production Practice Checklist Survey Data		Qualitative Practices Defined in the 1975 Grade A Dairy Farm Management and Production Survey Data		Quantitative Practices Defined in the 1975 Grade A Dairy Farm Management and Production Survey Data	
Practice #	Communality*	Practice #	Communality	Practice #	Communality
13*	.21201	21	.07919	33	.07351
14	.10623	28	.13220	39	.05585
15	.10385	32	.08977	40	.08223
16	.23624	34	.14069	41	.11631
17	.25626	36	.06913	51	.20573
18	.12005	37	.05203	56	.25949
19	.09561	45	.10678	60	.05169
20	.07116	46	.07457	61	.04469
21	.17597	47	.16298	62	.11414
22	.15088	57	.19945	63	.06703
23	.24123	59	.28128	81	.19429
24	.12155	82	.28103	83	.12736
25	.17349	89	.08170	84	.08195
26	.10950	97	.07369	85	.12216
27	.18078	98	.17268	86	.04835
28	.19626	99	.08570	87	.11734
29	.10644	100	.22544		
30	.06771	101	.21981		
31	.09910	102	.04400		
32	.19592	103	.05683		
33	.06244	104	.15412		
		105	.18637		

*Communality is defined as the total variance of a variable (practice) accounted for by the combination of all common factors, and indicates the amount of variance of a variable (practice) that is shared by at least one other variable in the set.

**Seven factors were extracted from each set of data analyzed.

common factors included from the factor analysis of the 1970 dairy survey. In reviewing this data it was found that practice 17, defined as providing high quality forages for the herd, had more variation in use accounted for by all seven of the common factors than any other practice in 1970. In other words, the seven factors accounted for a greater amount of the total variation in the use of practice 17 (provided high quality forages) than in any of the other practices. Dairymen who were providing high quality forages tended also to be using a larger number of the other 20 practices than was true for any other single practice included in this analysis.

Practice 23 (adequate milk production records maintained) and practice 16 (adequate forages provided last year), respectively, were the next best predictors of the use of all the practices.

Conversely, three practices exhibited low communalities. These were practice 33 (75 percent of cows freshening in the fall); practice 30 (use of a strip cup before applying milkers); and practice 20 (feeding of an all-grain concentrate). Therefore, the amount of total variance in the use of each of these practices accounted for by the combination of all seven of the common factors was very small, compared to the other practices. This indicated that the use of these practices was more independent of the use of other practices (i.e., use of these practices did not depend upon the use of other practices).

Communalities Observed for 22 Qualitative Recommended Dairy Production Practices Defined in the 1975 Grade A Dairy Farm Management and Production Survey

Table VIII also presents the total variance of each of 22 qualitative dairy production practices accounted for by the combination of all of the seven common factors identified from the qualitative practices included in the 1975 dairy survey. In reviewing this data, it was found that practice 59, defined as the keeping of dry cows separate from the herd, had more variation in use accounted for by all the common factors than any other practice observed. In other words, dairymen who kept dry cows separate also tended to be following (using) more of the other practices. It was the best predictor of use of the other practices.

Practice 82 (are cows ready to calve kept separate from the herd) and practice 100 (do you dry each udder with an individual service towel), respectively, were the next best predictors of use of the other practices.

Conversely, three practices exhibited low communalities. These were practice 103 (do you begin milking at least two minutes after washing); Practice 37 (is one acre of supplemental pasture provided per four cows); and practice 103 (do you strip cows with the machine). Therefore, these were poor predictors of use of the other practices--their use was tied less closely to the use of other recommended practices.

Communalities Observed for 16 Quantitative Recommended Dairy Production Practices Defined in the 1975 Grade A Dairy Farm Management and Production Survey

Table VIII also presents the total variance of each of the 16 quantitative recommended dairy production practices accounted for by the combination of all common factors as observed from the 1975 dairy survey. In reviewing this data it was found that practice 56 (times per day herd is checked for heat) had more variation in use accounted for by all the common factors than any other practice among the quantitative items included. Practice 51 (what percent of the herd was bred by artificial insemination) had the next greatest amount of variation in use accounted for by all seven common factors. Therefore, use of these practices tended to be tied closely to the use of more of the other practices (i.e., dairymen who frequently check their cows for heat or who bred a high percentage of their cows by artificial insemination tended also to be high users of the other recommended practices).

Conversely, two practices exhibited low communalities. These were practice 86 (what percent of heifers are fed grain between the ages of 4 and 10 months) and practice 61 (what percent of the cows have at least a 60 day dry period). The total variance for these two practices accounted for by the combination of all seven factors was very small. Use of these practices did not depend upon the use of the other practices included in this analysis (i.e., they would be poor predictors of the use of other practices).

II. AMOUNT (EIGENVALUES) AND PROPORTION OF TOTAL VARIANCE IN THE USE OF ALL PRACTICES, ACCOUNTED FOR BY EACH FACTOR DEFINED IN THE 1970 AND 1975 GRADE A DAIRY SURVEY DATA

Section II is divided into three sub-sections. Each sub-section presents findings concerned with the eigenvalues (the amount of total variance in the use of all practices accounted for by each common factor) and the percent of variation in the use of all practices accounted for by each factor extracted from the 1970 and from the 1975 Grade A dairy surveys.

Eigenvalues and Percent of Total Variation in the Use of All Practices Accounted for By Each Factor Extracted from the 1970 Grade A Milk Production Practice Checklist Survey Data

Table IX presents data concerned with the amount (eigenvalue) and proportion of variance in use of all practices accounted for by each factor extracted from the 1970 and 1975 Grade A dairy surveys. In reviewing the seven factors observed from the 1970 Grade A Milk Production Practice Checklist Survey, it was found that the seven common factors accounted for about 50 percent of the variation in use of all 21 of the practices studied. Factor I, interpreted as General Herd Management, accounted for 13.5 percent of the variation in use of all practices (eigenvalue=2.83). Likewise, Factor II, defined as Breeding Management and Record Keeping, accounted for 7 percent of the total variance in the use of all 21 recommended practices (eigenvalue=1.47). The other five factors combined accounted for about 30 percent of the remaining

TABLE IX

AMOUNT AND PROPORTION OF VARIANCE IN USE OF PRACTICES ACCOUNTED FOR BY EACH FACTOR EXTRACTED FROM THE 1970 GRADE A MILK PRODUCTION PRACTICE CHECKLIST AND THE 1975 GRADE A DAIRY FARM MANAGEMENT AND PRODUCTION SURVEY

1970 Grade A Milk Production Practice Checklist Survey			Qualitative Items Defined in the 1975 Grade A Dairy Farm Management and Production Survey			Quantitative Items Defined in the 1975 Grade A Dairy Farm Management and Production Survey		
Factor	Eigenvalue*	% of Variation	Factor	Eigenvalue	% of Variation	Factor	Eigenvalue	% of Variation
I	2.82956	13.5	I	2.72483	12.4	I	2.19362	13.7
II	1.47143	7.0	II	1.59837	7.3	II	1.37394	8.6
III	1.39627	6.6	III	1.44461	6.6	III	1.30592	8.2
IV	1.27270	6.1	IV	1.21937	5.5	IV	1.18723	7.4
V	1.23894	5.9	V	1.20713	5.5	V	1.12385	7.0
VI	1.11129	5.3	VI	1.13009	5.1	VI	1.10443	6.9
VII	1.09579	5.2	VII	1.10158	5.0	VII	1.02159	6.4

*Eigenvalue is defined as the amount of total variance accounted for by the factor.

Factors defined in the 1970 dairy survey were as follows: I--General Herd Management; II--Breeding Management and Record Keeping; III--Forage Feeding Practices; IV--Length of Calving Interval; V--Herd and Breeding Management; VI--Herd Management and Record Keeping; VII--Heifer Management.

Factors defined for qualitative items in the 1975 dairy survey were as follows: I--Milking Management; II--Breeding Management; III--Milking Procedures; IV--Feeding Practices for the Milking Herd; V--Milking Management; VI--Forage Feeding, Production and Facilities; VII--Breeding and Milking Management.

Factors defined for quantitative items in the 1975 dairy survey were as follows: I--Herd Observation; II--Raising Replacement Heifers; III--Pasture Management; IV--Breeding Management; V--Breeding and Raising of Replacement Heifers; VI--Herd and Pasture Management; VII--Breeding Management.

variation in the use of all of the 21 practices.

The total variance in the use of all practices is the sum of three kinds of variances: (1) common variance or that which appears in more than one practice; (2) unique or specific variance which does not occur with the use of other practices; and (3) error variance. Since about half of the variance in the use of the 21 practices was due to common variance, it follows that the other 50 percent was specific variance and error variance not accounted for by the seven factors which were extracted. It would, therefore, appear that other factors could be extracted from the data (i.e., use of some of the practices is not associated with the extracted factors) and thus, increase the percent of variance in practice use which can be accounted for by the data.

Eigenvalues and Percent of Total Variation in the Use of All Practices Accounted for By Each Factor Extracted from Qualitative Practices Defined in the 1975 Grade A Dairy Farm Management and Production Survey

In reviewing the seven factors extracted from the 22 qualitative practices included in the 1975 dairy survey it was found that 47 percent of the variance in practice use was accounted for by the first seven factors. Factor I, defined as Milking Management, accounted for 12.4 percent of the variation in the use of these practices (eigenvalue=2.72). Likewise, Factor II, defined as Breeding Management, accounted for 7.3 percent of the common variance in the use of all 22 qualitative production practices (eigenvalue=1.60).

About 53 percent of the variance in the use of these practices was not accounted for by common variance and was thus due to specific and error types of variance.

Eigenvalues and Percent of Total Variation in the Use of All Practices Accounted for By Each Factor Extracted from Quantitative Practices Defined in the 1975 Grade A Dairy Farm Management and Production Survey

In reviewing the seven factors extracted from quantitative practices defined in the 1975 dairy survey (see Table IX), it was found that about 58 percent of the total variance in the use of all practices was accounted for by the first seven factors. Factor I, defined as Herd Observation, accounted for 13.7 percent of the total variation among all seven factors (eigenvalue=2.19). Likewise, Factor II, defined as Raising Replacement Heifers, accounted for 8.6 percent of the total variance in all 16 quantitative production practices (eigenvalue=1.37). The remaining factors accounted for about 35 percent of the total variance in the use of these practices. About 42 percent of the variance in practice use was due to specific and error types of variance.

This analysis seems to indicate that the percent of total variation in the use of practices measured using quantitative approaches left a smaller amount of the total variation to be accounted for by specific and error types of variance (eigenvalue only 42 percent of the variance in the quantitative practices was unaccounted for, compared to 53 percent for the qualitative practices included in the 1975 data). This hypothesis seems, also, to be supported by other findings of the study and will be discussed in the summary, conclusions and recommendations chapter.

CHAPTER VII

SUMMARY OF MAJOR FINDINGS, IMPLICATIONS AND RECOMMENDATIONS

I. PURPOSE OF THE STUDY

The purpose of this descriptive study was to compare the use of selected dairy production and management practices by Grade A dairymen in 32 major dairy producing counties at two time periods (i.e., FY 1970 and FY 1975) in order to indicate the amount of change in use of recommended production practices during the five year period. Factor-analytic techniques were employed to determine interrelations between practices used by the Grade A dairymen and then to reduce the data into smaller sets of factors or components for further analysis.

The specific objectives were as follows:

1. To review the situation of the Grade A dairy producers in 32 major Tennessee dairy counties in FY 1970 and FY 1975.
2. To describe the situation of the Grade A dairy producers in 32 major Tennessee dairy counties in FY 1975.
3. To determine and indicate change in dairy production and management practice use between 1970 and 1975.
4. To describe the association between practices used by Grade A dairymen in 1970 and 1975.

