Pretreatment of Feed Ingredients to Enhance Value

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Summary

Grains are typically harvested at <15% moisture to maintain quality during storage. When harvested at >15%, artificial drying may be employed but this increases cost. Low-quality high-moisture grains may also be preserved by acidification. These experiments were conducted with the overall objective of determining whether the benefits of acidification on performance and gut health of weanling pigs are maintained when the acid is presented as acid-preserved high-moisture grain. Results indicate that feeding acidified high-moisture wheat or barley to weanling pigs gave similar performance to feeding acidified diets providing an additional strategy for producers to utilize low quality grains.

Introduction

Harvesting grain at high moisture is an attractive option for grain producers, particularly during years with challenging growing conditions. However, drying the grain is expensive and may cause nutrient damage. A potential alternative to artificial drying is preserving the grain by acidification.

Acidification of diets for the weanling pig has demonstrated potential to improve the feeding value of the diets and various acids have been suggested as potential alternatives for antibiotic growth promotants. The overall objective of this series of experiments was to determine if the benefits of diet acidification are maintained when the acid-preserved grains are used in the diets for weanling pigs.

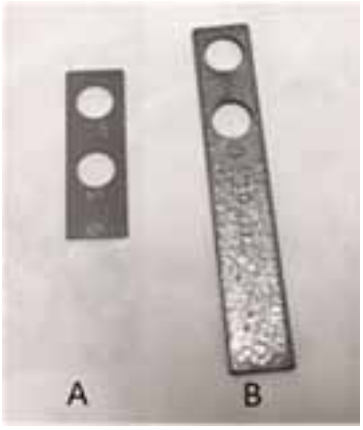

Figure 1. *Carbon steel (A) and galvanized steel (B) coupons used to estimate corrosion*

Experimental Procedures

Two experiments were conducted to determine the effect of grain acidification as an alternative to in-feed acidification on weaned pig performance, nutrient digestibility and gastro-intestinal health. Whole wheat and barley were reconstituted with water to achieve 20% moisture. Either a commercial phosphoric acid-based acidifier (30 to 50% phosphoric. 0.1 to 1% lactic, 5 to 10% citric and 1 to 5% malic acid) or propionic acid (99%) was then added to the grain with mixing, followed by storage in polyethylene barrels for about 35 days. –Weight loss of galvanized or carbon steel coupons, embedded in the acidified grain, were used to estimate corrosion rate (Figure 1).

The preserved grains were then used in piglet feeding trials. Trial 1 (wheat) and trial 2 (barley) used 160 and 90 pigs respectively (weaned at 21 ± 2 days of age, 6.50 to 6.60 kgs BW, housed 4 pigs/pen). Pigs were fed stage 1 and stage 2 treatments diets from day 0 to 7 and 8 to 21, followed by a common commercial diet from day 22 to 35.

The 5 Treatments in trial 1, arranged as a 2 x 2 factorial with a control, were type of acid (phosphoric acid mixture, or propionic) and type of application method (acid added as the preserved wheat or added directly to the diet) compared to a negative control. In trial 2 there were just 3 treatments, the phosphoric acid mixture added as a preservative or directly to the diet compared to a negative control.

Table 1. *pH and mould counts of high moisture (20% moisture) wheat and barley stored for about 35 days.*

		Acidified high moisture grain		
		pH		Mould, CFU/gm
		Initial	Final	Final
Study 1. Wheat	Phosphoric acid	4.27	5.72	7,000
	Propionic acid	4.56	4.85	20
Study 2. Barley	Phosphoric acid	4.60	5.47	821,000

Untreated wheat and barley had a pH of 6.24 and 6.19, respectively.

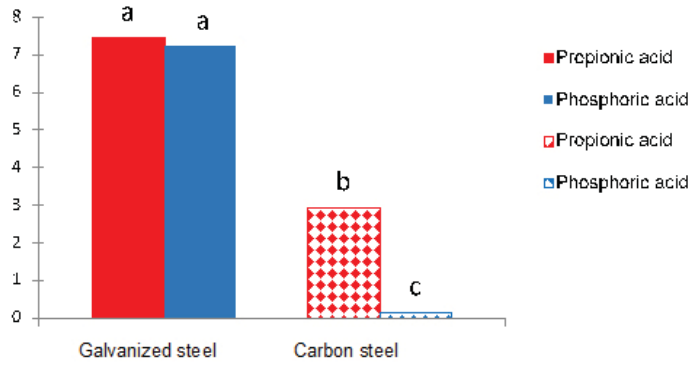

Figure 2. *The interaction of acid and metal on loss of coupon (mls per year) during storage for 35 days.*

