January 2016

Foreword and Supplemental Information, Swine Day

R. D. Goodband
Kansas State University, Manhattan, goodband@k-state.edu

M. D. Tokach
Kansas State University, Manhattan, mtokach@k-state.edu

S. S. Dritz
Kansas State University, Manhattan, dritz@k-state.edu

See next page for additional authors

Follow this and additional works at: https://newprairiepress.org/kaesrr

Part of the Other Animal Sciences Commons

Recommended Citation

This report is brought to you for free and open access by New Prairie Press. It has been accepted for inclusion in Kansas Agricultural Experiment Station Research Reports by an authorized administrator of New Prairie Press. Copyright 2016 the Author(s). Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. K-State Research and Extension is an equal opportunity provider and employer.
Foreword and Supplemental Information, Swine Day

Authors
Foreword

It is with great pleasure that we present the 2016 Swine Industry Day Report of Progress. This report contains updates and summaries of applied and basic research conducted at Kansas State University during the past year. We hope that the information will be of benefit as we attempt to meet the needs of the Kansas swine industry.

2016 Swine Day Report of Progress Editors
Bob Goodband, Mike Tokach, Steve Dritz, Joel DeRouchey, and Jason Woodworth
## Standard Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADG</td>
<td>average daily gain</td>
</tr>
<tr>
<td>ADF</td>
<td>acid detergent fiber</td>
</tr>
<tr>
<td>ADFI</td>
<td>average daily feed intake</td>
</tr>
<tr>
<td>AI</td>
<td>artificial insemination</td>
</tr>
<tr>
<td>avg</td>
<td>average</td>
</tr>
<tr>
<td>bu</td>
<td>bushel</td>
</tr>
<tr>
<td>BW</td>
<td>body weight</td>
</tr>
<tr>
<td>cm</td>
<td>centimeter(s)</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 lb</td>
</tr>
<tr>
<td>d</td>
<td>day(s)</td>
</tr>
<tr>
<td>DE</td>
<td>digestible energy</td>
</tr>
<tr>
<td>DM</td>
<td>dry matter</td>
</tr>
<tr>
<td>DMI</td>
<td>dry matter intake</td>
</tr>
<tr>
<td>F/G</td>
<td>feed efficiency</td>
</tr>
<tr>
<td>ft</td>
<td>foot(foot(s))</td>
</tr>
<tr>
<td>ft²</td>
<td>square foot(foot(s))</td>
</tr>
<tr>
<td>g</td>
<td>gram(s)</td>
</tr>
<tr>
<td>µg</td>
<td>microgram(s), .001 mg</td>
</tr>
<tr>
<td>gal</td>
<td>gallon(s)</td>
</tr>
<tr>
<td>GE</td>
<td>gross energy</td>
</tr>
<tr>
<td>h</td>
<td>hour(s)</td>
</tr>
<tr>
<td>HCW</td>
<td>hot carcass weight</td>
</tr>
<tr>
<td>in</td>
<td>inch(es)</td>
</tr>
<tr>
<td>IU</td>
<td>international unit(s)</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram(s)</td>
</tr>
<tr>
<td>kcal</td>
<td>kilocalorie(s)</td>
</tr>
<tr>
<td>kWh</td>
<td>kilowatt hour(s)</td>
</tr>
<tr>
<td>lb</td>
<td>pound(s)</td>
</tr>
<tr>
<td>Mcal</td>
<td>megacalorie(s)</td>
</tr>
<tr>
<td>ME</td>
<td>metabolizable energy</td>
</tr>
<tr>
<td>mEq</td>
<td>milliequivalent(s)</td>
</tr>
<tr>
<td>min</td>
<td>minute(s)</td>
</tr>
<tr>
<td>mg</td>
<td>milligram(s)</td>
</tr>
<tr>
<td>mL</td>
<td>cc (cubic centimeters)</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>NE</td>
<td>net energy</td>
</tr>
<tr>
<td>NDF</td>
<td>neutral detergent fiber</td>
</tr>
<tr>
<td>NFE</td>
<td>nitrogen-free extract</td>
</tr>
<tr>
<td>ng</td>
<td>nanogram(s), .001 µg</td>
</tr>
<tr>
<td>no.</td>
<td>number</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council</td>
</tr>
<tr>
<td>ppb</td>
<td>parts per billion</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>psi</td>
<td>pounds per square inch</td>
</tr>
<tr>
<td>PUFA</td>
<td>polyunsaturated fatty acid</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>SEW</td>
<td>segregated early weaning</td>
</tr>
<tr>
<td>SFA</td>
<td>saturated fatty acid</td>
</tr>
<tr>
<td>UFA</td>
<td>unsaturated fatty acid</td>
</tr>
<tr>
<td>wk</td>
<td>week(s)</td>
</tr>
<tr>
<td>wt</td>
<td>weight(s)</td>
</tr>
<tr>
<td>yr</td>
<td>year(s)</td>
</tr>
</tbody>
</table>
K-State Vitamin and Trace Mineral Premixes

