Department of Animal Science annual reports are available on the Web at: http://www.uark.edu/depts/agripub/Publications/researchseries/

Cover photo by Fred Miller of the new Department of Animal Science Wean-to-Finish Swine Unit (Savoy, Ark.), which contains both state-of-the-art and experimental CAFO waste-management technologies

Technical editing and cover design by Cam Romund; graphics conversion by Shelia Kidd

Arkansas Agricultural Experiment Station, University of Arkansas Division of Agriculture, Fayetteville. Milo J. Shult, Vice President for Agriculture and Director; Gregory J. Weidemann, Dean, Dale Bumpers College of Agricultural, Food and Life Sciences and Associate Vice President for Agriculture–Research, University of Arkansas Division of Agriculture. CM720QX50. The University of Arkansas Division of Agriculture follows a nondiscriminatory policy in programs and employment.

ISSN:1051-3140 CODEN:AKAMA6
ARKANSAS ANIMAL SCIENCE
DEPARTMENT REPORT 2003

Edited by

Zelpha B. Johnson
Research Associate Professor

and

D. Wayne Kellogg
Professor

Department of Animal Science
University of Arkansas

Arkansas Agricultural Experiment Station
Fayetteville, Arkansas 72701

Disclaimer
No findings, conclusions, or reports regarding any product or any process that is contained in any article published in this report should imply endorsement or non-endorsement of any such product or process.
INTRODUCTION

The faculty and staff of the Animal Science Program are pleased to present the sixth edition of the Arkansas Animal Science Report. As with virtually all programs in the country, budget constraints presented serious challenges to teaching, research, and extension programming. However, the faculty and staff responded with innovation, good management, and hard work to maintain a productive program designed to benefit the students of the University and the citizens of the state. We are committed to remaining faithful to our Land-Grant mission. A sincere thank you is owed to Dr. Zelpha Johnson and Dr. Wayne Kellogg for editing this publication.

We are proud that *Meat and Poultry* magazine ranked the animal and poultry programs at the University of Arkansas among the top four in the United States for 2003. This is a tribute to the dedicated and talented faculty in the Departments of Animal Science, Poultry Science, and Food Science and to their high level of cooperation.

We want to commend Laurie Harris, departmental secretary, for remodeling our departmental website. The new version has a modern look and is much more visually attractive, informative, and user friendly. The address is http://www.uark.edu/depts/animals/.

The Animal Science Program uses a multi-disciplinary approach to collaboratively address many of the most challenging issues facing the Arkansas livestock industry. The extension programs provide a critical bridge between evolving research and issues faced by Arkansas producers. Research-based solutions in the areas of beef, dairy, and horse production; forage and grazing management; waste management and many other livestock-related areas were delivered to our industry stakeholders. On any given day, you will find Department of Animal Science extension faculty taking forage samples, weighing cattle, presenting educational programs, serving on state, regional and national committees, teaching the youth of Arkansas, or visiting a ranch to help solve a problem.

Finally, we want to thank the many supporters of our teaching, research, and extension programs. Whether providing grants to fund research or funds for scholarships, educational programs, extension programs, facilities or donating horses and livestock, these friends are essential to maintaining a quality educational program. We thank each and every one of you on behalf of our faculty, staff, students, and clientele.

Sincerely,
Keith Lusby
Department Head

Tom Troxel
Section Leader
Scientists use statistics as a tool to determine which differences among treatments are real (and therefore biologically meaningful) and which differences are probably due to random occurrence (chance) or some other factors not related to the treatment.