Results and Discussion

Grain pH and mould count

pH of the grain fell by almost 2 points following the addition of the acid (Table 1), and while it had increased following storage it was remained below the initial values. Mould was observed on the phosphoric acid preserved wheat and barley, especially around the top of the barrel. However, when the grains were tested for a series of mycotoxins, all were below limits of detection, or below acceptable levels, thus the feeding trial proceeded.

Effect of acids on corrosion

Propionic acid and the phosphoric acid mixture were equivalent in their corrosiveness of galvanized steel while propionic acid was more corrosive to carbon steel (measured in mls per year, coupon x acid, P = 0.002). Produces will need to consider bin and feed equipment materials if considering using acid-preserved grains in their diets.

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Feeding acid preserved grains to weanling pigs.

Study 1.

Treatment had no effect on growth, feed intake or feed efficiency during the first 7 days post-weaning (P > 0.05; Figure 2). During phase 2, the pigs fed the propionic acid treatment grew faster and had improved feed efficiency than those fed the phosphoric acid mixture, regardless of application method (acid, P = 0.05). Feed efficiency was also improved in the acid treatments when the acid was applied directly to the diet, rather than acidified wheat. An improvement in feed intake and reduced gain:feed with the propionic acid treatments observed in phase 3, is difficult to explain as all pigs were receiving the same commercial production diet during this time.

Study 2.

Treatment had no effect on growth rate, feed intake or feed efficiency throughout the trial (data not shown).

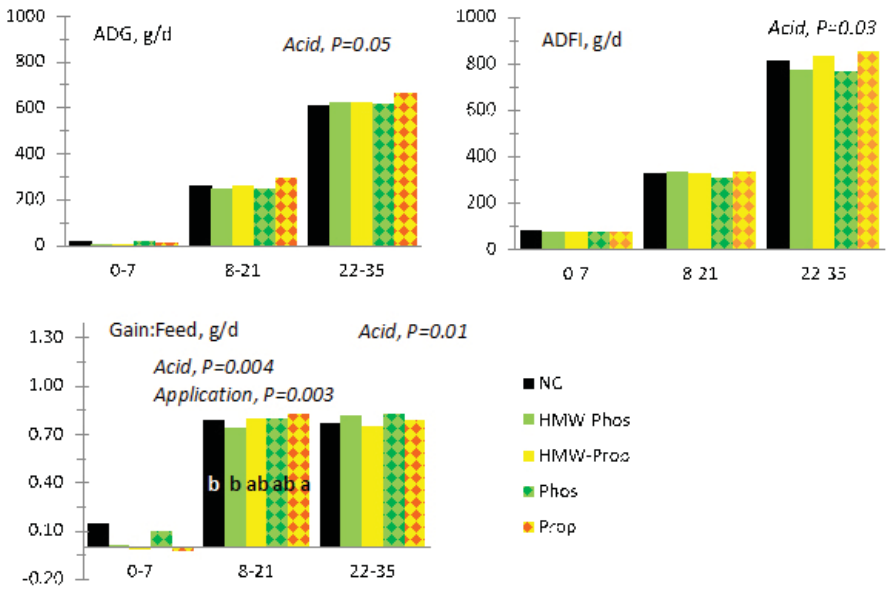

Figure 3. *Average daily gain, feed intake and feed efficiency of pigs fed a control diet (NC), or the control diet with wheat preserved with a phosphoric acid mixture (HMW-Phos) or propionic acid (HMW-Prop) compared to equivalent amounts of the phosphoric acid mixture (Phos) or propionic acid (Prop) added to the diet immediately prior to feeding in 2 phases. Days 22 to 35 the pigs were fed a common diet.*

Conclusions

Results indicate that feeding acidified high-moisture wheat or barley to weanling pigs gave similar performance to feeding acidified diets. Therefore, feeding acid-preserved high-moisture grains can be an alternative to direct diet acidification for weanling pigs. This provides producers an alternative tool to utilize and improve the feeding value of low quality, high-moisture wheat or barley with a potential to reduce cost.

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