II. METHODS AND PROCEDURES

Population and Sample

The population of the study included all Grade A dairymen in 41 Tennessee counties which had at least 40 percent of its total agricultural income from dairying and/or which had an annual income from dairying of three-quarters-of-a-million dollars.

1970 Grade A Milk Production Practice Checklist Survey. The Nth number technique was used to obtain a random sample of at least 10 Grade A dairymen from each of 41 dairy counties in Tennessee. The sample consisted of 410 Grade A dairymen in 41 major dairy producing counties in Tennessee. However, only 316 dairymen in 32 Tennessee counties were analyzed in this study.

1975 Grade A Dairy Farm Management and Production Survey. The required sample size was computed using a 95 percent probability level with a .15 variation above or below the true proportion. The sample included 704 of the 1,895 Grade A dairy producers in the 40 major dairying producing counties of Tennessee. However, data from only 621 dairymen in 32 Tennessee counties were included in the analysis.

Methods of Securing Data

Data for the surveys were secured through personal interviews by the County Extension Leaders in each of the counties. Each interview was conducted in the same manner following an interview schedule prepared specifically for each survey.

Development of the interview schedule for the 1970 Grade A Dairy Survey. A Grade A Practice Checklist Survey was developed by Extension Dairy Specialists at the University of Tennessee and was used to record information concerning procedures, milk production levels, numbers of cows in the dairy herd, and 21 recommended dairy production practices. Interviews were conducted in March, 1970.

Development of the interview schedule for the 1975 Grade A Dairy Survey. A Grade A Dairy Farm Management and Production Survey interview schedule, developed by the University of Tennessee Agricultural Extension Service in cooperation with the ES/USDA, was used with each interview to record responses and personal observations regarding the use of various dairy production and farm management practices by Grade A dairymen in the 32 Tennessee counties. Interviews were conducted between March and September of 1976.

III. METHODS OF ANALYSIS

Interview schedules, which were precoded, were checked for completeness and accuracy before data processing and punching on IBM cards. The Statistical Package for Social Sciences computer program was used to analyze the data. Simple statistical analysis included descriptive statistics (e.g., mean, variance, range, standard error, standard deviation) and one-way frequency distribution statistics (e.g., absolute relative, adjusted and cummulative statistics). The methods of factor analysis employed were principle factoring with interaction with varimax orthogonial rotation. Statistics computed by the factor program included

mean and standard deviations, correlation matrix, communalities, eigenvalues and proportion of total and common variance, and factor score coefficient matrix.

The questions and responses were then grouped into three sets of data identified as qualitative items defined in the 1970 Grade A dairy survey; qualitative items defined in the 1975 Grade A dairy survey; and quantitative items defined in the 1975 Grade A dairy survey. Results of the data analysis were organized and summarized in separate tables, each dealing with selected aspects of the study, such as comparisons of the 1970 and 1975 Grade A dairy surveys, interrelationships between the use of selected practices, identification of factors by item (practice) content and the proportion and total amount of variance in practice use accounted for by each factor. Tables were then organized into three chapters, each chapter presenting findings regarding specific study objectives.

The approach to summary and interpretation of findings was basically descriptive in nature with emphasis upon comparison of practice use at the two time periods.

IV. MAJOR FINDINGS

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

Situation of Grade A Dairy Producers in 32 Major Tennessee Dairy Counties in FY 1970

The average herd size of Grade A dairymen in 1970 was 59 cows and an average of 10,029 pounds of milk per cow was produced. The average

income per Grade A dairyman from the sale of milk in 1970 was $29,398.

Eight of the 21 dairy practices included in the 1970 survey were classified as breeding management practices. It was found that each producer used an average of 6.2 of these practices. Each dairyman was using an average of 2.6 of the four forage feeding practices, an average of 1.5 of the two concentrate feeding practices, and an average of 3.5 of the seven herd management practices in 1970.

Situation of Grade A Dairy Producers in 32 Major Tennessee Dairy Counties in FY 1975

In reviewing the situation of Grade A dairymen in FY 1975, it was found that each Grade A dairyman operated an average of 336 acres of cropland. It was also observed that the producers had an average of 11,981 pounds of milk and 449 pounds of butterfat produced per cow in 1975.

Other major findings regarding the general situation of Grade A dairy producers in 1975 are summarized below.

1. About half (51.9 percent) of the dairymen had not increased the acres of land operated since 1970; however, 59.6 percent had added new buildings or silos.
2. Of the 621 producers interviewed in the 1975 dairy survey, 40.6 percent had had their milking systems checked within the previous six months.
3. An average of 75.6 acres of silage was harvested per producer in 1975 with an average yield of 16.3 tons per acre.
4. Of the 621 dairymen interviewed, 83.3 percent responded that they normally had enough silage to feed through the winter.
5. Fifty-one percent of the dairymen removed cows in heat from

the milking herd and checked the milking herd an average of 2 times per day. It was also observed that the dairymen allowed 79 percent of the cows at least a 60 day dry period.

6. Three-fourths of the dairymen had not changed their systems of keeping milk production records since 1970 and about the same percent had not changed their overall farm record keeping system.
7. About 85 percent of the dairymen were raising replacement heifers on their own farm in 1975. Also, it was found that about one-fourth of the cows culled were sold because of reproductive problems.
8. Dairymen in 1975, had received an average of 3.4 farm visits from Extension agents and had made an average of 2.8 visits to the Extension Office during the past 12 months.

Indication of Change in Dairy Production and Dairy Production Practice Use Between 1970 and 1975

Eleven recommended dairy production practices were selected from the two dairy surveys for purposes of comparing the percentage of producers using these practices in 1975 with those in 1970. It was observed that the average percentage of all dairymen using each of the eleven recommended dairy practices had increased for six practices and had decreased for five of the practices between 1970 and 1975. These practices and the percentage increase in use were as follows: (1) provide adequate summer pasture, 30 percent increase; (2) use of the University of Tennessee Forage Testing Laboratory, 59.4 percent increase; (3) maintain

adequate milk production records, 13 percent increase; (4) maintain adequate herd records, 24.3 percent increase; (5) provide separate feeding and loafing areas, 9 percent increase; and (6) use of a strip cup before applying milkers, 49 percent increase.

The five recommended practices found to decrease in the percent of producers using them between 1970 and 1975 were as follows: (1) provide adequate forages for the herd, 13.4 percent decrease; (2) feeding an all-grain concentrate, 3 percent decrease; (3) feeding grain according to production, 7 percent decrease; (4) check the milking system every six months, 4 percent decrease; and (5) maintaining adequate methods of fly control, 9.8 percent decrease.

Interrelationships Between the Use of Selected Recommended Dairy Production Practices in FY 1970 and FY 1975

Major finding regarding interrelations among practices used in 1970 and 1975 are summarized below.

Interrelations among dairymen's use of 21 practices in 1970. Four practices were found to be most highly related to the largest number of other recommended practices. These were as follows:

1. Cows bred to a plus A. I. proof bull.
2. Adequate forages provided last year.
3. Grain fed according to production.
4. Adequate milk production records maintained.

These practices were significantly (e.g., $p \leq .05$) related to nine or more of the remaining practices.

Three practices which were found to have a low correlation with

the use of other practices were as follows:

1. Cows allowed 60 day after calving before breeding.
2. Raise at least 75 percent of the replacement heifers.
3. Obtaining professional advice.

Dairymen's use of each of these three practices was significantly related to not over two of the other 19 practices.

Interrelations among quantitative measure of dairymen's use of 22 practices in 1975. Three of the 22 practices where dairymen's use was measured qualitatively (i.e., dichotomous questions--yes or no) showed a high correlation with a large number of other practices. Three of these practices were defined as follows:

1. Is milking machine checked every six months.
2. Were cows fed grain according to production.
3. Are dry cows kept separate from the herd.

Dairymen's use of the above practices was significantly ($p \leq .05$) related to at least nine other practices in 1975.

The practice showing the least correlation with other practices used by dairymen in 1975 was "milking at regular hours." Dairymen's use of this practice was significantly related to only two other practices.

Interrelations among quanitative measures of dairymen's use of 22 practices in 1975. Grade A dairymen's use of only one recommended practice was significantly related ($p < .05$ or greater) to their use of nine or more of the 16 recommended dairy practices measured quantitatively in 1975. This practice was defined as "What percent of land was limed and fertilized at seeding based on soil tests?" However, two practices

were found to be significantly related to dairymen's use of either one or two of the other recommended practices measured quanitatively. These two practices were, "The percent of pasture clipped each year," and "The percent of cows which had at least a 40 day dry period."

Items Used to Identify Seven Factors, Their Factor Loadings, Subject Area to Which Initially Assigned and Item (Practice) Content Observed from Whether or Not Producers were Using Recommended Practices in 1970 and 1975

The purpose of this analysis was to determine which measured characteristic varied together as a basis of reducing the number of practices with which to operate. Another purpose was to make an interpretation of common factors underlying the use of practices by taking note of practices which had substantial loadings in common in each factor in contrast to other practices which had low loadings.

Results of factor analysis of dairymen's use of recommended practices in 1970. Several underlying factors extracted from data regarding Grade A dairymen's use of 21 recommended dairy practices in 1970 appeared to be interpretable. Interpretations of factor names were based upon the factor loadings (e.g., high and low) or correlation between the factor and each of the measures of practice use. Names applied to interpretations regarding the nature of what was measured by each of the underlying factors extracted from measures of the use of 21 practices in 1970 are given below. Also listed below, under each factor name are the practices which loaded most heavily (i.e., above .40) on that factor.

Factor I "General Herd Management"

1. High quality forages provided last year (.770 loading).
2. Adequate amounts of forages provided last year (.525 loading).

Factor II "Breeding Management and Record Keeping"

1. Cows bred to a plus A. I. proof bull (.818 loading).

Factor III "Forage Feeding Practices"

1. Provide separate feeding and loafing areas (.489 loading).
2. Provide adequate amounts of improved pasture (.479 loading).

Factor IV "Length of Calving Interval"

1. Maintain a 12 to 14 month calving interval (.616 loading).

Factor V "Herd and Breeding Management"

1. Cows allowed 60 day dry period (.558 loading).

Factor VI "Herd Management and Record Keeping"

1. Fed grain according to milk production (.496 loading).
2. Adequate milk production records maintained (.479 loading).
3. Professional advice obtained when needed (.439 loading).

Factor VII "Heifer Management"

1. Heifers freshen at 24 to 27 months of age (.501 loading).

Results of factor analysis of qualitative measures of dairymen's use of recommended practices in 1975. Twelve of the 21 practices were found to be highly related (loading of greater than .40) to the seven

factors extracted from the 1975 data. Interpretations regarding the name of underlying factors along with the practices loaded most heavily on each factor were as follows:

Factor I "Milking Management"

1. Dry each udder with an individual service towel (.706 loading).
2. Cows with mastitis milked last (.504 loading).
3. Remove fore-milk from each quarter before applying milkers (.467 loading).

Factor II "Breeding Management"

1. Cows ready to calve kept separate from the herd (.710 loading).
2. Dry cows kept separate from the herd (.645 loading).

Factor III "Milking Procedures"

1. Milk cows at regular hours each day (.691 loading).

Factor IV "Feeding Practices"

1. Cows fed all the silage and hay they could eat (.536 loading).

Factor V "Milking Management"

1. Treat each quarter with a history of mastitis (.566 loading).
2. Dip each teat in a sanitizing solution after milking (.467 loading).