Most data will be presented as means or averages of a specific group (usually the treatment). Statements of probability that treatment means differ will be found in most papers in this publication, in tables as well as in the text. These will look like (P < 0.05); (P < 0.01); or (P < 0.001) and mean that the probability (P) that any two treatment means differ entirely due to chance is less than 5, 1, or .1%, respectively. Using the example of P < 0.05, there is less than a 5% chance that the differences between the two treatment averages are really the same. Statistical differences among means are often indicated in tables by use of superscript letters. Treatments with any letter in common are not different, while treatments with no common letters are. Another way to report means is as mean ± standard error (e.g. 9.1 ± 1.2). The standard error of the mean (designated SE or SEM) is a measure of how much variation is present in the data – the larger the SE, the more variation. If the difference between two means is less than twice the SE, then the treatments are usually not statistically different from one another. Other authors may report an LSD (least significant difference) value. When the difference between any two means is greater than or equal to the LSD value, then they are statistically different from one another. Another estimate of the amount of variation in a data set that may be used is the coefficient of variation (CV) which is the standard error expressed as a percentage of the mean. Orthogonal contrasts may be used when the interest is in reporting differences between specific combinations of treatments or to determine the type of response to the treatment (i.e. linear, quadratic, cubic, etc.).

Some experiments may report a correlation coefficient (r), which is a measure of the degree of association between two variables. Values can range from –1 to +1. A strong positive correlation (close to +1) between two variables indicates that if one variable has a high value then the other variable is likely to have a high value also. Similarly, low values of one variable tend to be associated with low values of the other variable. In contrast, a strong negative correlation coefficient (close to –1) indicates that high values of one variable tend to be associated with low values of the other variable. A correlation coefficient close to zero indicates that there is not much association between values of the two variables (i.e. the variables are independent). Correlation is merely a measure of association between two variables and does not imply cause and effect.

Other experiments may use similar procedures known as regression analysis to determine treatment differences. The regression coefficient (usually denoted as b) indicates the amount of change in a variable Y for each one-unit increase in a variable X. In its simplest form (i.e. linear regression), the regression coefficient is simply the slope of a straight line. A regression equation can be used to predict the value of the dependent variable Y (e.g. performance) given a value of the independent variable X (e.g. treatment). A more complicated procedure, known as multiple regression, can be used to derive an equation that uses several independent variables to predict a single dependent variable. Associated statistics are $r^2$, the simple coefficient of determination, and $R^2$, the multiple coefficient of determination. These statistics indicate the proportion of the variation in the dependent variable that can be accounted for by the independent variables. Some authors may report the square root of the Mean Square for Error (RMSE) as an estimate of the standard deviation of the dependent variable.

