rate (98% for NW HIGH vs. 94% NW LOW cows, with EW treatment intermediate). Mean calving date was 3 d later ($P < 0.05$) by cows on EW HIGH than EW LOW or NW HIGH. Calving and weaning rates did not differ ($P > 0.70$) among WEAN or WINTER treatments. Calf ADG from birth to EW tended ($P = 0.06$) to be greater for EW vs. NW calves (1.09 vs. 1.06 ± 0.015 kg/d, respectively). Cows on LOW had greater ($P < 0.05$) cull rates and were on study a shorter amount of time compared to cows on HIGH. Early vs. normal weaning maintained cow BW and BCS at greater levels throughout the study. WEAN and WINTER treatments rarely interacted in their influence on performance.

Key Words: DDGS, early weaning, hay, winter feeding

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125 Influence of growing phase feed efficiency classification on finishing phase growth performance and carcass characteristics of beef steers fed different diet types.

J. R. Russell[1,*], E. L. Lundy[1], N. O. Minton[2], W. J. Sexten[2], M. Kerley[2], S. L. Hansen[1], *[1]Iowa State University, Ames, [2]University of Missouri, Columbia.*

A multi-year study utilized 985 crossbred steers (464 ± 32 kg, SD) fed in six separate groups to determine the influence of growing phase (GP) feed efficiency (FE) classification and diet type on finishing phase (FP) FE. At University of Missouri, steers were fed GP corn (G-Corn; 528 steers) or roughage-based (G-Rough; 457 steers) diets using GrowSafe feed bunks to measure DMI for 69 to 89 d. At the end of the GP, steers were ranked by residual feed intake (RFI), shipped to Iowa State University, and blocked into FP pens (5 to 6 steers/pen) by GP diet and RFI rank (lower, middle, or upper one-third). Steers were transitioned to either FP corn or byproduct-based diets. After completion of the sixth group, average GP gain:feed within GP diet was calculated for each FP pen (168 total pens) using GP initial BW as a covariate. Pens were classified as highly (HFE; > 0.5 SD from the G:F mean; 58 pens), mid (MFE; ± 0.5 SD from the G:F mean; 60 pens), or lowly (LFE; < 0.5 SD from the G:F mean; 50 pens) feed efficient. Data were analyzed using PROC MIXED of SAS. Experimental unit was FP pen, and the model included the fixed effects of GP diet, FE classification, FP diet, and the interactions. Group (1 to 6) was included as a fixed effect. There were no three-way interactions ($P \geq 0.2$) for any traits. Finishing phase G:F was not affected by any interactions ($P \geq 0.5$) but was greater ($P \leq 0.03$) for HFE versus MFE and LFE and greater ($P = 0.02$) for MFE versus LFE. Growing phase diet × FE classification effects were detected ($P \leq 0.01$) for FP final BW (FBW), ADG, and DMI. Among G-Corn steers, LFE had greater ($P = 0.03$) FBW than HFE while ADG was unaffected ($P \geq 0.2$) by FE classification, but among G-Rough steers, HFE and MFE had greater ($P \leq 0.04$) FBW and ADG than LFE. Among G-Corn steers, LFE had greater ($P \leq 0.003$) DMI than MFE and HFE, but DMI was unaffected ($P \geq 0.3$) by FE classification among G-Rough steers. Overall, differences in finishing phase G:F between FE classifications were driven by different factors depending on diet; DMI differed among corn-grown steers and ADG differed among rough-age-grown steers. In this study, FE was repeatable from the growing to the finishing phase.

Key Words: cattle, feed efficiency, repeatability

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126 Effects of grinding corn through a 2-, 3-, or 4-high roller mill on milling characteristics, and finishing pig growth performance and carcass characteristics.

