Sow Feeder Shakedown:

Scientists Watch Sows Eat, Design A Better Feeder

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If a sow is allowed to do her "thing" as she eats, she'll pretty much stand stock still. Her only movement will be the highly coordinated, rhythmic actions of her jaws, lips, and tongue.

In contrast, the sow that is "dancing" while she eats is probably a frustrated sow.

Frustrated, because she can't eat comfortably.

If the headgate feeders in your farrowing and gestation crates don't "fit" your sows' natural way of eating — you probably have unhappy, frustrated sows that are not getting enough to eat, wasting feed or injuring themselves. If they aren't eating well, it's a pretty good bet they are not performing at their peak either.

Recent studies have provided increasing evidence, from both casual observations and scientifically controlled experiments, that feed wastage with feeder models on the market today is much larger than we previously thought.

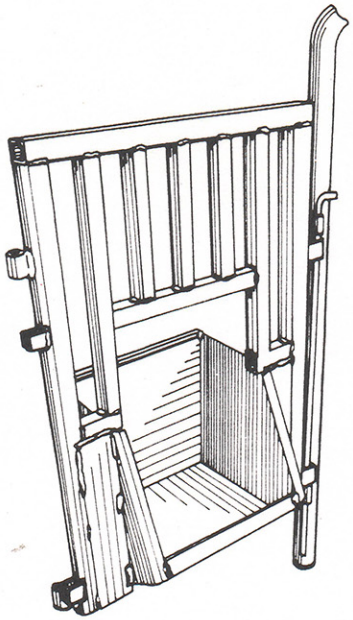
In the past three years, we have used several approaches to investigate the design of hog feeders used at all stages of production. Funded in part by the National Pork Producers Council, this research began with a hard look at feeders for gestating and lactating sows.

Early Tests

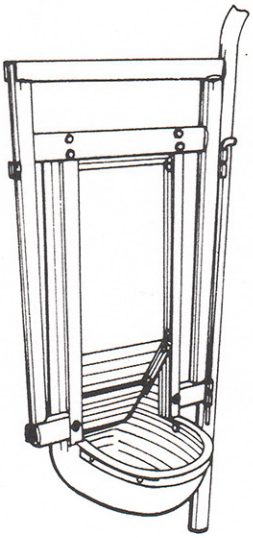
Preliminary testing soon showed us how much feeder design can affect feed wastage. We evaluated six feeder models in early tests, simply measuring the amount of feed left in feeders and the amount rooted out and dropped through the woven wire floor.

We found two things affected feed wastage — feeder design and the different ways individual gilts ate. The design also affected the amount of feed left behind because the sow could not reach it. In fact, feeder design influenced the amount of feed left in the feeder more than it influenced the amount dropped.

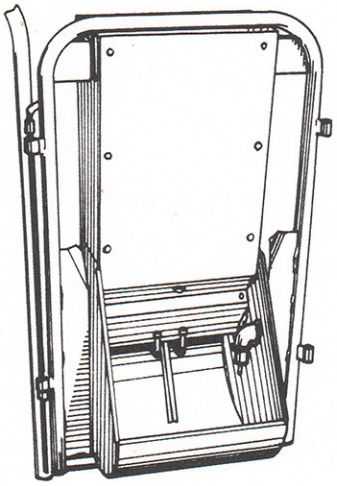
Ian Taylor *(above)* studied eating movements of sows using very slow motion films to identify their precise range of motion.



1. Feed Wastage Range: 1 to 38%



2. Feed Wastage Range: .8 to 35%



3. Feed Wastage Range: .5 to 28%

Conversely, animal individuality influenced the amount of feed dropped more than it did the amount left.

Large, consistent differences among feeders were also noted in terms of injury to the animal, and injury and inconvenience to the herdsman.

These early findings confirmed our hunch that there is a lot of room for design improvements in feeders.

Our next step was to conduct a more comprehensive test to document how 10 widely used sow feeder designs performed relative to one another.

Comparison Tests

Trials involving 90 gestating sows with varied genetic backgrounds, a parity range 2 through 9, were conducted in a controlled setting. Sows were fed a precise ration of 5 lb. once daily. Standardized feed data collections were made 7 hours after each feeding.

Over 2,000 records of the amount of feed dropped through the floor and the amount left in the feeder have been registered so far.