Genetic studies may report estimates of heritability ($h^2$) or genetic correlation ($r_g$). Heritability estimates refer to that portion of the phenotypic variance in a population that is due to heredity. A genetic correlation is a measure of whether or not the same genes are affecting two traits and may vary from –1 to +1.
## COMMON ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADFI</td>
<td>Average daily feed intake</td>
</tr>
<tr>
<td>ADG</td>
<td>Average daily gain</td>
</tr>
<tr>
<td>avg</td>
<td>Average</td>
</tr>
<tr>
<td>BW</td>
<td>Body weight</td>
</tr>
<tr>
<td>cc</td>
<td>Cubic centimeter</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>CP</td>
<td>Crude protein</td>
</tr>
<tr>
<td>CV</td>
<td>Coefficient of variation</td>
</tr>
<tr>
<td>cwt</td>
<td>100 pounds</td>
</tr>
<tr>
<td>d</td>
<td>Day(s)</td>
</tr>
<tr>
<td>DM</td>
<td>Dry matter</td>
</tr>
<tr>
<td>DNA</td>
<td>Deoxyribonucleic acid</td>
</tr>
<tr>
<td>°C</td>
<td>Degrees Celsius</td>
</tr>
<tr>
<td>°F</td>
<td>Degrees Fahrenheit</td>
</tr>
<tr>
<td>EPD</td>
<td>Expected progeny difference</td>
</tr>
<tr>
<td>F/G</td>
<td>Feed:gain ratio</td>
</tr>
<tr>
<td>FSH</td>
<td>Follicle stimulating hormone</td>
</tr>
<tr>
<td>ft</td>
<td>Foot or feet</td>
</tr>
<tr>
<td>g</td>
<td>Gram(s)</td>
</tr>
<tr>
<td>gal</td>
<td>Gallon(s)</td>
</tr>
<tr>
<td>h</td>
<td>Hour(s)</td>
</tr>
<tr>
<td>in</td>
<td>Inch(es)</td>
</tr>
<tr>
<td>IU</td>
<td>International units</td>
</tr>
<tr>
<td>kcal</td>
<td>Kilocalorie(s)</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram(s)</td>
</tr>
<tr>
<td>lb</td>
<td>Pound(s)</td>
</tr>
<tr>
<td>L</td>
<td>Liter(s)</td>
</tr>
<tr>
<td>LH</td>
<td>Lutenizing hormone</td>
</tr>
<tr>
<td>m</td>
<td>Meter(s)</td>
</tr>
<tr>
<td>mg</td>
<td>Milligram(s)</td>
</tr>
<tr>
<td>Meq</td>
<td>Milliequivalent(s)</td>
</tr>
<tr>
<td>Mcg</td>
<td>Microgram(s)</td>
</tr>
<tr>
<td>min</td>
<td>Minute(s)</td>
</tr>
<tr>
<td>mm</td>
<td>Millimeter(s)</td>
</tr>
<tr>
<td>mo</td>
<td>Month(s)</td>
</tr>
<tr>
<td>N</td>
<td>Nitrogen</td>
</tr>
<tr>
<td>NS</td>
<td>Not Significant</td>
</tr>
<tr>
<td>ng</td>
<td>Nanogram(s)</td>
</tr>
<tr>
<td>ppb</td>
<td>Parts per billion</td>
</tr>
<tr>
<td>ppm</td>
<td>Parts per million</td>
</tr>
<tr>
<td>r</td>
<td>Correlation coefficient</td>
</tr>
<tr>
<td>r²</td>
<td>Simple coefficient of determination</td>
</tr>
<tr>
<td>R²</td>
<td>Multiple coefficient of determination</td>
</tr>
<tr>
<td>s</td>
<td>Second(s)</td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>SE</td>
<td>Standard error</td>
</tr>
<tr>
<td>SEM</td>
<td>Standard error of the mean</td>
</tr>
<tr>
<td>TDN</td>
<td>Total digestible nutrients</td>
</tr>
<tr>
<td>wk</td>
<td>Week(s)</td>
</tr>
<tr>
<td>wt</td>
<td>Weight</td>
</tr>
<tr>
<td>yr</td>
<td>Year(s)</td>
</tr>
</tbody>
</table>
**TABLE OF CONTENTS**

Carcass and Color Characteristics of Three Biological Types of Cattle Grazing  
Cool-Season Forages Supplemented with Soyhulls  

Chemical, Fatty Acid and Sensory Characteristics of Beef from Cattle Grazing Forages Supplemented with Soyhulls vs. USDA Choice and Select Beef  
R.T. Baublits, F.W. Pohlman, A.H. Brown, Jr., Z.B. Johnson, B.A. Sandelin, and D.O. Onks ................................................................. 12

Effects of Treadmill Exercise on Stress Physiology and the Incidence of Dark-Cutting Longissimus Muscle in Holstein Steers  

Feeding Feedlot Steers Fish Oil Differentially Enhances the Fatty Acid Composition of Muscle Tissue  
T.J. Wistuba, E.B. Kegley, J.K. Apple, and D.C. Rule ........................................................................................................ 21

Influence of Fish Oil Addition to Finishing Diets on the Professional Descriptor Sensory Analysis of Steaks from Cattle  
T.J. Wistuba, E.B. Kegley, and J.K. Apple ........................................................................................................ 26

Impact of Ham and Brine Temperatures on Processing Characteristics of Cured Ham  
J.N. Leach and F.W. Pohlman ........................................................................................................................................ 30