Diets listed in this report contain the following vitamin and trace mineral premixes unless otherwise specified.

- **Trace mineral premix:** Each pound of premix contains 10 g Mn, 33 g Fe, 33 g Zn, 5 g Cu, 90 mg I, and 90 mg Se.

- **Vitamin premix:** Each pound of premix contains 1,600,000 IU vitamin A, 400,000 IU vitamin D3, 8,000 mg vitamin E (dl-α-tocopherol acetate or 4,000 mg d-α-tocopherol acetate), 800 mg menadione, 1,500 mg riboflavin, 5,000 mg pantothenic acid, 15,000 mg niacin, and 7 mg vitamin B12.

- **Sow add pack:** Each pound of premix contains 100,000 mg choline, 40 mg biotin, 300 mg folic acid, 400 mg pyridoxine, 4,000 mg Vit E (dl-α-tocopherol acetate or 2,000 mg d-α-tocopherol acetate), 9,000 mg L-carnitine, and 36 mg Cr.

**Note**

Some of the research reported here was carried out under special U.S. Food and Drug Administration (FDA) clearances that apply only to investigational uses at approved research institutions. Materials that require FDA clearances may be used in the field only at the levels and for the use specified in that clearance.
Biological Variability and Chances of Error

Variability among individual animals in an experiment leads to problems in interpreting the results. Animals on treatment X may have higher average daily gains than those on treatment Y, but variability within treatments may indicate that the differences in production between X and Y were not the result of the treatment alone. Statistical analysis allows us to calculate the probability that such differences are from treatment rather than from chance.

In some of the articles herein, you will see the notation “P < 0.05.” That means the probability of the differences resulting from chance is less than 5%. If two averages are said to be “significantly different,” the probability is less than 5% that the difference is from chance, or the probability exceeds 95% that the difference resulted from the treatments applied.

Some papers report correlations or measures of the relationship between traits. The relationship may be positive (both traits tend to get larger or smaller together) or negative (as one trait gets larger, the other gets smaller). A perfect correlation is one (+1 or -1). If there is no relationship, the correlation is zero.

In other papers, you may see an average given as 2.5 ± 0.1. The 2.5 is the average; 0.1 is the “standard error.” The standard error is calculated to be 68% certain that the real average (with unlimited number of animals) would fall within one standard error from the average, in this case between 2.4 and 2.6.

Using many animals per treatment, replicating treatments several times, and using uniform animals increase the probability of finding real differences when they exist. Statistical analysis allows more valid interpretation of the results, regardless of the number of animals. In all the research reported herein, statistical analyses are included to increase the confidence you can place in the results.
Index of Key Words