Factor VI "Forage Feeding Production and Management"

1. Silage and hay tested by a laboratory (.427 loading).
2. Have a silo (.405 loading).

Factor VII "Breeding and Milking Management"

1. Cows in heat removed from the herd (.521 loading).

Results of factor analysis of quantitative measures of dairymen's use of recommended practices in 1975. Ten of the 16 practices factor analyzed were found to be highly related (loading of greater than .40) to seven factors extracted from these data. Interpretation regarding the name of each underlying factor along with the practices which loaded most heavily were as follows:

Factor I "Herd Observation"

1. Times per day cows ready to calve were checked (.649 loading).
2. Times per day cows checked for heat (.548 loading).

Factor II "Raising Replacement Heifers"

1. Percent of heifers fed calf starter until four months of age (.622 loading).

Factor III "Pasture Management"

1. Percent of pasture clipped each year (.543 loading).

Factor IV "Breeding Management"

1. Percent of heifers freshening at 24 to 27 months of age (.509 loading).

Factor V "Breeding and Raising Replacement Heifers"

1. Percent cows bred by artificial insemination (.577 loading).

Factor VI "Herd and Pasture Management"

1. Percent of pasture limed and fertilized based on soil test (.432 loading).

2. Times per day cows ready to calve are checked (.411 loading).

Factor VII "Breeding Management"

1. Percent of cows with 60 days after calving before breeding (.475 loading).
2. Percent of cows with at least a 40 day dry period (.413 loading).

Findings Regarding the Amount of Variance in the Use of Each of the Practices Accounted for by the Factors

The practice of providing high quality forages for the herd, had a higher percentage of the variation in use among the dairymen accounted for by the common factors than did any other practice included in the 1970 survey. This indicates that this practice was the best single predictor of what ever was measured by all the extracted factors. Keeping adequate milk production records and providing adequate amounts of forages, respectively, were the next best predictors of practices used by dairymen in 1970.

Among the qualitative measures of the 21 practices included in the 1975 survey, the practice of keeping dry cows separate from the milking herd had more variation in use by the dairymen accounted for by all the common factors than any other practice observed. Keeping cows ready to calve separate from the milking herd and drying each udder with an individual service towel were the next best predictors, respectively, of all practices used in 1975 by the dairymen.

Among the quantitative practices defined in the 1975 Grade A dairy

survey, the practice regarding the number of times per day the herd was checked for heat had more variation in use among the dairymen accounted for by all the common factors than any other practice. The percent of the herd bred by artificial insemination was the next best predictor of practice use by the dairymen.

Findings Regarding the Amount of Variance in the Use of Practices Accounted for by All the Factors

The seven common factors extracted from the practices studied in 1970, accounted for about 50 percent of the variation in use of all 21 of the practices studied. Factor I, interpreted as "General Herd Management," accounted for the largest (13.5 percent) amount of the variation in use of all practices.

The seven factors extracted from the qualitative measures of the 22 practices included in the 1975 dairy survey accounted for 47 percent of the variance in practice use by the dairymen. Factor I, interpreted as "Milking Management," accounted for the largest (12.4 percent) amount of the variation in the use of these practices. About 53 percent of the variance in the use of these practices was not accounted for by common variance and thus was due to specific and error types of variance.

The seven factors extracted from the quantitative measures of the 16 practices defined in the 1975 dairy survey accounted for about 54 percent of the total variance in the use of all practices. Factor I, interpreted as "Herd Observation," accounted for 13.7 percent of the total variation among all seven factors. The remaining factors accounted for about 43.6 percent of the total variance in the use of these practices.

About 42 percent of the variance in practice use was due to specific and error types of variance.

V. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study, the review of literature, the researcher's experience and views, the following conclusion and recommendations are made. If it is desired to improve the practice checklist approach to planning and evaluation in order to obtain more valid, reliable, and meaningful data, the factors found here to be associated with the approach should be considered by those responsible.

Indication of Change in Dairy Production and Dairy Production Practice Use Between 1970 and 1975

In reviewing the initial comparisons between the use of recommended production practices in 1970 and 1975 a high degree of change, due to unknown factors, was indicated. Therefore, an instability of the data was observed in terms of the increased variation in practice use and the high range existing between the number of producers per county, during each of the two fiscal years, using the recommended practices. The instruments were thus measuring something different, and the errors which existed resulted in little confidence being placed in the ability of using percentage to accurately measure change.

It is recommended that if change is going to be measured, then a method other than the use of percentages to measure differences in practice use, is needed. One possibility would be that of measuring numbers of producers using each recommended practice during the two time

periods and observe the data without placing any change score value on it. Still a second method would be the development of an index of practice use for the two time periods. Here one could observe the number of individuals in the population using the recommended practice. Then taking this observation and multiplying it by the number of practices being used, an index of practice use could be established. Then, based upon the number of individuals using the practice at the two time periods, a score, based upon the index, could be computed to determine practice use.

Both of these measures would be possible measures of practice use and each should be further examined to determine the possibilities of its future use.

Interrelations Between the Use of Selected Recommended Dairy Production Practices in FY 1970 and FY 1975

Two types of data observed in determining the interrelations between the use of selected recommended dairy production practices at the two time periods. Both the qualitative and quantitative measures of the interrelations between the use of selected practices exhibited low correlation coefficients. This indicated that a low percentage of the variation was accounted for among the practices and this low variation indicated that each practice tended to be measuring something different than any other practice.

The 1970 qualitative measures of practice use exhibited low correlation coefficients and a higher number of significantly related practices than did the 1975 qualitative measure. Therefore, each

practice tended to be measuring something different.

The 1975 quantitative measures of practice use gave the lowest coefficients between practices, thus, indicating that the practices were each measuring something different. On an overall basis, findings indicate that this quantitative measure was a more specific, accurate, and refined measure of the degree of practice use than the dichotomy or yes and no qualitative measure.

However, it is recommended that the degree to which a practice is to be measured in terms of "how specific of a measure is needed" should be previously established depending upon the purposes for which the measure is going to be used. How close to 1.00 does a coefficient need to get before it is measuring a similar (instead of specific) characteristic in common with another practice? Also, the type of question used (i.e.,qualitative or quantitative) should depend upon the content of the practice (e.g., whether or not the practice can be used to various degrees,like "Do you have a silo?") and how specific a measure is required to achieve purposes previously established.

Use of Factor Analysis in Data Reduction and Interpretation

Factor analysis was found to be a meaningful and useful statistical procedure for both the reduction and interpretation of a large number of measurements regarding a broader characteristic. It was found that a large quantity of data could be adequately reduced and classified into smaller components for interpretation and application, or for use in further analysis of broader concepts.

Also, the loadings of practices (as seen by the size of their

coefficients) on each factor appears to be a useful statistic for purposes of determining the relative strength of a specific practice as a measure of the underlying factor. Factor loadings, for example, could be used to develop an instrument for measuring the dairymen's use of a bundle of practices. Factor analysis can also be successfully used in the determination of subject areas to which a group of practices could be associated.

It is therefore recommended that factor analysis be used in revising survey schedules in order to remove redundant questions or practices, and also to provide a more accurate instrument for measuring degrees of practice use by Extension clientele. This approach, thus, appears promising for purposes of increasing the efficiency of staff time used to secure more accurate data regarding clientele use of bundles of recommended practices.

Findings Regarding the Amount of Variance in the Use of Each of the Practices As Accounted for by the Factors and As Accounted for by All the Factors

The use of statistical measures such as Eigenvalues and Communalities were found to be useful for purposes of identification of practices as to which was a "more" or "less" specific measure of practice use. Findings revealed by these two statistics both support the concept that the use of quantitative measures, as compared with qualitative measures, provide a more precise measure of the degree of use provided practices are such that they can be applied to varying degrees (i.e., are not yes or no or all or nothing).

In observing these statistics upon the basis of size of the coefficients, one can determine practices which would provide more specific measures (low coefficients) or if a broad measure of practice use (e.g., a bundle of practices) is needed, practices with higher coefficients could be chosen to meet this criteria.

Therefore, it can be concluded that the practices with lower coefficients tend to be more "independent" in terms of clientele use. It is recommended that more studies be undertaken in the use of these statistics to identify bundles of practices, and determine strength of individual practices, as an indicator of the underlying group of practices. Also, the possibility of using statistics available through factor analysis as a measure of practice use by clientele and thus a useful tool for evaluating Extension programs needs further study.

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APPENDIXES

APPENDIX A

COOPERATIVE AGREEMENT
between
THE COOPERATIVE EXTENSION SERVICE
UNIVERSITY OF TENNESSEE
and
THE EXTENSION SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

PURPOSE: To develop procedures for evaluating progress and establishing Extension eductional priorities.

This agreement is made and entered into by and between the Cooperative Extension Service, University of Tennessee, hereinafter called the Cooperator, and the Extension Service, United States Department of Agriculture, hereinafter called the Service.

WHEREAS, there is a need to develop instruments and techniques of data collection for measurement of Extension educational program effectiveness, and

WHEREAS, there is a need to identify key factors contributing to Extension educational program effectiveness and establish quantitative relationships between TEMIS and other input data and practice checklist and other output data, and

WHEREAS, there is a need to develop an approach for utilizing findings in resource allocation and program development and develop effective materials for use in related training, and

WHEREAS, the Cooperator and the Service wish to cooperate in developing programs for evaluating Extension programs and establishing priorities.

NOW THEREFORE, for and in consideration of the promises and covenants herein contained, the parties hereto agree as follow:

1. The Cooperator agrees to:

   a. Identify input and output (result) variables needed to measure program efforts, effectiveness and efficiency.

   b. Develop procedure for synthesizing benchmark and progress check data to arrive at output (result) measures.

   c. Develop an approach for utilizing findings in resource allocation and program development.

   d. Pay all costs associated with the work accomplished under the agreement not covered by funds advanced by the Service.

   e. Provide the Service with a statement of expenditure as of June 30, 1973 within 60 days thereafter.

f. Provide the Service with progress reports as requested.

g. Provide the Service with 6 copies of a written report evaluating the results of the project and with copies of any published materials.

h. Impose no negotiated overhead or indirect cost rate on funds received to finance this project.

2. The Service agrees to:

a. Advance funds in the amount of $10,000 upon execution of this agreement. Additional funds will be advanced upon receipt of a properly prepared billing. Cost to the Service under this agreement will not exceed $20,600.

b. Provide technical assistance and guidance as needed.

c. Review any progress reports requested by the Service and recommend any adjustments needed.

3. It is mutually agreed that:

a. This agreement shall become effective on the date of the last affixed signature and shall remain in effect until June 30, 1973, unless extended by mutual consent.

b. This agreement may be terminated at any time by either party upon receipt of written notice 30 days in advance of the intended date of termination.

c. Should there be any unobligated funds remaining in the advance, at the conclusion of the project, such funds shall be refunded to the Service.

d. The cooperation of the Service and the Cooperator will be acknowledged on any materials published as a result of work carried out under the terms of this agreement.

e. Attached hereto and made a part of this agreement are the provisions of Executive Order No. 11246, dated September 24, 1965, Sec. 202, para. (1) through (7). As appearing throughout these paragraphs, the word "contract" shall be construed to mean "agreement" and the word "contractor" shall be construed to mean "cooperator."

f. No member of or delegate to Congress shall be admitted to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

g. The provisions of the project proposal as approved, on which this agreement is based, not specifically contained herein, shall be a part of the agreement.

IN WITNESS WHEREOF, the parties whose signatures appear below admit to having authority to enter into such agreements and agree that this agreement shall become effective on the date of the last affixed signature.