J. T. Gebhardt[1,*], M. D. Tokach[1], J. C. Woodworth[1], J. M. DeRouchey[1], R. D. Goodband[1], K. F. Coble[2], C. R. Stark[1], C. K. Jones[1], S. S. Dritz[1], *[1]Kansas State University, Manhattan, [2]New Fashion Pork, Jackson, MN.*

Finishing pigs ($n = 922$, initial BW = 40.1 kg) were used in a 97-d experiment to determine the effects of grinding corn through various roller mill configurations on milling characteristics and growth performance and carcass characteristics of finishing pigs in a commercial setting. Pens were randomly allotted to 1 of 4 experimental treatments by initial BW with 11 pens/treatment and 21 pigs/pen. All diets were fed in 5 phases with the same corn-soybean meal-based diets containing 20% dried distiller's grains with solubles. Experimental treatments included corn ground to 685 µm using 2 sets of rolls (2-high), corn ground to 577 µm using 3 sets of rolls (3-high), corn ground to 360 µm using 4 sets of rolls in a fine grind configuration (4-high fine), and corn ground to 466 µm using 4 sets of rolls in a coarse grind configuration (4-high coarse). The same roller mill was used for all configurations with the appropriate lower rolls completely open when using 2 or 3 sets of rolls. Grinding rate (tonnes/hour) was greatest ($P < 0.05$) for the 2-high and 4-high coarse configurations followed by the 3-high configuration and lowest for the 4-high fine configuration. Electricity cost was lowest ($P < 0.05$) per tonne of ground corn for the 2-high configuration and was greatest for the 4-high fine configuration. Pigs fed diets containing corn ground with the 2-high configuration had the greatest ($P < 0.05$) ADFI and ADG with pigs fed diets with corn ground using the 4-high fine configuration having the poorest ADFI and ADG (2.81, 2.73, 2.65, 2.73 kg for ADFI and 0.987, 0.967, 0.940, 0.971 kg for ADG for 2-high, 3-high, 4-high fine, 4-high coarse, respectively). There were no differences in G:F, caloric efficiency, or carcass characteristics among pigs fed diets ground with the different roller mill configurations. Feed cost/kg gain was lowest ($P < 0.05$) for the 4-high coarse configuration and revenue/pig was greatest ($P < 0.05$) for the 2-high and 4-high coarse configurations. Income over feed cost (IOFC) was lowest ($P < 0.05$) for pigs fed diets with corn ground using the 4-high fine configuration; however, there were no differences in IOFC among the other milling configurations. In our study, roller mill configuration had a significant impact on grinding

electricity cost, grinding rate, as well as ADFI and ADG; however, roller mill configuration had no impact on G:F.

Key Words: finishing pigs, grinding cost, roller mill

GROWTH, DEVELOPMENT, MUSCLE BIOLOGY AND MEAT SCIENCE

127 Pork quality: 2015 national retail benchmarking study. L. A. Bachmeier[1,*], S. J. Moeller[2], C. Carr[3], J. M. Young[1], X. Sun[1], J. H. Liu[1], S. B. Schauunaman[1], D. J. Newman[1], *[1]North Dakota State University, Fargo, [2]The Ohio State University, Columbus, [3]University of Florida, Gainesville.*

The purpose of this benchmarking study is to quantify pork quality variation in the retail self-serve meat case and provide information that can be used to implement changes necessary to meet the National Pork Board SMART objective of reducing pork having a subjective color score of 1 or 2 by 10% by the year 2020. The objective of this study was to benchmark pork quality from the top 3 major retailers and supermarkets in each market area across the United States according to the 2013 Progressive Grocer Marketing Guidebook (Stagnito Media, 2013). A total of 133 retail supermarkets, representing 28 market areas from 23 states were selected for the study. Samples were collected between January 2015 and April 2015 to eliminate seasonal variation. An experienced grader analyzed subjective color and marbling scores according to the National Pork Board Color and Marbling Standards (NPB, 2011) and various quality defects (bruising, blood splash, bone dust) in the meat retail case. Ten center-cut loin chop packages for each brand and enhancement type (enhanced and non-enhanced) were purchased. After purchase, samples were shipped to North Dakota State University for subjective and instrumental parameters for evaluation of subjective color, subjective marbling, instrumental color (CIE L*, a*, and b* color space values), pH, cook-loss percentage, and tenderness as determined by the Warner-Bratzler shear force method. Data were analyzed using the means and mixed procedures in SAS (SAS Institute, Cary, NY). Mean subjective color score values were 2.85 ± 0.79 for in store evaluation and 2.74 ± 0.79 for in laboratory evaluation. Mean subjective marbling score values were 2.30 ± 1.07 for in store evaluation and 2.27 ± 1.02 for in laboratory evaluation of subjective marbling. Mean instrumental color values were 55.56 ± 3.63 for L*, 16.60 ± 2.30 for a*, and 10.33 ± 1.53 for b*. Mean pH value was 5.83 ± 0.32. Mean cook-loss percentage was 14.22 ± 6.34%, and the Warner-Bratzler shear force value was 24.25 ± 7.23 N. Results indicate that a great deal of pork quality variation exists in the retail meat case nationwide.

