RESEARCH ABSTRACT

ANIMAL SCIENCE

Title: **Should Producers Invest in 2-High, 3-High, or 4-High Roller Mills? -NPB project #14-068**

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Scientific Abstract:

A total of 1,332 pigs were used in three studies to determine the effects of various roller mill configurations on performance and feed preference of nursery pigs, growth and carcass performance of finishing pigs, electricity consumption, roller mill throughput, and economic implications.

In Exp. 1, pens of pigs (320 DNA 400 × 200, initial BW 24 lb) were randomly allotted to 1 of 4 dietary treatments and fed for 21 d with 16 pens per treatment and 5 pigs per pen. The 4 dietary treatments used the identical corn-soybean meal-based formulation that were batched from the same batch of ingredients (Table 1). Experimental diets were: (1) feed with corn fraction ground to 650 µ using 2 sets of rolls (2-High); (2) feed with corn fraction ground to 495 µ using 3 sets of rolls (3-High); (3) feed with corn fraction ground to 340 µ using 4 sets of rolls in a fine grind configuration (4-High fine); and (4) feed with the corn fraction ground to 490 µ 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 the 2 or 3 sets of rolls configurations. There were no differences (P > 0.05) in ADG, ADFI or F/G between roller mill configurations. Similarly, no differences were observed (P > 0.05) for caloric efficiency or economics among roller mill configurations.

In Exp. 2, 90 pigs (PIC 327 × 200; initial BW 27 lb) were randomly allotted to one of three diet comparisons to determine feed preference. The 3 diets used were from the 2-high roller mill configuration or the fine or coarse 4 high roller mill ground corn. Each pen contained 2 feeders, each containing 1 of the 3 treatment diets. The 3 diet comparisons tested were 2-High vs. 4-High fine (1 vs. 3), 2-High vs. 4-High coarse (1 vs. 4), and 4-High Fine vs. 4-High Coarse (3 vs. 4). Feeders were rotated once daily within each pen for the 7-d study. There were 5 pigs per pen, and 6 pens per treatment. Pigs consumed 67% (P < 0.05) of the diet containing corn ground through the 2-High roller mill compared to only 33% from the diet containing 4-High fine corn (Table 6). There was no difference (P > 0.05) in feed consumption of 2-High roller mill manufactured diet and diet manufactured with the 4-High roller mill in a coarse configuration (50.3 to 49.7%, respectively). However pigs consumed 63% (P < 0.05) of the diet manufactured using the 4-High roller mill in a coarse configuration and only 37% from the diet using the 4-High mill in a fine grind configuration.

In Exp. 3, 922 pigs (PIC TR4 × (FAST Large white × PIC Landrace), initial BW 88.3 lb) were used in a 97-d experiment to determine the effects of grinding corn through various roller mill configurations on growth performance and electrical consumption. Pens were randomly allotted to 1 of 4 experimental treatments by initial BW with 11 pens per treatment and 21 pigs per pen. All diets were fed in five phases with the same corn-soybean meal-based diets containing 20% dried distiller's grains with solubles. The treatments were the same as Exp. 1 with: (1) corn ground to 685 µ using 2 sets of rolls (2-High); (2) corn ground to 577 µ using 3 sets of rolls (3-High); (3) corn ground to 360 µ using 4 sets of rolls in a fine grind configuration (4-High fine); and (4) corn ground to 466 µ using 4 sets of rolls in a coarse grind configuration (4-High coarse).

Pigs fed diets containing corn ground with the 2-High configurations 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. Pigs fed diets ground using the 3-High or 4-High coarse configuration had intermediate ADFI and ADG. There were no observed differences ($P > 0.05$) in F/G or caloric efficiency among roller mill configurations. There also were no observed differences ($P > 0.05$) in yield, backfat, loin depth, or percent lean among roller mill configurations. Feed cost/pig matched feed intake being greatest for pigs fed diets containing corn ground using the 2-High configuration, whereas pigs fed diets with corn ground with the 4-High configurations had the lowest ($P < 0.05$) feed cost/pig. Feed cost/lb gain was lowest ($P < 0.05$) for the 4-High coarse configuration and revenue/pig was greatest for the 2-High and 4-High coarse configurations. IOFC was lowest ($P < 0.05$) for pigs fed diets with corn ground using the 4-High fine configuration; however, there were no observed differences ($P > 0.05$) in IOFC among the other configurations.

Grinding rate was significantly impacted by roller mill configuration, with the 4-High fine configuration having the lowest ($P < 0.05$) throughput. Grinding rate was greatest ($P < 0.05$) for the 2-High and 4-High coarse configurations, followed by the 3-High configuration. Electricity cost was lowest ($P < 0.05$) per ton of ground corn for the 2-High configuration, and was greatest for the 4-High fine configuration.

In nursery pigs, there were no observed differences in gain, feed consumption, feed efficiency, or economics for the roller mill configurations. However, there was a clear impact of roller mill configuration on feed preference with preference being negatively impacted by fine particle sizes. In finishing pigs, ADFI and ADG was reduced when the particle size was reduced from 685 µ to 360 µ, with no observed improvement in feed efficiency. Results did not indicate any benefit in feed efficiency or economic return when particle size was reduced below 685 µ by grinding through a roller mill when fed to finishing pigs.