Director, Cooperative Extension Service University of Tennessee	2-27-73 Date
Administrator, Extension Service	2-13-73 Date

APPENDIX B

SUGGESTIONS FOR MAKING THE 1970 DAIRYING SAMPLE SURVEY

1. Obtain an up-to-date list of Grade A producers from the County Health Department.

2. Number the names on the list, leaving list in order obtained.

3. Use nth number technique to randomly draw 10 names from list, as follows:

   a) Flip coin to see where sample starts--heads=2nd, or tails=3rd name in list.

   b) Divide total number in list by ten to get the nth number.

   c) Starting from #2 in the list (heads) or #3 (tails) move n numbers down the list, systematically, to select each producer to interview.

4. Interview the ten producers whose names are drawn, making appointments beforehand where possible.

   (Note: if producer is not contacted after two attempts, take the next name below on the original list and proceed as before. If that one is not contacted after two attempts, take the name above the one originally drawn--and so on, down and up until that interview is conducted.)

5. If there are only 10 (or fewer) Grade A producers, interview all.

6. When interviewing, use the Grade A practice checklist, 416L1.

7. In conducting the interview, the agent, not the producer, holds and marks the checklist.

8. When interviewing, do not ask practices as they are written in 416L1 but, rather, ask questions related to practice (see 416L1 guide sheet for subject matter preparation) so as to assure yourself whether or not the producer is using the practice.

9. Following interview, have secretary make extra copy (416L1).

10. When all 10 interviews have been conducted and duplicates made, send the 10 duplicates to District Office to be forwarded to the Dairy Husbandman. Keep the 10 original copies for your file. (Note: a copy of 416L3 also should be returned.)

Tennessee ET&S 416L4
January 15, 1970

THE AGRICULTURAL EXTENSION SERVICE, UNIVERSITY OF TENNESSEE
Knoxville, Tennessee

GRADE A MILK PRODUCTION PRACTICE CHECKLIST

Name _____ Address _____

County _____ Date _____ Tenure Status _____ No. _____

Total number of Cows in Herd _____ Number Registered _____ Number Grade _____

Herd Average _____ lbs. milk _____ lbs. fat

RECOMMENDED PRACTICE (See explanatory guide sheet)	YES	NO
1. Was the majority of your herd bred to a bull with a plus A. I. (artificial insemination) proof last year (i.e., his artifically sired daughters' production exceeded that of their herdmates)?		
2. Were heifers bred to freshen at 24-27 months of age?		
3. Was a period of at least 60 days following calving allowed each cow prior to breeding?		
4. Was an adequate amoung of stored forage provided so that each cow had all the hay and/or silage that she could consume every day?		
5. Was high quality hay and/or silage (alfalfa--bud to 1/10 bloom stage; grasses and small grain-- in the boot to early bloom stage; corn for silage-- in the dent stage) provided last year?		
6. Was an adequate amount (1 to 2 acres per cow) of improved pasture (e.g., Ladino and orchard grass) provided last year?		
7. Was an adequate amoung of summer pasture (¼ to ½ acre per cow) provided?		
8. Was an all-grain concentrate mixture (i.e., one not containing ground hay, etc.) fed to your milking herd?		
9. Was grain fed according to production with special attention to assure that high producers got enough grain (i.e., 1 to 3 or 1 to 4)?		

	YES	NO
10. Was forage fed last year based on U. T. Forage Testing Laboratory recommendations?		
11. Were adequate milk production records kept last year (DHIA, DHIE, OS, or WADAM)?		
12. Was an average dry period of 60 days per cow provided last year?		
13. Was a 12-14 month calving interval maintained last year?		
14. Did you raise at least 75% of herd replacements?		
15. Were adequate herd records (heat, health, identification) maintained?		
16. Were separate feeding and loafing areas provided for milking herd?		
17. Was the milking system checked every 6 months to see that it was functioning properly as to pulsation rate and vacuum level?		
18. Was each cow prepared properly for milking (including the use of a strip cup, or its equivalent, on each quarter) before the machine was attached?		
19. Was a recommended method of fly control systematically used around barns, loafing and milking areas?		
20. Was the advice of professional dairy workers obtained with regard to management of your herd?		
21. Did at least 75% of your cows freshen in the fall last year?		

Tennessee ET&S 416L1
2/12/70

APPENDIX C

SAMPLE SIZE

FOR

GRADE A DAIRY FARM MANAGEMENT
AND PRODUCTION SURVEY, 1975

District	County	Number of Grade A Producers*	Number of Grade A Producers to be Surveyed**
I	Fayette	15	11
	Gibson	12	9
	Henry	22	15
	Obion	18	13
	Weakley	44	22
II	Bedford	65	27
	Davidson	25	16
	Giles	42	22
	Lawrence	48	23
	Lincoln	55	25
	Marshall	95	31
	Maury	68	27
	Robertson***	46	23
	Rutherford	94	30
	Sumner***	39	21
	Williamson	82	29
	Wilson	41	21
III	Bradley	78	29
	Coffee	32	19
	Franklin	54	25
	Hamilton	33	19
	McMinn***	108	32
	Monroe***	108	32
	Polk	15	11
	Rhea	15	11
	Sequatchie	13	10

*Source Extension Dairy Department, University of Tennessee 3/31/75.
**Sample size was computed by Dr. William T. Sanders, Statistician, U.T. Agricultural Experiment Station using 95% probability level with .15 variation above or below true proportion.
***Test county--survey already completed.

Continued

SAMPLE SIZE - Continued

FOR

GRADE A DAIRY FARM MANAGEMENT
AND PRODUCTION SURVEY, 1975

District	County	Number of Grade A Producers*	Number of Grade A Producers to be Surveyed**
IV	Cannon***	17	12
	Macon***	10	8
	Smith	15	11
	White	48	23
V	Blount	46	23
	Campbell	7	6
	Cocke	25	16
	Greene	136	34
	Hamblen	22	15
	Hawkins	22	15
	Jefferson	65	27
	Knox	46	23
	Loudon	50	24
	Sullivan	29	18
	Washington	90	30

*Source Extension Dairy Department, University of Tennessee 3/31/75.
**Sample size was computed by Dr. William T. Sanders, Statistician, U.T. Agricultural Experiment Station using 95% probability level with .15 variation above or below true proportion.
***Test county - survey already completed.

TABLE X

TOTAL NUMBER OF DAIRY PRODUCERS PER COUNTY, AND NUMBER OF DAIRY PRODUCERS SURVEYED PER COUNTY IN THE 1970 AND 1975 DAIRY PRODUCTION SURVEYS

COUNTIES	N= 1970	Number of Producers 1970	N= 1975	Number of Producers 1975
Gibson	10	22	8	12
Henry	10	47	15	22
Obion	10	31	13	18
Weakley	9	75	22	44
Bedford	10	75	27	65
Davidson	10	33	8	25
Giles	10	51	22	42
Lawrence	10	32	23	48
Lincoln	9	74	25	55
Marshall	10	112	31	95
Maury	10	78	27	68
Rutherford	10	124	30	94
Williamson	10	97	29	82
Wilson	10	46	29	41
Bradley	10	99	25	78
Coffee	10	45	19	32
Franklin	10	48	23	54
Hamilton	10	32	15	33
Polk	10	20	9	15
Rhea	9	23	7	15
Sequatchie	10	14	6	13
Smith	10	20	7	15
Blount	10	51	23	46
Cocke	10	29	14	25
Greene	10	139	34	136
Hamblen	10	36	11	22
Hawkins	10	33	15	22
Jefferson	9	70	22	65
Knox	10	70	19	46
Loudon	10	59	25	50
Sullivan	10	46	16	29
Washington	10	106	30	90
Totals	316	1,827	621	1,497

*N equals the sample size, or the number of producers per county surveyed in 1970 and 1975, respectively.

APPENDIX D

SPECIAL CODES

FOR

GRADE A DAIRY FARM MANAGEMENT
AND PRODUCTION SURVEY, 1975

General Coding Instructions with Examples:

1. All columns (e.g., blanks above a card column number) should be filled except columns ____ ____ ____ ____ ____ a response
   5 6 7 8 9
   to each question should be recorded for each respondent.

2. All card column entries should be right justified and the remaining columns zero filled. Example: if the response to question I-1 is "375 acres," the response should be recorded as follows in columns 7-10: 0 3 7 5.
   7 7 9 10

3. All fractions should be rounded to the nearest whole number. Example: if the answer to question I-1 is "374.5 acres," the response should be recorded as follows in columns 7-10:
   0 3 7 5.
   7 8 9 10

4. Computing percentage change from one time period to another: Example: using question I-5.

   Step #1: Compute the difference in the number of cows milked in 1970 and at present time.

   Example: In 1970 the dairyman had 75 milk cows and his present numbers of milk cows (i.e., including dry cows) is 125. Thus the difference would be 125 minus 75 = 50 cows.

   Step #2: Divide the difference (i.e., "50") by the number of cows milked in 1970 (i.e., "75") then multiply by 100 to convert to percent.

   Example: 125-75 = 50; 50 ÷ 75 = .67; .67X100 = 67 percent increase.

   Step #3: Record whether there was an increase (i.e., +) or decrease (i.e., -) in the first column and the actual percentage in the remaining three columns.

   Example: The example used in steps #1 and #2 would be recorded as follows in columns 18-21: + 0 6 7.
   18 19 20 21

Special Codes:

a. The number "9" recorded in each column may mean any of the following: "does not apply," "no response," or "don't know." Example: Assume the dairyman does not raise any silage--then the question regarding "Corn Silage Production and Management Practices" (i.e., question III-1,2,3,4,5 and 6) would not apply to him, therefore, all the card columns for these questions would be filled with number nine (9).

b. The number "zero" (0) is used in each column to record the response "none" or "not any," assuming the question applies to the dairyman. If the question does not apply see instructions in special codes "a" above.

Example using "none" as the best response:

Assume that "none" of the pasture acreage is grazed rationally (i.e., question III-11), then columns 13-15 would be zero filled: 0 (13) 0 (14) 0 (15).

Example using "does not apply" as the best response:

Assume the dairyman feeds all his pasture forages as "green chop." The best response to question III-11 (What percentage of your pasture is grazed rotationally?) would be "does not apply" and columns 13-15 would be filled with the number nine (9): 9 (13) 9 (14) 9 (15).

GENERAL INTERVIEW INSTRUCTIONS FOR GRADE A DAIRY PRODUCTION

GENERAL INSTRUCTIONS

A. Planning the Interviews

1. Inform those to be interviewed of the purpose, general nature and plans for the survey - see copy of a sample letter.

2. Become familiar with questions in the interview schedule including the codes.

3. Schedule the date, place and time of interview with each farmer at least one day prior to the visit.

B. Approach to Respondent

1. Develop a positive and confident attitude. A negative or apologetic approach encourages lack of interest and suspicion.

2. Develop a short introduction to the interview. The following information should be conveyed to the respondent during your introductory statements.

   a. Name of organization sponsoring the survey (e.g., the Agricultural Extension Service)

   b. Purpose of the survey (e.g., to help in making decision about the County Extension program over the next five years)

   c. General nature or the "kinds" of questions that will be asked.

   d. Assurance that the information he gives will be combined with other dairymen and his name will not be associated with any information he gives.

   e. Approximate length of time required to complete the interview. It is better to over estimate the time required than to underestimate it.

3. Conduct the interview at the respondent's home or on his farm.

4. Do not make substitutions unless absolutely necessary. In this case, follow suggested procedures for replacing respondents.

C. Asking the Questions

Experience shows that the interview process is more systematic and the data have greater validity and reliability when the following ideas are followed:

1. Establish rapport. Put your respondent at ease and establish a warm and friendly atmosphere.

2. Follow the rules. Ask the questions as stated in the questionnaire. If the respondent doesn't understand, repeat the question slowly. Define or explain words the respondent doesn't understand.

3. Read the question in an interested and interesting way.

4. Adjust the tempo of the interview to the respondent and his speed in answering the questions - flow and continuity are essential to the maintenance of the respondent's interest.

