RESEARCH ABSTRACT
ANIMAL SCIENCE

Title: Enhancing feed utilization and nutrient digestibility through management of particle size and feed processing options – **NPB #13-037** revised

Investigator: John Patience, Ph.D.

Institutions: Iowa State University

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Scientific Abstract:

The objective of this study was to determine the impact of mean particle size (PS) of corn, wheat and DDGS with two different grinding technologies on the apparent total tract digestibility (ATTD) of DM, GE, CP, AEE and NDF in growing pigs (GP) and finishing pigs (FP). One hundred and twenty growing barrows (BW= 54.6 ± 0.4 kg) and the same number of finishing barrows ((BW =110.2 ± 0.8); PIC 337 sires x C22 or C29), were housed in individual pens and randomly assigned to 1 of 15 treatments providing 8 observations per dietary treatment. Corn and wheat were ground at three different PS (300, 500, and 700 microns), using either a roller mill (RM) or a hammermill (HM), generating 6 treatments per ingredient. For corn DDGS there were 3 treatments. Each DDGS diet contained 51% of corn ground at 500 microns with a RM, and then mixed with 45% of corn DDGS ground at 450 microns using HM, or ground at 450 microns using a RM or not further ground (unprocessed) at 650 microns. Mean and standard deviation of PS were determined using a sieve shaker. Samples from middle sieve fractions were collected for further laboratory analyses. Fecal samples were collected for the last three days of an 11d feeding period. Titanium dioxide was used as indigestible marker. Digestibility data were analyzed using the MIXED procedure of SAS. In corn, grinding method interacted with PS (P<0.001), suggesting that reducing the mean PS of corn with a RM (from 700 to 300 microns) increased ATTD of DM (P<0.05), GE (P<0.05) and CP (P<0.05); however, decreasing mean PS of corn with a HM had little to no effect on these same parameters (P>0.05). GP had greater ATTD of AEE than FP (P<0.001), while grinding method interacted with PS (P<0.001); this interaction suggest that reducing corn mean PS from 500 to 300 microns, but not from 700 to 500 microns with a roller mill, result in greater ATTD of AEE. In contrast, corn ground with a hammermill result in similar ATTD of AEE from 700 to 300 microns (P>0.05). For ATTD of NDF, there was a three way interaction among BW period, grinding method and PS (P=0.003); GP fed corn ground with a HM presented lower ATTD of NDF as micron size was reduced (from 700 to 300 microns; P<0.05). However, GP fed corn ground with RM had greater ATTD of NDF when PS was reduced from 700 to 500 microns (P<0.05), but similar from 500 to 300 microns (P>0.05). FP fed corn ground to a lower PS (from 700 to 300 microns) with a HM had similar ATTD of NDF (P>0.05). FP fed corn ground with a RM had greater digestibilities for 700 than for 500 microns (P<0.05); however, digestibility was similar for 500 and 300 microns (P>0.05). Results from wheat showed that ATTD of DM, GE, CP, AEE and NDF were influenced by the interaction among BW period, grinding method and PS (P<0.001, P<0.001, P<0.001, P<0.001 and P<0.001 respectively); GP had greater ATTD of DM, GE, CP, AEE and NDF by lowering mean PS with a HM or a HM from 700 to 500 microns (P<0.05). However, there was no further increase from 500 to 300 microns (P>0.05),

except for AEE (P<0.05). FP pigs had greater ATTD of DM, GE, CP, AEE and NDF by lowering mean PS with a HM from 700 to 500 microns (P<0.05), but it was greater for 500 than for 300 microns (P<0.05). Using a RM ATTD of DM and NDF decreased by lowering PS from 700 to 300 microns (P<0.05). For ATTD of GE was decreased by lowering PS from 700 to 500 microns (P>0.05), but was similar from 500 to 300 microns (P<0.05). Finally, ATTD of CP and AEE were similar from 700 to 300 microns (P>0.05). Results from corn DDGS showed that GP had greater ATTD of DM, GE and CP (P=0.09, P=0.026, P<0.0001 respectively), but ATTD of AEE and NDF were similar between GP and FP (P=0.391 and P=0.335 respectively). There were significant differences among treatments for ATTD of DM, GE, and AEE (P<0.001, P<0.001 and P<0.001 respectively) and ATTD of CP tend to be different among treatments (P=0.090); resulting in greater digestibility for DDGS at 650 than at 450 microns; P<0.05, and not being influenced by grinding method (at 450 microns; P>0.05). In conclusion, mean particle size, grinding method and BW can influence the digestibility of corn, wheat and corn DDGS differently; while smaller particle size was found to be generally better, this did not hold true in all instances. If ingredients can efficiently be ground to different particle sizes, profits can be maximized at the lowest possible processing cost.