January 2005

# Out-of-Feed Events in Grow-Finish Pigs: Causes and Consequences

Mike Brumm
*University of Nebraska*, mbrumm1@unl.edu

Brian Richert
*University of Nebraska - Lincoln*

Jeremy Marchant-Forde
*USDA-ARS*

Ruth Marchant-Forde
*USDA-ARS*

# Out-of-Feed Events in Grow-Finish Pigs: Causes and Consequences

**Mike Brumm**
**Brian Richert**
**Jeremy Marchant-Forde**
**Ruth Marchant-Forde**[1]

**Summary and Implications**

*In theory, bulk bins and automated feed delivery systems assure an uninterrupted flow of feed to the feeder in swine grow-finish facilities. In practice, growing-finishing pigs have varying disruptions in feed availability, some of which may have serious consequences. While every swine grow-finish facility has occasional disruptions due to mechanical failures in the feed delivery system, there are additional disruptions due to human errors associated with keeping feed in the bulk bin and feed bridging associated with feed removal from the bin. Out-of-feed events are a known cause of ulcers in pigs and are suspected of being associated with increased incidence of hemorrhagic bowel syndrome and ileitis. It is speculated that each 20 to 24 hour out-of-feed event results in an increase in variation in growth within a population of pigs and results in a reduction in daily gain.*

**Introduction**

One of the most common responses to critics of modern production practices, especially confinement grow-finish facilities, is "we put pigs in these facilities to better provide for their daily needs." Yet, evidence is mounting that many producers are failing to meet this claim if the daily needs include unlimited access to feed.

A majority of finishing facilities have bulk bins and automated feed delivery systems. In theory, these bins and delivery systems assure an uninterrupted flow of feed to the feeder. In practice, growing-finishing pigs have varying disruptions in feed availability, some of which may have serious consequences.

**Causes**

The three major causes for out-of-feed events in grower-finisher facilities are:

1. human errors,
2. bridging of feed,
3. equipment malfunction.

*Human Errors.* Human errors generally are associated with empty bins, which occurs when feed is not ordered, prepared, and delivered in a timely manner. While preventable, this cause of out-of-feed events occurs more often than producers like to admit. It is most likely that this cause has increased as an increasing percentage of feed processing and delivery is provided by commercial mills, rather than on the farm. When feed is processed on the farm, an empty feeder or empty bin is relatively easy to resolve. The producer immediately processes enough feed to fill the bin and/or feeder.

However, with commercial mills, feed preparation and transport scheduling becomes an issue. Instead of a producer making an independent decision that feed processing is a high priority due to an empty (or near empty) bin or feeder, a central mill may require 24-hour or even 48-hour notice. Even if a mill accepts same-day orders, an order placed at 7 a.m. (when the empty bin is discovered) may not be delivered until

*(Continued on next page)*

mid-afternoon due to orders already received or previously scheduled. This means producers and production managers must estimate bin inventories and anticipate feed disappearance. Field experience suggests there is a wide variation in the ability of producers/managers to accomplish this vital task.

One method commonly used to reduce this source of out-of-feed events is the addition of a second bulk bin to the feed delivery line. In theory, one of the two bins is always full of feed. When one bin runs empty, the producer only has to close the delivery device on one bin and open up the other bin to restore feed access and place an order to refill the empty bin. However, production staff and/or supervisors will often by-pass this system by keeping both bins open since it is 'easy'. Now, the two bulk bins are in reality one bin, with no reserve supply.

There are several companies that offer bin monitoring equipment. There is an expense to this equipment, and until data is available to put a dollar value on the impact of out-of-feed events, producers (both owners and contract growers) have been reluctant to invest in this equipment.

*Feed Bridging.* A second cause of out-of-feed events is bridging of ground feed in bulk bins. In this case, feed is in the bin, but because of issues associated with flowability, it does not flow out of the bin into the feed delivery line. Producers often refer to this as "rat-holing" of feed in the bin.

Issues with bridging generally are limited to systems that use meal diets. Recent results from Kansas State University suggest that as particle size decreases, and the amount of fat added increases in corn-based diets, the angle of repose (an estimate of likelihood of bridging) increases. In the past 10 years, there has been a marked reduction in the average particle size for swine diets, driven by data which suggests a 1-1.5% improvement in feed conversion efficiency for each 100 micron reduction in particle size from 1000 to 500 microns. The current University of Nebraska and Purdue University recommendation is to process complete diets to an average particle size of 650 to 750 microns for all grains except wheat.

*Equipment Malfunction.* The final cause of out-of-feed events is equipment malfunction. Again, some producers have a larger incidence of this than others, generally related to the level of preventive repair and maintenance practiced. Intermixed with the above causes is the fact that out-of-feed events increase as facilities age, due to both equipment malfunctions and general producer apathy. To understand producer apathy, consider what happens in a new swine facility the first time an out-of-feed event occurs. In most cases, the producer panics since his assumption was the facility was built to provide for the pigs' every need, and an out-of-feed event will have production consequences. As facilities age and producers experience a variety of out-of-feed events, a general apathy often sets in. Producers with a fixed payment production contract ($x/pig space/year) often ask – what are/were the consequences to me as a grower from the out-of-feed event? Did the pigs become ill on the day they were out of feed? Did my payment change as a consequence of out-of-feed events? Did the pig owner notify me of a concern because of an out-of-feed event that they didn't even know about?