Key Words: benchmarking, pork, quality

128 *Moringa oleifera* as an alternative protein source to soybean meal in pig production. A. Ruckli[1], G. Bee[2,*], *[1]Institute for Livestock Sciences, Posieux, Switzerland, [2]Agroscope Institute for Livestock Sciences, Posieux, Switzerland.*

Due to the rather ideal amino acid composition, soybean meal (SBM) is commonly used as the sole protein source in pig diets. In countries where this protein source is not easily available, alternative protein sources such as *Moringa oleifera* (MO) leaves have been proposed for pig diets. The aim of the present study was to establish the impact of replacing SBM by MO in a finisher diet on growth performance and carcass and meat quality. For the study, 24 Swiss Large White pigs from 6 litters were selected at 66.7 kg BW and assigned within litter to 2 treatments: finisher diet containing SBM (7.18%) and MO (15.56%) as the major protein source. All pigs were reared in one pen equipped with 4 automatic feeders equipped with individual pig recognition systems. They had ad libitum access to the assigned isonitrogenous (162 g/kg DM) and isoenergetic (14.4 MJ/kg DM) diets. The pigs were weighed weekly, and individual feed intake was monitored daily. After 55 d of feeding, pigs were slaughtered and organ weights and carcass and meat quality traits were assessed. Body weight at slaughter was 8.59 kg lighter (109.87 vs. 118.46 kg; $P < 0.01$) in MO than SBM pigs. The lower (771 vs. 954 g/d; $P < 0.01$) growth rate was a result of the lower average daily feed intake (2.71 vs. 3.41 kg/d; $P < 0.01$) whereas gain:feed was not affected (284 vs. 280 g/kg; $P = 0.49$). Hot carcass weight and carcass yield was lower (87.30 vs. 97.45 kg; 79.42 vs. 82.27%; $P < 0.01$ for each) in the MO group. Due to heavier ($P \leq 0.06$) ham (17.46 vs. 16.76%) and shoulder (12.09 vs. 11.23%) and lower (14.78 vs. 16.31%; $P < 0.01$) subcutaneous fat weight, lean meat percentage was greater in MO than SBM pigs (55.17 vs. 53.36%; $P = 0.05$). Expressed as percentage hot carcass weight, relative liver weight was greater (8.08 vs. 7.09%; $P < 0.01$) and relative kidney (1.48 vs. 1.63%) and lung weight (2.61 vs. 2.74%) were lower ($P < 0.01$ for each) in MO pigs. The loin of MO pigs was less ($P < 0.01$) red (a*: 5.0 vs. 5.8) and yellow (2.1 vs. 2.6), and ultimate pH was 0.1 units greater (5.6 vs. 5.5; $P = 0.02$). Similar effects were observed on backfat color. Water holding capacity but not shear force was impaired in the loin of MO pigs as drip loss (1.35 vs. 0.88%), thaw (8.47 vs. 6.91%), and cooking loss (23.14 vs. 21.90%) were greater ($P \leq 0.06$). Despite similar nutrient content of the finisher diets, replacing SBM by MO not only impaired growth but also negatively affected important meat quality traits.

Key Words: *Moringa oleifera*, pig, protein source