Swine Day Report Foreword and Acknowledgments

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Cover Page Footnote
Appreciation is expressed to the organizations for assisting with swine research at Kansas State University.

Authors

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Foreword

It is with great pleasure that we present the 2020 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.

2020 Swine Day Report of Progress Editors
Bob Goodband
Jordan Gebhardt
Mike Tokach
Joel DeRouchey
Jason Woodworth
### Standard Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</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 (feet)</td>
</tr>
<tr>
<td>ft²</td>
<td>square foot(eyes)</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>
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<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>
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<tr>
<td>in</td>
<td>inch(es)</td>
</tr>
<tr>
<td>IU</td>
<td>international unit(s)</td>
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<tr>
<td>kg</td>
<td>kilogram(s)</td>
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<tr>
<td>kcal</td>
<td>kilocalorie(s)</td>
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<td>kWh</td>
<td>kilowatt hour(s)</td>
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<tr>
<td>lb</td>
<td>pound(s)</td>
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<tr>
<td>Mcal</td>
<td>megacalorie(s)</td>
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<tr>
<td>ME</td>
<td>metabolizable energy</td>
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<tr>
<td>mEq</td>
<td>milliequivalent(s)</td>
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<tr>
<td>min</td>
<td>minute(s)</td>
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<tr>
<td>mg</td>
<td>milligram(s)</td>
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<tr>
<td>mL</td>
<td>cc (cubic centimeters)</td>
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<td>mm</td>
<td>millimeter(s)</td>
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<tr>
<td>mo</td>
<td>month(s)</td>
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<tr>
<td>MUFA</td>
<td>monounsaturated fatty acid</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 Fg</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>s</td>
<td>second(s)</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>
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</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 750,000 IU vitamin A, 300,000 IU vitamin D3, 8,000 mg vitamin E (dl-alpha-tocopherol acetate or 4,000 mg d-alpha-tocopherol acetate), 600 mg menadione, 1,500 mg riboflavin, 5,000 mg pantothenic acid, 9,000 mg niacin, and 6 mg vitamin B12.

*Sow add pack:* Each pound of premix contains 750,000 IU vitamin A, 100,000 mg choline, 40 mg biotin, 400 mg folic acid, 180 mg pyridoxine, 4,000 mg vitamin E (dl-alpha-tocopherol acetate or 2,000 mg d-alpha-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 $2.5 \pm 0.1$. 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

acidification
administration
African swine fever virus
amino acid
amino acid digestibility
animal welfare
antibiotics
AviPlus
branch chain amino acids
castration
cellulose
classical swine fever
$\text{CO}_2$
surgical laser
compensatory growth
conditioning temperature
copper
corn
corn protein
crude protein
crystalline amino acids
CSF
culture approach
distillers dried grains
with solubles
E. coli serogroups
environmental contamination
farrowing duration
fecal dry matter
feed mill
feed safety
fiber
finisher pigs
formic acid
gleptoferron
growth
growth performance
growth rate
hemoglobin
high amylase
high amylase corn
high protein distillers dried grains
insoluble fiber
iron
isoleucine
KNB-E2
lactation
late finishing
lignosulfonate
lysine
maillard reaction
manganese
manganese hydroxychloride
meal
moisture content
mortality
nursery pigs
pain
particle size
pellet
pellet die thickness
pellet quality
pelleting
pellets
phosphorus
phytase
phytase activity
phytase stability
pig
piglet
piglet performance
pigs
Porcine Epidemic Diarrhea Virus
Porcine Reproductive and Respiratory Syndrome Virus
power calculation
premix stability
protein source
PRRS
real-time PCR
reducing sugars
refinement
release value
sample preparation
sample size
sample storage
slow-down program
steam conditioning
stomach ulcers
subunit vaccine
survival
swine
timing
transition sow
tryptophan
valine
vitamin stability
vitamin storage
wheat bran
yellow dent corn
zinc
zinc acidification
zinc oxide
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CJ America, Downers Grove, IL
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DSM Nutritional Products, Parsippany, NJ
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Feed One Co., Ltd., Yokohama, Japan
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Havermamp Brothers, Bern, KS
Roy and Linda Henry, Longford, KS
Holden Farms, Northfield, MN
Hord Family Farms, Bucyrus, OH
Hubbard Feeds, Mankato, MN
ICM, Inc., Colwich, KS
International Ingredient Corporation, St. Louis, MO
Iowa Select Farms, Inc., Iowa Falls, IA
J. Rettenmaier USA, Schoolcraft, MI
JBS Live Pork, Greely, CO
JYGA Technologies, St. Nicolas, Quebec, Canada
Kansas Pork Association, Manhattan, KS
Kansas Swine Alliance, Abilene, KS
Lesaffre, Milwaukee, WI
Livestock and Meat Industry Council, Manhattan, KS
Micronutrients, Indianapolis, IN
National Pork Board, Des Moines, IA
Natural Foods Holdings, Sioux City, IA
Gene Nemechek Family, Wilson, NC
New Fashion Pork, Jackson, MN
New Horizon Farms, Pipestone, MN
Origination, Inc., Maplewood, MN
PIC USA, Hendersonville, TN
Pipestone Grow-Finish, Pipestone, MN
Provimi North America, Brookville, OH
Purco, Edgerton, MN
SVC Research, LLC, St. Peter, MN
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Vetagro, Chicago, IL

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Swine Industry Day Committee

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Jordan Gebhardt
Bob Goodband
Mike Tokach
Jason Woodworth
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