In addition, sow injury and "user friendliness" was observed and recorded for each model.

It was soon obvious that there's a lot of feed wasted in farrowing and gestation units. Some is due to sow feeder design, some due to sow eating habits.

If you haven't checked under your farrowing crates or sow gestation stalls recently, it may be worth a look. Remember, if a mere 1% of the feed is wasted, that amounts to over 1 ton wasted per 100 sows per year. (.01 × 5 lb. × 100 sows × 365 days = 1825 lb.). Factor in higher feeding levels during lactation periods and your 100 sows can easily waste a ton of feed, even with good feeders. It's not unusual for sows to waste 6%, 8%, 10%, even 12% of the feed placed in some feeders.

Feeder Critique

Here's a look at the 10 sow feeder designs we studied. Generic sketches of those designs were made to broaden the application of this review.

Most headgate feeders were designed for farrowing crates and/or gestation stalls. Here are our thoughts and observations on how their design features affected feed wastage and sow injury:

1. Starting at the high end of the wastage range, this sort of feeder resulted in a range of 1% to 38% of the feed dropped through the wire mesh floors, on an individual sow, 3-day average, basis. The design's overall average was 10% feed wasted. Some sows actually wasted over half of the feed they were fed some days.

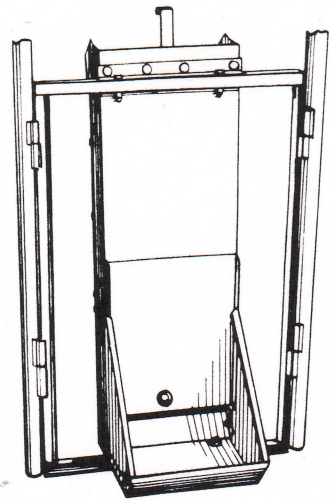
This feeder doesn't "fit" most sows so they tend to throw feed everywhere as they eat.

The soft aluminum alloy used to construct some models doesn't hold up well, which often resulted in jagged edges that injured sows. A lot of feed also got trapped under the front lip and in the corners, where it could spoil.

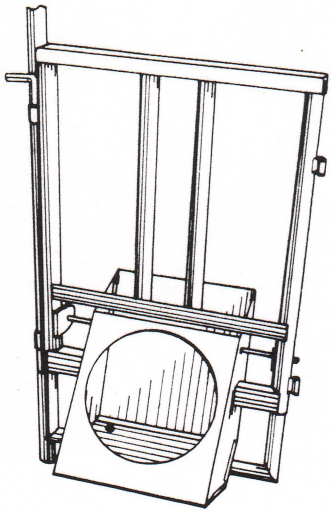
2. This sort of design averaged around 8% wastage (range .8% to 35%). It's simply too small. Sows jam their heads down diagonally as they eat; rub raw spots on their brow and near the base of the ears. Adjusting the baffle didn't reduce feed wastage. Moistened feed also tended to collect under the lip.

3. This kind of feeder averaged about 7% feed wastage (range .5% to 28%). It is too confining. Bolt heads injured sows, as did the sharp edges at the feed drop agitator, especially with very anxious or large sows.

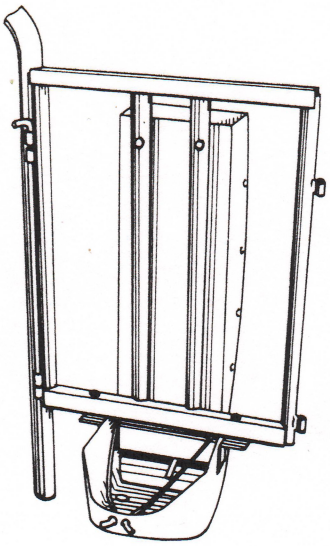
4. Sow feeders of this design resulted in around 5% wastage (range .3% to 27%). It's too space-restrictive and too shallow. The



4. Feed Wastage Range: .3 to 27%



5. Feed Wastage Range: .3 to 27%



6. Feed Wastage Range: .3 to 9%

feedgate edges are turned in toward the sow so they rubbed raw spots at the base of her ears as they pushed into the feeder.