5. Do not show emotions (e.g., approval or disapproval, surprise or shock) at responses given, bur merely interest and expectancy.

6. Ask questions in the order in which they are printed on the questionnaire.

7. Questions should not be omitted because it is assumed that they have already been answered.

8. Alert the respondent to a change from one topic on the questionnaire to another topic or subject. "You have answered the questions on size of herd and plans for the future." "Now, the next few questions are about your farm buildings, milking and feeding facilities.

9. If the respondent responds "don't know" to a question, pause briefly then repeat the question slowly. Allow plenty of time for the respondent to think about the question. Do what you can to clarify the question but if a person really does not know the question is coded with the number nine (9) in each column.

10. You will need to help respondents convert actual numbers into percentages on some of the questions.

11. Treat each interview as a separate experience. You may be prone, after a few interviews, to develop your own ideas about answers to certain questions. Be very careful that these ideas are not reflected in your manner of asking the questions, or in the way you record the responses.

D. Closing the Interview

The respondent should be left with a pleasant feeling about the interview. He should be left with the feeling of having been helpful and that his cooperation is appreciated.

Editing. Too much emphasis cannot be given to the importance of checking the completeness, accuracy and legibility of the questionnaire before you leave the farm.

PROPOSAL FOR INSERVICE TRAINING OF EXTENSION LEADERS IN DAIRY PILOT COUNTIES

Date of meeting: September 11, 1975

Time of meeting: 9:30 a.m. - 12:00 p.m.

Place of meeting: District IV Extension Office in Cookeville

Purpose of meeting: Plan dairy survey in six pilot counties

Person attending meeting: Associate Supervisors: Owen Hodges, Rural Peace and Ray Stamey; Extension Leaders: Demps Breeding, Marvin Farris, Clayton Glenn, Earl Law, Marvin Lowery and Don Malone

AGENDA

Orientation: Troy Hinton, presiding

- Introductions
- Purpose of meeting
- Plans for meeting
- Purpose of UT-ES/USDA research project
- General plans for dairy survey in pilot counties

Plans for Executing the Research Project: Bill Sanders

- Design of project
- Use and importance of data from pilot counties

Plans for Securing Data in Pilot Counties: Ted Carter

- Tasks of Extension Leaders
- Schedule for training interviewers
- Review of the dairy interview schedule

SUGGEST CRITERIA FOR SELECTING INTERVIEWERS
IN PILOT DAIRY COUNTIES

Interviews:

1. Should be honest.
2. Should have the ability to meet and get along with others.
3. Should have the ability to gain dairyman's trust and respect.
4. Should be free to work at the job full-time until completed.
5. Should provide their own transportation.
6. Should have an interest in the job, other than the pay (i.e., will stay on the job until completed).
7. Should be willing to spend one day in training prior to beginning the interviews.

APPENDIX E

TEST COUNTY SURVEY

THE UNIVERSITY OF TENNESSEE AGRICULTURAL EXTENSION SERVICE
IN COOPERATION WITH THE ES/USDA

1975 GRADE A DAIRY FARM MANAGEMENT
AND PRODUCTION SURVEY

Name of respondent_____ Address_____

Name of County_____ Name of Interviewer_____

Date of interview_____

___ (1) Card Number One

___ ___ ___ (2-4) County Number (Use TEMIS code number)

___ ___ ___ ___ ___ (5-9) Respondent Number (leave blank)

___ (10) Was this respondent included in the 1970 dairy survey? (1 = yes, 2 = no)

I. GENERAL INFORMATION

IA. Size of Farm

___ ___ ___ ___ (11-14) 1. How many acres of land (owned and rented) do you operate? (Self-coded (sc) - all entries in this questionnaire should be right justified and rounded to the nearest whole number.)

___ ___ ___ ___ (15-18) 2. How many acres of land do you own? (sc)

___ ___ ___ ___ (19-22) 3. How many acres of cropland do your operate ? (sc)

IB. Year Farming Experience

___ ___ (23-24) 4. How many years has there been a dairy operation on this farm under the present ownership? (sc)

___ ___ (25-26) 5. How many years have you sold milk? (sc)

Approval:_____ Date_____
Extension Leader

TAEE 416LX
9/8/75

____ ____ 6. How many years have you sold grade A milk? (sc)
27 28

IC. Size of Dairy Herd and Plans for Expansion

____ ____ ____ 7. How many cows did you milk this morning? (sc)
20 30 31

____ ____ 8. How many dry cows did you have this morning? (sc)
32 33

9. In your milking herd:

____ ____ ____ a. How many cows are Holsteins? (sc)
34 35 36

____ ____ ____ b. How many cows are Jerseys? (sc)
37 38 39

____ ____ ____ c. How many cows are Guernseys? (sc)
40 41 42

____ ____ ____ d. How many cows are mixed and/or other breeds? (sc)
43 44 45

____ ____ ____ 10. What percentage change in the number of cows milked (i.e., either increase or decrease) have you had over the past five years? (In column #46 place a plus (+) to indicate an increase, a minus (-) to indicate a decrease or a zero to indicate no change. Columns #47 and #48 self coded.)
46 47 48

____ ____ ____ 11. How many acres of land have your purchased in the past 5 years? (sc)
49 50 51

____ ____ ____ ____ 12. What percentage change in the acres of land rented have you had over the past 5 years? (In column #52, place a plus sign (+) to indicate an increase, a minus sign to indicate a decrease or a zero (0) to indicate no change. Columns #53-#55 are self coded.)
52 53 54 55

____ 13. Have you added new buildings or silos in the past 5 years? (1=yes, 2=no)
56

____ ____ ____ ____ 14. In the past 5 years what percentage change (either increase or decrease) have you had in the amount of labor used (i.e., man-days) on your farm? (In column #57, place a plus sign (+) to indicate an increase, a minus sign (-) to indicate a decrease, or a zero (0) to indicate no change. Column #58-60 are self-coded.)
57 58 59 60

____ (61) 15. Have you changed the capacity of your milk cooler or bulk tank within the past 5 years? (1=yes, 2=no)

____ ____ ____ ____ (62 63 64 65) 16. What percentage change in the number of cows milked (i.e., either increase or decrease) do you plan to make over the next 5 years? (In column #62, place a plus sign (+) to indicate plans to increase, a minus sign (-) to indicate plans to decrease or a zero (0) to indicate no change planned. Columns 63-65 are self-coded.)

____ ____ ____ (66 67 68) 17. Approximately what percentage of your farm income comes from the sale of milk? (sc)

____ ____ ____ (69 70 71) 18. Approximately how many days do you work each year off the farm including custom work for hire? (sc)

____ (1) 2 Card Number Two

____ ____ ____ (2 3 4) County Number (use TEMIS code number)

____ ____ ____ ____ ____ (5 6 7 8 9) Respondent Number (leave blank)

ID. Farm Machinery, Milking, and Feeding Facilities and Equipment

____ ____ ____ (10 11 12) 19. With your present amount of land, buildings, equipment and machinery, what percentage increase could you make in the number of cows you could milk? (sc)

____ ____ ____ ____ (13 14 15 16) 20. How many tons of silage can you store in existing structures? (sc)

____ (17) 21. Do you use an upright silo? (1=yes, 2=no)

____ (18) 22. Do you use a trench and/or a bunker silo? (1=yes, 2=no)

____ (19) 23. Do you use a milking parlor? (1=yes, 2=no)

____ (20) 24. Do you plan to change your silage feeding facilities within the next 5 years? (1=yes, 2=no)

_____ 21 25. Have you increased your silage storage capacity with in the past 5 years? (1= yes, 2=no)

_____ 22 26. Have you changed your silage feeding equipment in the past 5 years? (1=yes, 2=no)

IE. Farm Labor

_____ 23 27. How many full-time workers, including yourself, operate your farming program? (sc)

_____ 24 _____ 25 _____ 26 28. Approximately how many man-days of labor, other than the immediate family, do you hire each year? (sc)

_____ 27 29. Is your farming operation a partnership? (1=yes, 2=no)

_____ 28 30. Do you have a son or a son-in-law who is presently involved or plans to become involved in your farm operation? (1=yes, 2=no)

_____ 29 31. Do full-time employees participate in making management decisions? (1=yes, 2=no)

_____ 30 32. Are employees given extra pay for exceptionally good work? (1=yes, 2=no)

_____ 31 33. Would you advise a qualified young man to go into the dairy business? (1=yes, 2= no)

_____ 32 34. Do they have a 4-H project animal on your farm? (1=yes, 2=no)

II. DAIRY HERD MANAGEMENT

II-A. Raising Replacement Heifers

_____ 33 _____ 34 _____ 35 1. Approximately what percentage of your herd replacements are raised on your farm? (sc)

_____ 36 2. How many times each day do you check cows that are about ready to calve? (sc)

____ 37 3. Are cows about ready to calve kept separate from the milking herd? (1=yes, 2=no)

4. Approximately what percentage of your heifer calves:

____ ____ ____ 38 39 40 a. Are treated at birth with a navel disinfectant? (sc)

____ ____ ____ 41 42 43 b. Are given an identification mark at birth? (sc)

____ ____ ____ 44 45 46 c. Receive colostrum within one to two hours after birth? (sc)

____ ____ ____ 47 48 49 d. Are housed in individual pens? (sc)

____ ____ ____ 50 51 52 e. Are dehorned as calves? (sc)

____ ____ ____ 53 54 55 f. Are fed milk replacer? (sc)

____ ____ ____ 56 57 58 g. Are fed a commercial calf starter until four (4) months of age? (sc)

____ ____ ____ 59 60 61 h. Are fed grain from 4 to 10 months of age? (sc)

____ 62 5. Over the past 5-year period, have you made changes in practices used in raising replacement heifers? (1=yes, 2=no)

II-B. Sanitation and Non-Infectious Diseases

____ 63 6. Are you generally pleased with the condition of your milking area when visitors appear? (1=yes, 2=no)

____ 64 7. Do you have an effective system for controlling flies around the milking and loafing areas? (1=yes, 2=no)

____ ____ 65 66 8. Approximately how many milk cows have you sold from your herd within the past 12 months? (sc)

9. Approximately how many cows were culled within the past 12 months because of:

____ ____ 67 68 a. Udder problems? (sc)

____ ____ b. Low production--independent of udder problems? (sc)
69 70

____ ____ c. Reproductive problems? (sc)
71 72

10. Over the past 12 months, how many of your fresh cows:

____ ____ a. Had ketosis? (sc)
73 74

____ ____ b. Had retained placentas? (sc)
75 76

____ ____ c. Had milk fever? (sc)
77 78

3 Card Number Three
1

____ ____ ____ County Number (Use TEMIS code number)
2 3 4

____ ____ ____ ____ ____ Respondent Number (Leave blank)
5 6 7 8 9

II-C. Machine Milking Step-By-Step

Instructions to Interviewer:

1. Give dairyman the "key to responses to step-by-step milking statements."

2. Explain that you (the interviewer) will read several statements about milking procedures and that he (the dairyman) is to respond by giving the number (i.e., 1,2,3,4,or 5) preceding the key which most accurately describes his response.

3. The interviewer should record the number indicated by the dairyman.

KEY TO RESPONSES TO STEP-BY-STEP MILKING STATEMENTS

1 = I <u>always</u> do that (95 to 100% of cows milked).

2 = I <u>usually</u> do that (75 to 94% of cows milked).

3 = I <u>sometimes</u> do that (50 to 74% of cows milked).

4 = I usually do not do that (10 to 49% of cows milked).

5 = I never do that (less than 10% of cows milked).