**Consequences**

Feed restriction in pigs is known to cause high levels of hunger-driven feeding motivation. In sows, which are commonly restricted-fed long-term, these high levels of feeding motivation are thought to contribute to the development of stereotypic behaviors. In grow-finish pigs exposed to feed restriction for short time periods the high levels of feeding motivation have been shown to manifest themselves in other ways. For example, feed restriction results in an increase in redirected behavior, such as pen-mate manipulation and an overall increase in activity. When food supply is reinstated, there is an increase in feeding rate (g/min), which in other species has been shown to be sustained even when feed supply subsequently remains constant. This suggests that repeated out-of-feed events lead to long term changes in the eating behavior of pigs.

There is considerable anecdotal evidence suggesting that when pigs are given access to feed following a period of deprivation, large amounts of fighting and aggressive behaviors occur. It is likely that this will adversely affect the welfare of all pigs within that pen. There is one report in the literature of increased competition and aggression for feeding spaces at feeding time when there was an unreliable or no signal of feed delivery. Difficulties in gaining access to feeders does appear to influence the number of feeding events and the length of these feeding events and it is possible that periods of feed unavailability will cause a disruption in the circadian pattern of many behaviors within the pen. Certainly, intermittent stressors are known to cause changes in circadian patterns of hormone secretion in pigs and of behavior in other species. There is also evidence that variation in weight gain increases when signals of feed availability are unreliable versus reliable.

Gastric ulceration is a common condition in modern pig production, with reports varying from 30 to 90% of all pigs in the

U.S. having some amount of stomach ulceration at slaughter. Short term feed deprivation (24 hours) was shown to create ulcers in growing pigs in studies at Purdue University. Periodic feed interruptions will likely create a similar effect in ad libitum fed pigs. While pigs being fed a 750 micron diet had most of these ulcers repaired by 28 days, those remaining on a finely ground diet (550 microns) or continuing to see weekly feed deprivations had increased stomach ulcerations.

Hemorrhagic bowel syndrome is a health concern because as much as 50% of all finishing deaths on some farms are attributed to this cause and sporadic outbreaks may result in upwards of 10 to 20% mortality in severe instances. It has been suggested by Michigan State University extension swine veterinarians that interruptions of feeding, such as occur with out-of-feed events, can be an inciting factor for hemorrhagic bowel syndrome. Veterinary pathologists also have speculated that inconsistent feed consumption leading to engorgement is a risk factor for hemorrhagic bowel syndrome.

If pigs miss one or more meals in a 24-hour period, they do not compensate for this missed feed intake by over consumption when feed does become available. This observation is based on on-farm recording of auger run times taken every 15 minutes using a commercially available monitoring system. If feed delivery fails sometime during the night and feed is rapidly made available first thing in the morning, there is little consequence. If feed delivery stops immediately after the previous morning's observations of pig health, etc., and feed isn't available until 4 p.m. on the following day, this is more than 24 hours of feed withdrawal (depending on the amount of feed in the feed hopper), a period of time likely to result in catabolism of body stores.

Pigs transported to slaughter plants and given water but no feed access during lairage have a relatively rapid loss of both live and carcass weight beginning approximately 18 hours after the last meal. The rate of liveweight loss was approximately 0.21%/hour and the loss in carcass weight was 0.13%/hour of fast in one study. The difference in rate of weight loss is presumably due to loss of intestinal fill, a loss that would be immediately restored with feed availability. USDA and University of Missouri researchers reported GI tract contents represented 50-60% of the total liveweight loss in pigs fasted 24 hours. Liver glycogen was almost completely depleted in pigs deprived of food for 12 and 18 hours in work done with slaughter pigs at packing plants.

It is quite possible that repeated out-of-feed events impact carcass composition. As early as 1970 there is a report that pigs fed ad libitum every other day with a one-day fasting period had a reduction in daily gain with minimal impact on feed conversion efficiency. However, carcass dressing percentage was reduced, in part because a higher percentage of weight at slaughter was visceral mass. In a later study, there was an increase in backfat depth for pigs fed every other day versus once or twice daily.

Using the equations of the 1998 National Research Council publication 'Nutrient Requirements of Swine', a 110 lb pig housed in thermo-neutral conditions requires 1990 kcal ME/day for maintenance or 83 kcal/hour. Assuming 20 hours for an out-of-feed event, this 110 lb pig uses body stores equivalent to just over 1 lb of a corn-soy diet (1500 kcal/lb). When feed does become available, the pig must consume 1 extra pound of feed to compensate for body stores lost in meeting the maintenance requirement, plus feed associated with the loss in growth. If the 110 lb pig was consuming 4.5-5.0 lb/day when feed was available, to compensate for the missed intake, feed consumption would have to increase to 5.5-6.0 lb just to compensate for maintenance and to restore growth to its previous rate, not including feed consumed to restore gut fill. In all likelihood, any tissue gain that is lost because of an out-of-feed event is not compensated for in subsequent meals based on on-farm feed delivery system monitoring. Thus, a 20-hour out-of-feed event can be thought of as the equivalent to 1 day longer to slaughter, a severe economic impact in production systems which have fixed time constraints on production flow.

**Conclusion**

Out-of-feed events are a growing concern in swine grow-finish facilities. Until production or research evidence is available, many care-takers of pigs remain complacent regarding the negative impacts of this management failure. Because pigs don't die, or appear to have clinical symptoms of disease within 24 hours of the out-of-feed event, there is no sense of urgency by many in the industry to eliminate, or at least significantly reduce the incidence of this failure. However, there are long term impacts, on pig welfare, health and performance that are only just beginning to be understood. As the industry achieves a greater understanding of these impacts it is logical to expect to see greater emphasis placed by all involved in grow-finish production to reduce the incidence of this management failure.

---

Mike Brumm, Extension Swine Specialist, University of Nebraska; Brian Richert, Extension Swine Specialist, Purdue University; Jeremy Marchant-Forde and Ruth Marchant-Forde, USDA-ARS Research Associates, Livestock Behavior Research Unit, Purdue University.