5. Sows using this feeder type wasted over 3% of their feed (range .3 to 27%). The lack of any feed-retaining reservoir means the sow gets very excited at feeding time as she goes for a quick meal. That, plus the very restricted access to the feed, led to some unfortunate, severe abrasions of the sow's snout, brow, and jowl. The hole size is simply too small for many sows and the feeding surface too deep.

Sows often became very agitated when eating from this feeder. The continuous contact of the jowl with the feeder edge could also aggravate jowl abscess problems.

This feeder also has blind corners where feed collected, was inaccessible to the sow and could spoil. As with all feeders that didn't have an effective way to slow feed flow, the more feed put before the sow at any one time (i.e., during lactation), the greater the chance for feed wastage as she roots around and carries feed out on her snout.

6. Sow feeders of this general type have been around for many years. In our trials they averaged over 2% feed wastage (range .3% to 9%). That's over 2 tons of feed/year/100 sows.

The feeder is too small. It rubbed the sow at the brow. The "feed guard rods" rubbed her jowl as she pushed into the feeder. These rods also trapped a lot of feed making it inaccessible and probably frustrating to the sow. When the rods were removed, wastage approached 9%.

This "bowl" design can also be extremely space-limiting for larger sows, depending on whether the feed chute/hopper is mounted on the sow's side or the aisle side of the headgate.

7. Feeders of this "metal bin" type are another common design. They averaged over 2% feed wastage (range .1% to 18%). It has no reservoir, so all the feed drops in front of the sow at feeding time. Full-fed lactating sows waste considerably more than 2% with this feeder. Many sows pushed feed up and over the back.

Unfortunately, the top brace is positioned too low and its inside edge is sharp; on many sows, it rubbed the back of the neck and ears raw.

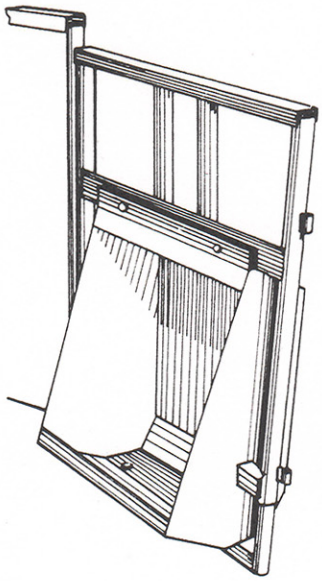
8. This feeder's average wastage was about 2% (range .4% to 8%). It has an intricate feed-delivery mechanism which tended to cause the sow to push feed into the back corners of the bowl as she ate. Moreover, she forced her snout into these confining corners, often scraping and cutting the lower bridge of her snout. *(Sketch note: Feedgate cover panel is not shown to allow full view of feeder.)*

Sows often appeared generally "agitated" and hopped about a lot as they ate from this feeder. Specific adjustment of the delivery system to fit individual sow needs was required.

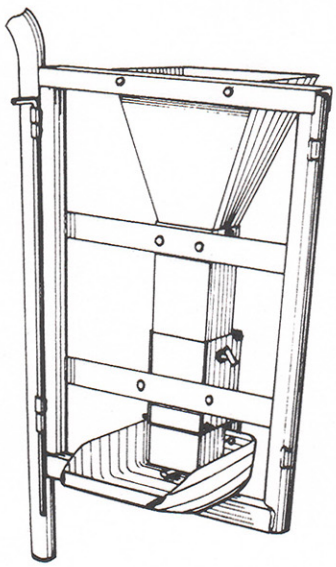
Moisture in the bowl could be wicked up the feed-delivery column, causing feed to "set up" — necessitating disassembly of the column.

9. This feeder is characteristic of many plastic models now offered. This one averaged around 1% feed wastage (range .1% to 4%). We've seen some gouging of the plastic with the teeth. This design has no feed-retaining reservoir, but the overall size and shape of the surrounding shell is less antagonistic to the sow's ability to adopt a comfortable eating posture. Thus, the majority of her eating movements remain within the feeder, where dropped feed can be recaptured.