11. Step-by-step machine milking statements.

____ 10 a. Milk at regular hours.

____ 11 b. Milk cows having a record of mastitis last.

____ 12 c. Wash udder with a warm, water-sanitizing solution.

____ 13 d. Dry udder with a clean towel.

____ 14 e. Remove several streams of fore-milk from each quarter.

____ 15 f. Begin milking within two minutes after the udder is washed.

____ 16 g. Strip with the machine.

____ 17 h. Remove the milking machine as soon as the milk flow stops.

____ 18 i. Dip each teat in a sanitizing solution.

____ 19 j. Sterilize teat cup liner after milking each cow.

____ 20 k. Treat each quarter having a history of mastitis with an appropriate dry cow treatment.

That complete the step-by-step milking statements.

____ 12. Have you made changes in your milking procedures within the past 5 years?
21

III. FORAGE PRODUCTION AND MANAGEMENT

III-A. Pasture Fertilization

____ ____ ____ 1. When last seeded, what percentage of your permanent pasture land was limed and fertilized based on soil test recommendations? (sc)
22 23 24

____ ____ ____ 2. Within the past three years, what percentage of your permanent pasture land has been limed and fertilized based on soil test recommendations? (sc)
25 26 27

____ ____ ____ 3. In an average year, approximately what percentage of your permanent pasture land is overseeded with legumes? (sc)
28 29 30

____ 4. Have you changed your pasture fertilization practices with the past 5 years? (1=yes, 2=no)
31

III-B. Forage Management

____ ____ ____ 5. What percentage of your pasture forage is fed as "green chop" in the dry lot? (sc)
32 33 34

____ ____ ____ 6. Approximately what percentage of your pasture is grazed rotationally? (sc)
35 36 37

____ ____ 7. How many inches tall is your small grain when grazing is started? (sc)
38 39

____ ____ 8. How many inches tall is your summer pasture when grazing is started? (sc)
40 41

____ ____ ____ 9. What percentage of your permanent pastureland is clipped each year to control weeds? (sc)
42 43 44

____ ____ ____ 10. How many acres of corn were grown for silage this year? (sc)
45 46 47

____ ____ 11. What is your average yield per acre of corn silage grown? (sc)
48 49

____ 12. Do you double-crop corn and small grain for silage? (1=yes, 2=no)
50

___ ___ ___ (51 52 53) 13. Approximately what percentage of your clover have and/or clover silage is cut when in the "bud to 1/10 bloom stage" of maturity? (sc)

___ ___ ___ (54 55 56) 14. Approximately what percentage of your grass hay and/or grass silage is cut when in the "boot to early bloom stage"? (sc)

___ ___ ___ (57 58 59) 15. Approximately what percentage of your corn silage is cut when in the "dent stage" of maturity? (sc)

___ (60) 16. Have you changed your forage management practices within the last 5 years? (sc)

___ (61) 17. Was your hay and/or silage tested by a forage testing laboratory last year? (sc)

IV. FEEDING THE MILKING HERD

___ ___ ___ (62 63 64) 1. How many acres of corn were grown for grain this year? (sc)

___ ___ ___ (65 66 67) 2. What is your average yield per acre of corn grown for grain this year? (sc)

___ ___ ___ ___ (68 69 70 71) 3. Approximately how many tons of hay do you feed each winter? (sc)

___ (72) 4. Do you usually feed some hay each day during the winter months? (1=yes, 2=no)

___ ___ ___ (73 74 75) 5. Approximately how many tons of "excess silage" do you plan to carry-over each year? (sc)

___ (1) 4 Card Number Four

___ ___ ___ (2 3 4) County Number

___ ___ ___ ___ ___ (5 6 7 8 9) Respondent Number (Leave blank)

___ ___ ___ ___ (10 11 12 13) 6. Approximately how many tons of silage do you feed each year? (sc)

_____ 14 7. Do you feed each cow in milk all the hay and/or silage she will eat each day during the winter= (1=yes, 2=no)

_____ 15 8. Are cows divided into groups, by milk production? (1=yes, 2=no)

_____ 16 9. Are cows fed grain according to milk production? (1=yes, 2=no)

_____ 17 10. Have you made changes in your forage feeding practices within the last 5 years? (1=yes, 2=no)

_____ 18 11. Have you changed your concentrate feeding practices within the last 5 years? (1=yes, 2=no)

V. DAIRY CATTLE BREEDING PROGRAM

_____ _____ _____ 19 20 21 1. What percentage of your cows are bred by artificial insemination? (sc)

_____ 22 2. Do you have certain production qualifications required of bulls used to breed your cows? (1=yes, 2=no)

_____ 23 3. Does the person in charge of the herd decide which bull to use in artificially breeding your cows? (1=yes, 2=no)

_____ 24 4. Is some one person responsible for checking cows for heat? (1=yes, 2=no)

_____ 25 5. How many times each day is the herd checked for heat? (sc)

_____ 26 6. In the winter months especially, are cows checked for heat at least two hours after milking? (1=yes, 2=no)

_____ 27 7. Are cows in heat removed from the milking herd? (1=yes, 2=no)

_____ _____ _____ 28 29 30 8. Approximately what percentage of your cows are bred during the last half of the heat period? (sc)

_____ _____ _____ 31 32 33 9. Approximately what percent of your cows freshen in the fall? (sc)

____ 34 10. Are dry cows kept separate from the milking herd? (1=yes, 2=no)

____ 35 ____ 36 ____ 37 11. Approximately what percentage of your cows have at least a 40-day dry period? (sc)

____ 38 ____ 39 ____ 40 12. Approximately what percentage of your cows have over a 60-day dry period? (sc)

____ 41 ____ 42 ____ 43 13. Approximately what percentage of your cows have at least 60 days after calving before breeding? (sc)

____ 44 ____ 45 ____ 46 14. Approximately what percentage of your heifers freshen at 24 to 27 months of age? (sc)

____ 47 15. Have you changed your dairy breeding practices within the past 5 years? (1=yes, 2=no)

VI. DAIRY RECORDS

VI-A. Dairy Breeding Records

____ 48 1. Do you have a system for permanently identifying each animal in your herd (1=yes, 2=no)

2. Do you keep each of the following types of records on each cow in your herd:

____ 49 a. Date came in heat? (1=yes, 2=no)

____ 50 b. Date bred? (1=yes, 2=no)

____ 51 c. Bull used to breed cows? (1=yes, 2=no)

____ 52 d. Expected calving date? (1=yes, 2=no)

____ 53 e. Date to dry-off cows? (1=yes, 2=no)

____ 54 f. Calving date? (1=yes, 2=no)

_____ 55 3. Have you changed your dairy record keeping practices within the past 5 years? (1=yes, 2=no)

VI-B. Milk Production Records

4. Do you presently use each of the following types of milk production record keeping systems:

_____ 56 a. Dairy Herd Improvement Association--DHIA? (1=yes, 2=no)

_____ 57 b. Dairy Herd Improvement Registry--DHIR? (1=yes, 2=no)

_____ 58 c. Owner Sampler Record--OSR? (1=yes, 2=no)

_____ 59 d. Basic Management Record? (1=yes, 2=no)

_____ 60 5. Do you keep some type of milk production record on each cow in your herd? (1=yes, 2=no)

_____ 61 6. Do you feel that keeping milk production records on each individual cow is worth the effort? (1=yes, 2=no)

_____ 62 7. Have you changed your systems of keeping milk production records within the last 5 years? (1=yes, 2=no)

VI-C. Total Farm Records and Plans

_____ 63 8. Do you participate in a commercial farm record keeping program? (1=yes, 2=no)

_____ 64 9. Do you have a plan for increasing the average pounds of milk produced per cow over the next 5-year period? (1=yes, 2=no)

_____ 65 10. As a part of your farm record program, do you keep a beginning and ending inventory of cattle, stored feed and other supplies? (1=yes, 2=no)

____ 66 11. Do you keep a crop and yield history of your cropland by fields? (1=yes, 2=no)

____ 67 12. Do you calculate or have calculated such efficiency factors as machinery cost and/or milk sales per full-time worker? (1=yes, 2=no)

____ ____ 68 69 13. Approximately what percentage of your gross farm income are you able to convert to net income? (sc)

____ 70 14. Have you changed your farm record keeping system within the past 5 years? (1=yes, 2=no)

__5 1 Card Number Five

____ ____ ____ 2 3 4 County Number

____ ____ ____ ____ ____ 5 6 7 8 9 Respondent Number (Leave blank)

VII. MILK PRODUCTION

____ ____ ____ ____ ____ 10 11 12 13 14 1. What was your herd's average milk production per cow last year? (sc)

____ ____ ____ 15 16 17 2. What was your herd's average pounds of butter fat produced per cow last year? (sc)

____ ____ ____ ____ 18 19 20 21 3. Approximately, what percentage change in herd average pounds of milk produced per cow have you had since 1970? (In column #18 place a plus sign (+) to indicate an increase, a minus sign (-) to indicate a decrease or a zero (0) to indicate no change. Columns 19, 20, and 21 are self coded.)

VIII. PERSONAL QUESTIONS

VIII-A. Personal Information About Dairyman

____ ____ 1. How old are you? (sc)
22 23

____ ____ 2. How many school grades did you complete? (sc)
24 25

VIII-B. Contact Dairyman Had With the Extenstion Service

____ ____ 3. Approximately how many Extension meetings have you attended in the last 12 months? (sc)
26 27

____ ____ 4. Approximately how many visits have you made to the County Extension office in the last 12 months?
28 29

____ ____ 5. Approximately how many telephone calls have you made to the County Extension Office in the last 12 months? (sc)
30 31

____ ____ 6. During the past 12 months, approximately how many visits have Extension Agents made to your farm? (sc)
32 33

NOTE TO INTERVIEWER:

At this point tell the respondent that was the last question but that you do need to look back to make sure all answers have been recorded properly.

APPENDIX F

THE UNIVERSITY OF TENNESSEE AGRICULTURAL EXTENSION SERVICE
IN COOPERATION WITH THE ES/USDA

GRADE A DAIRY FRAM MANAGEMENT
AND PRODUCTION SURVEY, 1975

Name of respondent_____Address_____

Name of County_____County TEMIS Code Number_____

1 (1) Card Number One

(2) (3) (4) (5) (6) County and Respondent Number (leave blank)

I. GENERAL INFORMATION

(7) (8) (9) (10) 1. How many acres of cropland (i.e., include pasture) do you operate (i.e., owned and rented)? (sc)*

(11) (12) 2. How many years have you sold milk? (sc)

(13) (14) (15) 3. How many cows did you milk this morning? (sc)

(16) (17) 4. How many dry cows did you have this morning? (sc)

(18) (19) (20) (21) 5. What percentage change in the number of cows milked have you had since 1970? (In column #18 place a plus (+) to indicate an increase, a minus (-) to indicate a decrease or a zero (0) to indicate no change. Columns #19, #20 and #21 are self coded-sc).

(22) 6. Have you increased the acres of land operated (owned and rented) since 1970? (1=yes, 2=no)

(23) 7. In the past 5 years, have you increased the amount of labor used on your farm? (1=yes, 2=no)

(24) 8. Have you added new buildings or silos since 1970? (1=yes, 2=no)

*sc - self-coded - record the actual response (i.e., number or %) to the question.

TAEE 416LX
Revised 3/76

___ 25 9. Have you increased the capacity of your bulk milk tank during the past 5 years? (1=yes, 2=no)

___ 26 ___ 27 ___ 28 ___ 29 10. What percentage change in the number of cows milked do you plan to make over the next 5 years? (In column #26 place a plus (+) sign to indicate an increase, a minus (-) sign to indicate a decrease or a zero (0) to indicate no change planned. Columns #27, #28, and #29 are self coded).