Evaluation of the Electronic Nose for Rapid Determination of Meat Freshness  

Arkansas Feedout Program 2001-2002  
T.R. Troxel, M.S. Gadberry, S. Cline, G. Davis, and W. Wallace ........................................................................................................ 36

The Impact of Livestock Auction Location on the Selling Price of Replacement and Market Cows  
T.R. Troxel, M.S. Gadberry, S. Cline, J. Foley, G. Ford, D. Urell, and R. Wiedower ......................................................................................... 40

Factors Affecting the Selling Price of Market Cows Sold at Arkansas Livestock Auctions  
T.R. Troxel, M.S. Gadberry, S. Cline, J. Foley, G. Ford, D. Urell, and R. Wiedower ......................................................................................... 42

Factors Affecting the Selling Price of Replacement Cows Sold at Arkansas Livestock Auctions  
T.R. Troxel, M.S. Gadberry, S. Cline, J. Foley, G. Ford, D. Urell, and R. Wiedower ......................................................................................... 46

Blood Trace Mineral Concentrations of Cows and Heifers from Farms Enrolled in the Arkansas Beef Improvement Program  
M.S. Gadberry, T.R. Troxel, and G.V. Davis ........................................................................................................ 50

Comparison of Synchrony Rates of *Bos taurus* and *Bos indicus*-Type Females Using CIDR Devices in Combination with Prostaglandin and ECP or GnRH  
W.A. Whitworth, T.G. Montgomery, S.A. Gunter, and K.P. Coffey ................................................................................................. 53

Effect of Respiratory Disease Vaccination Program on Immune Response in Beef Calves  

*Escherichia coli* and *Salmonella* Shedding in Beef Cattle Grazing Tall Fescue  
M.L. Looper, C.F. Rosenkrans, Jr., G.E. Aiken, and T.S. Edrington ........................................................................................................ 58

Supplemental Lacto Edge for Shipping-Stressed Cattle  
E.B. Kegley and J. Kafka ........................................................................................................................................ 61

Effect of Electrolyte Supplementation On Growth Performance and(or) Weight Loss Of Fasted Calves  

Effect of Extrusion Processed De-Oiled Rice Bran Plus Whole Cottonseed on Growth Performance of Calves  
M.S. Gadberry, P.A. Beck, S.A. Gunter, and D.W. Kellogg ........................................................................................................ 68

Performance of Crossbred Beef Cows Supplemented with De-Oiled Rice Bran  
M.S. Gadberry, P.A. Beck, and S.A. Gunter ........................................................................................................ 70

Poultry Fat Addition to Finishing Rations Influences Cattle Performance I  
S. Hutchinson, E.B. Kegley, J.K. Apple, and T.J. Wistuba ........................................................................................................ 73

Seasonal Weight Changes and Prepartum Weight:Height Ratio in Angus and Brahman Cows Grazing  
Common Bermudagrass or Endophyte-Infected Tall Fescue  
M.A. Brown, A.H. Brown, Jr., and B.A. Sandelin ........................................................................................................ 76

Story in Brief: Three-Year Evaluation of Cool-Season Annual Grasses for Stocker Cattle  
P.A. Beck, S.A. Gunter, D.S. Hubbell, K.F. Harrison, and L.B. Daniels ........................................................................................................ 80

Growth Performance and Health of Dairy Calves Bedded with Different Types of Materials  
Post-Weaning Performance of Fall-Born Steers and Heifers that Graded Endophyte-Infected Tall Fescue Pastures at Two Rotational Grazing Intensities and Were Weaned on Two Dates

Impact Of Rotation Frequency and Weaning Date on Performance by Fall-Calving Cow-Calf Pairs Grazing Endophyte-Infected Tall Fescue Pastures

Impact of Rotation Frequency and Weaning Date on Forage Species Composition of Endophyte-Infected Tall Fescue Pastures Overseeded with Crabgrass, Lespedeza, and Red and White Clover