alternative  amino acid  fat source  nursery feed
amino acid ratio  feed additive  nursery pigs
antibiotic  feed manufacturing  particle size
antimicrobial  feed matrix  PEDV
blending  finishing feed  pharmacological trace
bone ash  fish meal  minerals
carbadox  flush  phosphorous
butyric acid  gilt training  phytase
calorie:lysine ratio  gluco-oligosaccharide  phytogens
carbadox  glutamate  pigs
carcass characteristics  glutamine  post-farrow maternal
chemical sanitation  group-housed gestating  weight
chemical treatment  sows  
chlorine (Cl)  growing-finishing pig  
carcass characteristics  growth  pigs
chemical sanitation  growth performance  pigs
chemical treatment  HP 300  pigs
chlromium propionate  isoleucine  pigs
chloride (Cl)  K-value  pigs
chromium propionate  lactation  pigs
cooper  Lactobacillus plantarum  pigs
cooper amino acid-complex  late finishing  pigs

crude protein  level  pork

crude protein level  net energy  pork

diet complexity  nutrition  pork

dietary electrolyte balance  phosphorous  pork

duration  phosphorous  pork

Elarom-F Plus  probiotic  pork
Elarom SES  protein source  pork
electrolyte balance  reproduction  pork

electronic sow feeders  sample preparation  pork

electronic sow feeding  space allowance  pork

enzymatically fermented  sow(s)  pork
soybean meal  stocking density  pork
essential oil  superdose  pork
Evosure  swine  pork

Evosure  tri-basic copper chloride  pork

fat source  uniformity of mix  pork

feed additive  valine  pork
feed manufacturing  wet mix  pork
feed matrix  yeast  pork
finishing feed  yeast  pork
fish meal  yeast  pork
flush  yeast  pork

gilt training  yeast  pork

gluco-oligosaccharide  yeast  pork
glutamate  yeast  pork
glutamine  yeast  pork

group-housed gestating  sows  pork

lysine  pigs  pork

growth  pigs  pork

growth performance  pigs  pork

HP 300  pigs  pork

isoleucine  pigs  pork

K-value  pigs  pork

lactation  pigs  pork

Lactobacillus plantarum  pigs  pork

late finishing  pigs  pork

level  pigs  pork

liquid addition  pigs  pork

lysine  pigs  pork

marketing  pigs  pork

medium chain fatty acids  pigs  pork

Micro-Aid  pigs  pork

mix time  pigs  pork

Sodium (Na)  pigs  pork

net energy  pigs  pork

nursery  pigs  pork

nursery feed  pigs  pork

nursery pigs  pigs  pork

particle size  pigs  pork

PEDV  pigs  pork

pharmacological trace  minerals  pork

minerals  pigs  pork

phosphorous  pigs  pork

phytase  pigs  pork

phytogens  pigs  pork

pigs  pigs  pork

post-farrow maternal  weight  pork

weight  pigs  pork

sample preparation  pigs  pork

space allowance  pigs  pork

source  pigs  pork

sow(s)  pigs  pork

stocking density  pigs  pork

superdose  pigs  pork

swine  pigs  pork

tri-basic copper chloride  pigs  pork

uniformity of mix  pigs  pork

valine  pigs  pork

valine  pigs  pork

wet mix  pigs  pork

yeast  pigs  pork

zinc  pigs  pork

zinc hydroxychloride  pigs  pork

zinc sulfate  pigs  pork
Acknowledgments

Appreciation is expressed to these organizations for assisting with swine research at Kansas State University.