___ 30 ___ 31 ___ 32 11. Approximately what percentage of your farm income comes from the sale of milk? (sc)

___ 33 12. Were you employed off the farm (i.e., include custom work for hire) over 100 days in 1975? (1=yes, 2=no)

___ 34 13. How many full-time workers (including yourself) operated your farm in 1975? (sc)

___ 35 14. Is your dairy operation a partnership? (1=yes, 2=no)

___ 36 15. Do full-time employees participate in making management decisions? (1=yes, 2=no)

___ 37 16. Do full-time employees receive extra pay for exceptionally good work? (1=yes, 2=no)

___ 38 17. Would you advise a qualified young man to go into the dairy business? (1=yes, 2=no)

___ 39 18. Does anyone on your farm have a 4-H dairy project animal? (1=yes, 2=no)

II. BUILDINGS, MILKING AND FEEDING FACILITIES

___ 40 1. Do you plan to build additional storage, feeding and/or loafing facilities for your milking herd? (1=yes, 2=no)

___ 41 2. Do you have a silo? (1=yes, 2=no)

___ 42 3. How many years have you had a silo? (sc)

___ 43 4. Do you have an upright silo? (1=yes, 2=no)

___ 45 5. Do you have a horizontal silo? (1=yes, 2=no)

___ 46 6. Have you increased your silage storage capacity since 1970? (1=yes, 2=no)

___ 47 7. Have you changed your system for feeding silage since 1970? (1=yes, 2=no)

___ ___ ___ 48 49 50 8. With your present land, buildings and milking and feeding facilities, what percentage increase could you make in the number of cows you could milk? (sc)

___ 51 9. Have you had your milking machine checked for pulsation rate and vacuum level within the last 6 months? (1=yes, 2=no)

III. FORAGE PRODUCTION AND MANAGEMENT

A. Corn Silage Production and Management Practices

___ ___ ___ 52 53 54 1. How many acres of silage (i.e., corn, small grain or hay crop) did you harvest in 1975? (sc)

___ ___ 55 56 2. What was your average yield (e.g., tons) per acre of corn silage harvested in 1975? (sc)

___ 57 3. Has your average yield per acre of corn silage increased since 1970? (1=yes, 2=no)

___ 58 4. Do you double crop corn and small grain for silage? (1=yes, 2=no)

___ ___ ___ 59 60 61 5. Approximately what percentage of your corn silage is cut when in the "dent stage" of maturity? (sc)

___ 62 6. Have you ever had your silage and/or hay tested by a forage testing laboratory? (1=yes, 2=no)

2 1 Card Number

___ ___ ___ ___ ___ 2 3 4 5 6 County and Respondent Number (leave blank)

B. Pasture Production and Management Practices

___ ___ ___ (7 8 9) 7. How many acres of improved pasture (e.g., grass and clover) do you have? (sc)

___ (10) 8. Did you have all the pasture you needed last summer? (1=yes, 2=no)

___ (11) 9. Did you grow at least one acre of supplemental summer pasture for every four cows in your herd last summer? (1=yes, 2=no)

___ (12) 10. Did you dry-lot-feed forages as "green chop" last summer? (1=yes, 2=no)

___ ___ ___ (13 14 15) 11. What percentage of your pasture is grazed rotationally? (sc)

___ ___ ___ (16 17 18) 12. What percentage of your pasture is clipped each year? (sc)

___ ___ ___ (19 20 21) 13. What percentage of your improved pasture was limed and fertilized based on soil test at time of seeding? (sc)

___ (22) 14. Have you changed the pasture fertilization practices followed since 1970? (1=yes, 2=no)

___ (23) 15. Have you changed pasture management practices used since 1970? (e.g., clipping, rotation, grazing, etc.) (1=yes, 2=no)

IV. DAIRY FEEDING PRACTICES

___ (24) 1. Do you normally have enough silage to feed through the winter months? (1=yes, 2=no)

___ (25) 2. Do you feed each cow in milk all the hay and/or silage she will eat each day during the winter? (1=yes, 2=no)

___ (26) 3. Are you now feeding an all-grain concentrate mixture (i.e., one not containing urea) to your milking herd? (1=yes, 2=no)

___ (27) 4. Are your cows fed grain according to milk production? (1=yes, 2=no)

___ (28) 5. Is your forage feeding area separate from the loafing area? (1=yes, 2=no)

___ 29 6. Have you changed forage feeding practices followed since 1970? (1=yes, 2=no)

___ 30 7. Have you changed concentrate feeding practices followed since 1970? (1=yes, 2=no)

V. DAIRY CATTLE BREEDING PRACTICES

___ ___ ___ 31 32 33 1. What percentage of your cows are bred by artificial insemination? (sc)

___ ___ ___ 34 35 36 2. What percentage of your cows are bred to bulls with a plus artificial insemination proof? (sc)

___ ___ ___ 37 38 39 3. What percentage of your heifers are bred by artificial insemination? (sc)

___ 40 4. Does the person in charge of the herd decide which bull to use in artificially breeding cows? (1=yes, 2=no)

___ 41 5. Is some one person responsible for checking cows for heat? (1=yes, 2=no)

___ 42 6. How many times each day is the herd checked for heat? (sc)

___ 43 7. Are cows in heat removed from the milking herd? (1=yes, 2=no)

___ ___ ___ 44 45 46 8. What percent of your cows freshen in the Fall (i.e., Sept., Oct., and Nov.)? (sc)

___ 47 9. Are dry cows kept separate from the milking herd? (1=yes, 2=no)

___ ___ ___ 48 49 50 10. What percentage of your cows have at least a 40-day dry period? (sc)

___ ___ ___ 51 52 53 11. What percentage of your cows have over a 60-day dry period? (sc)

___ ___ ___ 54 55 56 12. What percentage of your cows have at least 60 days after calving before breeding? (sc)

___ ___ ___ 57 58 59 13. What percentage of your heifers freshen at 24 to 27 months of age? (sc)

___ 60 14. Have you changed dairy breeding practices since 1970? (1=yes, 2=no)

VI. DAIRY RECORD KEEPING PRACTICES

A. Dairy Breeding Records

1. Do you keep each of the following types of breeding record on each cow in your herd:

___ 61 a. Date bred? (1=yes, 2=no)

___ 62 b. Identity of bull used to breed cows? (1=yes, 2=no)

___ 63 c. Expected calving date? (1=yes, 2=no)

___ 64 d. Date to dry-off cows? (1=yes, 2=no)

___ 65 e. Calving date? (1=yes, 2=no)

___ 66 2. Have you changed dairy breeding records kept since 1970? (1=yes, 2=no)

VI-B. Milk Production Records.

3. Do you presently use the following types of milk production record keeping systems:

___ 67 a. Dairy Herd Improvement Association--DHIA? (1=yes, 2=no)

___ 68 b. Basic Management Record? (1=yes, 2=no)

___ 69 4. Do you keep some type of milk production record on each cow in your herd? (1=yes, 2=no)

___ 70 5. Have you changed your systems of keeping milk production records since 1970? (1=yes, 2=no)

VI-C. Total Farm Records and Plans

___ 71 6. Do you participate in a commercial farm record keeping program? (1=yes, 2=no)

___ 72 7. As a part of your farm record program, do you keep a beginning and ending inventory of cattle, stored feed and other supplies? (1=yes, 2=no)

___ 73 8. Do you keep a crop and yield history of your cropland by fields? (1=yes, 2=no)

___ 74 9. Do you calculate or have calculated such efficiency factors as machinery cost and/or milk sales per full-time worker? (1=yes, 2=no)

___ 75 10. Have you changed your farm record keeping system since 1970? (1=yes, 2=no)

3 / 1 Card Number Three

___ ___ ___ ___ ___ 2 3 4 5 6 County and Respondent Number (leave blank)

VII. DAIRY HERD MANAGEMENT PRACTICES

VII-A. Raising Replacement Heifers

___ ___ ___ 7 8 9 1. Approximately what percentage of your herd replacements are raised on your farm? (sc)

___ 10 2. How many times each day do you check cows that are about ready to calve? (sc)

___ 11 3. Are cows about ready to calve kept separate from the milking herd? (1=yes, 2=no)

4. Approximately what percentage of your heifer calves:

___ ___ ___ 12 13 14 a. Are treated at birth with a navel disinfectant? (sc)

___ ___ ___ 15 16 17 b. Are fed milk replacer? (sc)

___ ___ ___ 18 19 20 c. Are fed a commercial calf starter until four (4) months of age? (sc)

___ ___ ___ 21 22 23 d. Are fed grain between 4 and 10 months of age? (sc)

___ ___ ___ (24 25 26) e. Are identified as to sire when they freshen? (sc)

VII-B. Sanitation and Non-Infectious Diseases

___ (27) 5. Are you generally pleased with the condition of your milking area when visitors appear? (1=yes, 2=no)

___ (28) 6. Do you have an effective system for controlling flies around the milking and loafing areas? (1=yes, 2=no)

___ ___ (29 30) 7. Approximately how many milk cows have you culled within the past 12 months? (sc)

8. Approximately what percentage of the cows culled in the past 12 months were sold for the following reasons:

___ ___ ___ (31 32 33) a. Udder problems? (sc)

___ ___ ___ (34 35 36) b. Low production - independent of udder problems? (sc)

___ ___ ___ (37 38 39) c. Reproductive problems? (sc)

9. Over the past 12 months, what percentage of your fresh cows:

___ ___ (40 41) a. Had ketosis? (sc)

___ ___ (42 43) b. Failed to clean after calving? (sc)

___ ___ (44 45) c. Had milk fever? (sc)

VII-C. Milking Practices:

Note: In the following statements the term "usually" means at least 75% of the time. The term "you" means the person doing the milking.

10. Do you usually:

___ (46) a. Milk at regular hours?

___ (47) b. Milk cows having a record of mastitis last?

___ 48 c. Wash udder with warm water-sanitizing solution?

___ 49 d. Dry udder with a single service towel?

___ 50 e. Remove several streams of fore-milk from each quarter?

___ 51 f. Begin milking within two minutes after the udder is washed?

___ 52 g. Strip with the machine?

___ 53 h. Dip each teat in a sanitizing solution after each milking?

___ 54 i. Treat each quarter having a history of mastitis with an appropriate dry cow treatment?

___ 55 11. Have you changed any of the above milking procedures since 1970? (1=yes, 2=no)

VIII. MILK PRODUCTION LEVEL

___ ___ ___ ___ ___ 56 57 58 59 60 1. What was your herd average pounds of milk produced per cow in 1975? (sc)

___ ___ ___ 61 62 63 2. What was your herd average pounds of butterfat produced per cow in 1975? (sc)

___ ___ ___ ___ 64 65 66 67 3. Since 1970, how much has your herd increased in average pounds of milk produced per cow? (sc - actual pounds increased)

IX. PERSONAL QUESTIONS

IX-A. Personal Information About Dairyman (i.e., Owner or major decision maker)

___ ___ 68 69 1. How old are you?

___ ___ 70 71 2. How many school grades did you complete?

4 / 1 Card Number Four

___ ___ ___ ___ ___ County and Respondent Number (leave blank)
2 3 4 5 6

IX-B. Contacts Dairyman (i.e., owner or major decisions maker) Had During The Last 12 Months With Farm Agencies, Milk Companies and Banks.