Growth Performance of Heifers Grazing Wheat and Ryegrass Pastures Sod-Seeded with Different Tillage Intensities and Seeding Dates
K.P. Coffey, G. Montgomery, W.K. Coblentz, and W. Whitworth .......................................................................................................................... 100

Growth Performance of Stocker Steers Grazing Bermudagrass
M.L. Looper, C.F. Rosenkrans, Jr., G.E. Aiken, and J.A. May .......................................................... 102

Milk Production in Four Divergent Biological Types Grazing Common Bermudagrass or Endophyte-Infected Tall Fescue
B.A. Sandelin, A.H. Brown, Jr., M.A. Brown, Z.B. Johnson, and R.T. Baublits .......................................................... 105

2002 Dairy Herd Improvement Herds in Arkansas
J.A. Pennington .......................................................................................................................... 107

DairyMetrics for Arkansas Herds
J.A. Pennington .......................................................................................................................... 110

Comparisons of In Situ Nitrogen Disappearance Kinetics of Wheat Forages in Confined and Grazing Steers

Nutritive Value of Crabgrass Harvested on Seven Dates in Northern Arkansas

Effect of N Fertilization Rate on the Degradability of Bermudagrass Protein Using Streptomyces griseus Protease
J.E. Turner, R.K. Ogden, W.K. Coblentz, M.B. Daniels, J.L. Gansaules, K.P. Coffey, D.A. Scarbrough, K.A. Teague, and J.D. Speight .......................................................................................................................... 123

Effects of Management on the Voluntary Dry-Matter Intake and Dry-Matter Digestibility of Tall Fescue Hay

Using Orchardgrass and Endophyte-Free Fescue Versus Endophyte-Infested Fescue Overseeded on Bermudagrass for Cow Herds: Three-Year Summary of Forage Characteristics

Using Orchardgrass and Endophyte-Free Fescue Versus Endophyte-Infested Fescue Overseeded on Bermudagrass for Cow Herds: Three-Year Summary of Cattle Performance

Sampling Requirements for Determining Forage Quality
R.S. Milliken, M.S. Gadberry, and E.B. Kegley .......................................................................................................................... 137

Effects of Iron Supplementation Level in Diets of Growing-Finishing Swine I. Pig Performance and Carcass Characteristics
J.K. Apple, W.A. Wallis, C.V. Maxwell, L.K. Rakes, and J.D. Stephenson .......................................................................................................................... 140

Effects of Iron Supplementation Level in Diets of Growing-Finishing Swine. II. Pork Quality Traits During Retail Display
W.A. Wallis, J.K. Apple, C.V. Maxwell, L.K. Rakes, S. Hutchison, and J.D. Stephenson .......................................................................................................................... 144

Effect of Dietary Manganese Inclusion Level on Performance and Carcass Characteristics of Growing-Finishing Swine

Potential for Fish Meal Analog as a Replacement for Fish Meal in Early-Weaned Pig Diets
C.V. Maxwell, M.E. Davis, D.C. Brown, P. Bond, and Z.B. Johnson .......................................................................................................................... 153

The Effect of Phosphorylated Mannans on Growth and Immune Responses of Weanling Pigs
M.E. Davis, C.V. Maxwell, D.C. Brown, G.F. Erf, and T.J. Wistuba .......................................................................................................................... 158

Influence of Lactobacillus brevis 1E-1 on the Gastrointestinal Microflora, Gut Morphology, and Growth Performance of Weanling Pigs Pre- and Post-Weaning
M.E. Davis, C.V. Maxwell, D.C. Brown, G.F. Erf, and T.J. Wistuba .......................................................................................................................... 158

Effects of Immunization of Gilts Against 17α-hydroxyprogesterone on Follicular Size Distributions and Follicular Steroid Synthesis

Relationship Between Body Length and Number of Nipples in Swine
Z.B. Johnson, J.J. Chewning, and R.A. Nugent III .......................................................................................................................... 167