Abilene Animal Hospital, Abilene, KS
Ajinomoto Heartland LLC, Chicago, IL
Dave and Lois Baier, Abilene, KS
BASF Corporation, Florham Park, NJ
Biomin USA, San Antonio, TX
DNA Genetics, Columbus, NE
DSM Nutritional Products, Parsippany, NJ
Elanco Animal Health, Indianapolis, IN
Farmland Foods LLC, Crete, NE
Feedlogic Corporation, Willmar, MN
Hamlet Proteins, Findlay, OH
Haverkamp Brothers, Bern, KS
Holden Farms, Northfield, MN
Hubbard Feeds, Mankato, MN
ILC Resources, Urbandale, IA
International Ingredient Corporation, St. Louis, MO
JYGA Technologies, St. Nicolas, Quebec, Canada
Kalmbach Feeds, Upper Sandusky, OH
Kansas Pork Association, Manhattan, KS
Kansas Swine Alliance, Abilene, KS
Kemin Industries, Inc., Des Moines, IA
Lesaffre Yeast Corporation, Milwaukee, WI
Livestock and Meat Industry Council, Manhattan, KS
Micronutrients, Indianapolis, IN
Midori USA, Cambridge, MA
National Pork Board, Des Moines, IA
Natural Foods Holdings, Sioux City, IA
New Fashion Pork, Jackson, MN
New Horizon Farms, Pipestone, MN
Novus International, St. Charles, MO
Nutraferma, Dakota Dunes, SD
Nutraquest, Mason City, IA
Pancosma North America, Drummondville, Quebec, Canada
PIC USA, Hendersonville, TN
Purco, Edgerton, MN
Thomas Livestock Company, Broken Bow, NE
Trouw Nutrition USA, Highland IL
Triumph Foods, St. Joseph, MO
United Sorghum Checkoff Program, Lubbock, TX
USDA National Institute of Food and Agriculture, Washington, D.C.
Zinpro Corp., Eden Prairie, MN
Zoltenko Farms Inc., Hardy, NE
We especially appreciate the assistance and dedication of Kansas State University employees Duane Baughman, Frank Jennings, Mark Nelson, Chance Fiehler, Caitlin Evans, Ashton Yoder, and Theresa Rathbun.

Appreciation is also expressed to: Allan Morris, Heath Houselog, Marty Heintz, Craig Steck, and Bob Taubert, New Horizon Farms, Pipestone, MN, for their dedicated support.

Appreciation is expressed to Triumph Foods LLC, St. Joseph, MO, and Jerry Lehenbauer, David Donovan, Ann Smith, Brad Knadler, and Brittany Kimler for technical assistance.

**Swine Industry Day Committee**

Duane Davis  
Joel DeRouchey  
Steve Dritz  
Bob Goodband  
Joe Hancock  
Jim Nelssen  
Mike Tokach  
Jason Woodworth
The Livestock and Meat Industry Council, Inc.

The Livestock and Meat Industry Council, Inc. (LMIC) is a nonprofit charitable organization supporting animal agriculture research, teaching, and education. This is accomplished through the support of individuals and businesses that make LMIC a part of their charitable giving.

Tax-deductible contributions can be made through gifts of cash, appreciated securities, real estate, life insurance, charitable remainder trusts, and bequests as well as many other forms of planned giving. LMIC can also receive gifts of livestock, machinery, or equipment. These types of gifts, known as gifts-in-kind, allow the donor to be eligible for a tax benefit based on the appraised value of the gift.

Since its inception in 1970, LMIC has provided student scholarships, research assistance, capital improvements, land, buildings, and equipment to support students, faculty, and the industry of animal agriculture. If you would like to be a part of this mission or would like additional information, please contact the Livestock and Meat Industry Council/Animal Sciences and Industry, Weber Hall, Manhattan, Kansas 66506 or call 785-532-1227.

LMIC Board Members
Kyle Bauer                    Roy Henry                    Bill Miller
David Clawson                Patsy Houghton               Lisa Moser
Doug Deets                   Virgil Huseman                Stanton O’Neil
Mark Gardiner                Justin Janssen                Rich Porter
Craig Good                   Mark Knight                   Tom Toll
Ken Grecian                  Kelly Lechtenberg            Warren Weibert
Frank Harper                 Steve Mangan                 

Royal Board Members
Dell Allen                    Greg Henderson               Phil Phar
Jerry Bohn                    Steven Hunt                 Harland Priddle
Richard Chase                Steve Irsik                  Lee Reeve
Calvin Drake                  Larry Jones                 Don Smith
Stan Fansher                  Kenny Knight             Ken Stielow
Galen Fink                    Pat Koons                  Mikel Stout
Randy Fisher                  Jan Lyons                  Kathleen Strunk
Lyle Gray                      Gina Miller                 Duane Walker
Sam Hands                      Andrew Murphy             
Bernie Hansen                  Tom Perrier

Kansas State University Agricultural Experiment Station and Cooperative Extension Service