3. How many visits to your farm were made by representatives of the:

___ ___ 7 8 a. Milk company - (i.e., fieldmen)

___ ___ 9 10 b. Farmers Home Administration

___ ___ 11 12 c. Vocational Agriculture

___ ___ 13 14 d. Agricultural Extension Service

___ ___ 15 16 e. Soil Conservation Service

___ ___ 17 18 f. Production Credit Association and/or Bankers

4. How many visits to secure information or advise did you make to the:

___ ___ 19 20 a. Milk Company Office? (sc)

___ ___ 21 22 b. Farmers Home Administration Office? (sc)

___ ___ 23 24 c. Vocational Agriculture Office? (sc)

___ ___ 25 26 d. Agricultural Extension Service Office? (sc)

___ ___ 27 28 e. Soil Conservation Service Office? (sc)

___ ___ 29 30 f. Production Credit Association and/or Bank? (sc)

5. How many group meetings did you attend which were conducted by:

___ ___ 31 32 a. Milk companies? (sc)

___ ___ 33 34 b. Farmers Home Administration? (sc)

___ ___ 35 36 c. Vocational Agriculture Teachers? (sc)

___ ___ 37 38 d. Agricultural Extension Service? (sc)

___ ___ 39 40 e. Soil Conservation Service? (sc)

___ ___ 41 42 f. Production Credit Association and/or Bank? (sc)

IX-C. Other Sources of Information Used by the Dairyman (i.e., owner or major decision maker)

6. During the past five years, have you received useful information on the planning and management of your dairy farm from each of the following sources: (1=yes, 2=no)

___ 43 a. Relatives?

___ 44 b. Friends?

___ 45 c. Neighbors?

___ 46 d. Other farmers?

___ 47 e. Veterinarians?

___ 48 f. Farm machinery and/or equipment dealers?

___ 49 g. Fertilizer and/or feed and seed dealers?

7. Over the past 5 years, how helpful has been each of the following sources of information in the planning and management of your dairy farm? (1=not very helpful, 2=helpful, and 3=very helpful)

____ 50 a. Newspapers?

____ 51 b. Radio?

____ 52 c. Television?

____ 53 d. Farm magazines?

____ 54 e. Agricultural Extension Bulletins?

____ ____ 55 56 8. How long (years) do you plan to remain in the dairy business? (sc)

That completes the questions. Thank you for helping us with this survey.

NOTE: Interviewer should at this point check each question to make sure a response has been recorded for all questions - every column should be filled.

APPENDIX G

TABLE XI

LIST OF ITEMS SUBJECTED TO FACTOR ANALYSIS FROM THE 1970 GRADE A MILK PRODUCTION PRACTICE CHECKLIST SURVEY

Item Number	Item Content
13	Cows bred to a plus A. I. proof bull.
14	Heifers freshening at 24 to 27 months of age.
15	Cows allowed 60 days after calving before rebreeding.
16	Adequate forages provided last year.
17	High quality forages provided last year.
18	Adequate amount of improved pasture.
19	Adequate summer pasture provided.
20	Feeding of an all-grain concentrate.
21	Grain fed according to production.
22	Use of the U. T. Forage Testing Lab.
23	Adequate milk production records maintained.
24	60 day dry period.
25	12 to 14 month calving interval.
26	Raise at least 75% of herd replacements.
27	Adequate herd records maintained.
28	Provide separate feeding and loafing areas.
29	Milking system checked every 6 months.
30	Use of strip cup before applying milkers.
31	Effective measures of fly control.
32	Obtained professional advice.
33	75% of cows freshening in the fall.

TABLE XII

LIST OF QUALITATIVE* ITEMS SUBJECTED TO FACTOR ANALYSIS FROM THE 1975 GRADE A DAIRY FARM MANAGEMENT AND PRODUCTION SURVEY

Item Number	Item Content
21	Do you have a silo.
28	Milking machine checked for pulsation and vacuum every six months.
32	Do you double crop corn and small grains for silage.
34	Are silage and hay tested by lab.
36	Did you have all the pasture needed last summer.
37	Is one acre of supplemental pasture provided per four cows.
45	Were cows fed all the hay and silage they could eat.
46	Was an all grain concentrate fed.
47	Were cows fed grain according to production.
57	Are cows in heat removed from the herd.
59	Are dry cows kept separate from herd.
82	Are cows ready to calve kept separate from the herd.
89	Do you have an effective system for fly control.
97	Do you milk at regular hours.
98	Are cows with mastitis milked last.
99	Is udder washed with a warm sanitizing solution.
100	Do you dry each udder with an individual service towel.
101	Is fore-milk removed from each quarter before milker are applies.
102	Do you begin milking at least two minutes after washing.
103	Do you strip cows with the machine.
104	Do you dip each teat in a sanitizing solution after milking.
105	Do you treat each quarter with a history of mastitis.

*Qualitative items are those questions whose answers were in the form of a "yes" or "no" response.

TABLE XIII

LIST OF QUANTITATIVE* ITEMS SUBJECTED TO FACTOR ANALYSIS FROM THE 1975 GRADE A DAIRY FARM MANAGEMENT AND PRODUCTION SURVEY

Item Number	Item Content
33	What percent of your silage is cut in the dent stage of maturity.
39	What percent of your pasture is grazed rotationally.
40	What percent of your pasture is clipped each year.
41	What percent of your pasture is limed and fertilized based on soil tests.
51	What percent of your herd is bred by A. I.
56	Times per day herd is checked for heat.
60	What percent of the cows have at least a 40 day dry period.
61	What percent of the cows have at least a 60 day dry period.
62	What percent of the cows have at least 60 days after calving before re-breeding.
63	What percent of your heifers freshen at 24 to 27 months of age.
81	Times per day cows ready to calve are checked.
83	What percent of your heifers are treated at birth with navel disinfectant.
84	What percent of your heifers are fed milk replacer.
85	What percent of your heifers are fed calf starter until 4 months of age.
86	What percent of your heifers are fed grain between the ages of 4 and 10 months.
87	What percent of your heifers are identified to sire at birth.

*Quantitative items are those questions whose answers are based on a percentage, acres, or number of, rather than a "yes" or "no" response.

TABLE XIV

FACTOR LOADINGS FOR 21 ITEMS DEFINED IN THE 1970 GRADE A MILK PRODUCTION PRACTICE CHECKLIST SURVEY

Item No.	Factors						
	I	II	III	IV	V	VI	VII
13	.115*	.819*	.117*	.029	.076	.023	.086
14	-.025	.064	.016	-.026	.018	.039	.510*
15	.022	.147	.035	.080	.322*	.050	.019
16	.526*	.049	.105*	.013	.102	.082	.063
17	.777*	.016	.066	.044	-.119	.105*	.053
18	.174	-.040	-.479*	-.164	-.049	.041	.111*
19	.035	-.044	-.083	-.397*	.035	.153*	.026
20	-.009	.071	.140	-.003	.199*	-.006	.055
21	.067	.077	.014	-.012	.050	.496*	.060
22	.137*	.049	.359	.001	.061	.140	.181*
23	.065	.151*	.253	-.079	.176*	.479*	-.052
24	.042	-.127*	-.006	.011	.588*	.114*	.126*
25	.100*	-.054	-.064	.616*	.198*	.174*	.077
26	.282*	.081	-.109*	.002	.109	.152*	-.109*
27	.148*	.175*	-.023	-.052	.035	.377*	.109*
28	.176*	.019	.483*	-.134*	-.013	.176*	-.031
29	.155*	-.041	.003	.015	.032	.250*	-.107*
30	.003	.018	.044	.017	.034	.045	.069
31	.025	-.067	-.018	.146*	-.135*	.138*	.259*
32	.138*	-.050	.263*	.131*	.028	.439*	.223*
33	.069	.090	-.015	.122*	.082	.048	.136*

*Significantly loaded items observed for each factor.

TABLE XV

FACTOR LOADINGS FOR 22 QUALITATIVE ITEMS DEFINED IN THE 1975 GRADE A DAIRY FARM MANAGEMENT AND PRODUCTION SURVEY

Item No.	Factors						
	I	II	III	IV	V	VI	VII
21	.108	-.031	-.047	.031	.066	.405*	.044
28	.151*	.082	.079	.239*	.149*	.088	.226*
32	.010	.014	.024	.027	.107*	.180*	-.041
34	-.059	.097*	.082	.086	.076	.426*	-.164*
36	.077	.149*	.106	.207*	-.046	-.055	.004
37	.189*	-.066	-.094*	-.017	.120*	-.017	.017
45	-.008	.081	-.055	.536*	.104	.075	.053
46	.033	.005	.087	.086	.052	.025	-.033
47	.257*	.118*	-.029	-.202*	.138*	.292*	.183*
57	.187*	.203*	-.203*	-.005	.120*	.114*	.520*
59	.028	.644*	-.024	.177*	.108*	.022	.055
82	.075	.710*	.067	.012	.077	.013	.105*
89	.179*	.038	.173*	-.017	.082	-.028	.108*
97	-.028	.015	.691*	-.036	.041	-.033	.069
98	.504*	.037	-.026	-.036	.016	-.178	.178*
99	.102*	.003	.114*	.082	.010	-.048	.361*
100	.706*	.105*	.112*	.149*	.025	.097*	-.023
101	.468*	.041	-.016	.009	.167	.144*	.178*
102	.082	-.082	.050	.023	.239*	-.034	-.085
103	-.038	.095	-.084	.126*	-.116*	-.030	.148*
104	.098*	.138*	.036	.086	.467*	.141*	.128*
105	.037	.157*	.008	-.003	.566*	.141*	.128*

*Significantly loaded items observed for each factor.

TABLE XVI

FACTOR LOADINGS FOR 16 QUANTITATIVE ITEMS DEFINED IN THE 1975 GRADE A DAIRY FARM MANAGEMENT AND PRODUCTION SURVEY

Item No.	Factors						
	I	II	III	IV	V	VI	VII
33	-.001	-.131*	.131*	.378*	.734*	.190*	.051
39	.013	.039	.318*	.075	.165*	-.048	-.044
40	.017	-.011	.533*	.076	-.008	.153*	.068
41	.111*	.146*	.182*	.008	.027	.413	.056
51	.084	.152*	.070	-.039	.577*	.023	.188*
56	.549*	.066	.056	.177*	.365*	.028	.078
60	.073	-.039	-.032	.038	-.040	.059	.412*
61	.184*	.024	-.135*	.012	-.114*	-.154*	-.118*
62	-.015	.105*	.090*	.005	.262*	-.054	.475*
63	.044	.070	.050	.509*	-.030	-.076	.037
81	.649*	-.090*	.051	-.036	.067	.159*	.097
83	.056	.172*	-.071	.047	.256*	.411*	.025
84	.007	.383*	-.043	-.085	.044	.084	.038
85	-.053	.622*	.098*	.117*	.070	.087	-.038
86	.054	-.023	.111*	.061	.217*	.030	-.026
87	.016	.042	.003	-.052	.392*	.220*	.021

*Significantly loaded items observed for each factor.

VITA

James Michael Knight was born in Knoxville, Tennessee on April 5, 1953. He attended elementary school in California and Oklahoma and was graduated from Wurzburg American High School, Wurzburg, Germany in 1971. In September of that year he entered Tennessee Technological University with a major in the field of Animal Science. In 1975 he received a Bachelor of Science degree in Agriculture with a specialization in the areas of Pre-Veterinary Medicine and Animal Science.

During his college years he was employed as an Assistant Head Resident for Ellington Hall at Tennessee Tech University and worked part-time on the school farm for a three year period.

In September, 1975 he accepted an assistantship from the University of Tennessee College of Agriculture and began graduate study in Agricultural Extension Education. During this time he assisted in both teaching and research areas.

In the Fall of 1976 he accepted the position of Area Livestock Specialist with the University of Missouri Cooperative Extension Service in Reynolds County, Missouri. This appointment was effective January 31, 1977.

He is a member of Alpha Gamma Sigma, a Professional Agricultural Fraternity, Delta Tau Alpha, a national agricultural honor society, and Gamma Sigma Delta, an honorary agricultural society.