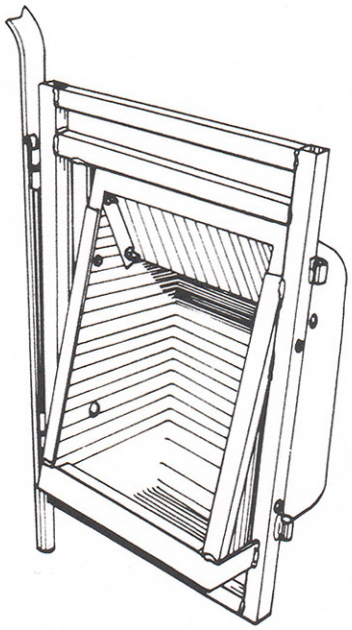
Unfortunately, feeders of this design may have prominent bolt



7. Feed Wastage Range: .1 to 18%



8. Feed Wastage Range: .4 to 8%



9. Feed Wastage Range: .1 to 4%

ends and sheet metal guards with sharp edges which cut the snouts of excited sows waiting to be fed.

10. This kind of feeder wasted less than 1% on average (range .1% to 8%). It is often marketed as a "wet" feeder, but we ran it dry, because our first study was limited to identifying the design features that make good dry feeders.

Like other low-waste feeders, this unit gives sows quite a bit of space. An even larger version might accommodate large sows better.

Another plus is the feed hopper with agitator pipe which slows the feed delivery to the sow. On a few occasions, feed jammed the throat of the hopper, causing erratic feed delivery.

Feed rooted around in the feeder tended to fall back to an accessible area. Inner surfaces are contoured to eliminate blind corners and trapped feed. Most sows appeared to stand calmly as they ate from this feeder. Overall, this feeder performed very well — although it was noisy.

Grouped Rankings

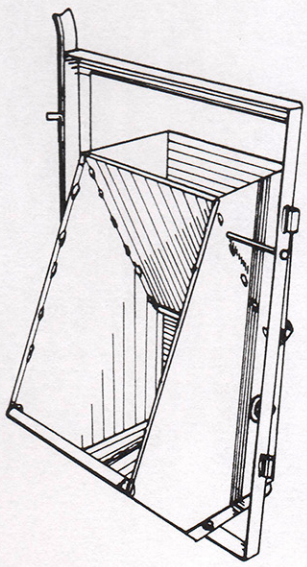
The overall ranking given these feeder designs is based on results of preliminary statistical analyses. Essentially, feeders fell into three groups based on amount of feed wastage — over 6%; 2% to 6%; and 1% or less.

Those with high feed waste averages also tended to show high variation among sows in the amount of feed they wasted. Those with less wastage have much less individual sow variation.

Poor design, sharp edges, anxious sows at feeding time are a bad combination. Illinois' research is aimed at avoiding such abrasions.

Future Designs

Students and faculty at the University of Illinois' College of Applied Life Studies' Biomechanics Research Laboratory and the School of Art & Design's Industrial Design Unit collaborated with us in order to help



10. Feed Wastage Range: .1 to 8%

identify which design elements are most important to the sow as she eats.

We studied how sows' heads are shaped so we can design feeders which best accommodate the range of body types in our nation's sow herd.

We've studied sow eating movements precisely using very-slow-motion films (100 frames per second). With computer-assisted analysis, studying those movements on a frame-by-frame basis, we've learned a great deal. We discovered that if a sow is allowed to eat in a posture that is natural for her, she wastes less feed.

When a sow can eat in a relatively unrestricted fashion — when she is allowed to eat in the manner she determines for herself — we see very little body movement except for the highly coordinated, rhythmic actions of the jaws, lips, and tongue. If she can get to the feed, and if she isn't being injured, her body will remain stock-still.

Ideal Sow Feeder — '88 Version

Based on what we have learned, the ideal headgate feeder design for sows being fed a limited ration should include these features:

► Feeder should allow sow to use her individual approach to the feed. Because each sow eats in a unique way, give her plenty of space so she can "do her thing" at feeding time. Among other things, that means providing adequate head room. This approach runs exactly counter to the very restrictive approach currently found in many feeder designs.

► Feed-delivery mechanism should, in effect, slow the sow down as she eats. She's being fed a restricted ration, she's hungry, she's anxious, she's impatient, and soon she can become frustrated. That's when a lot of feed wastage occurs.

During lactation, we want to encourage feed intake by supplying fresh feed upon her demand, without allowing it to accumulate and spoil.

► Design allows the sow to swallow with her mouth above or in the feeder.

► Feed is readily accessible to the sow at, or near, floor level.

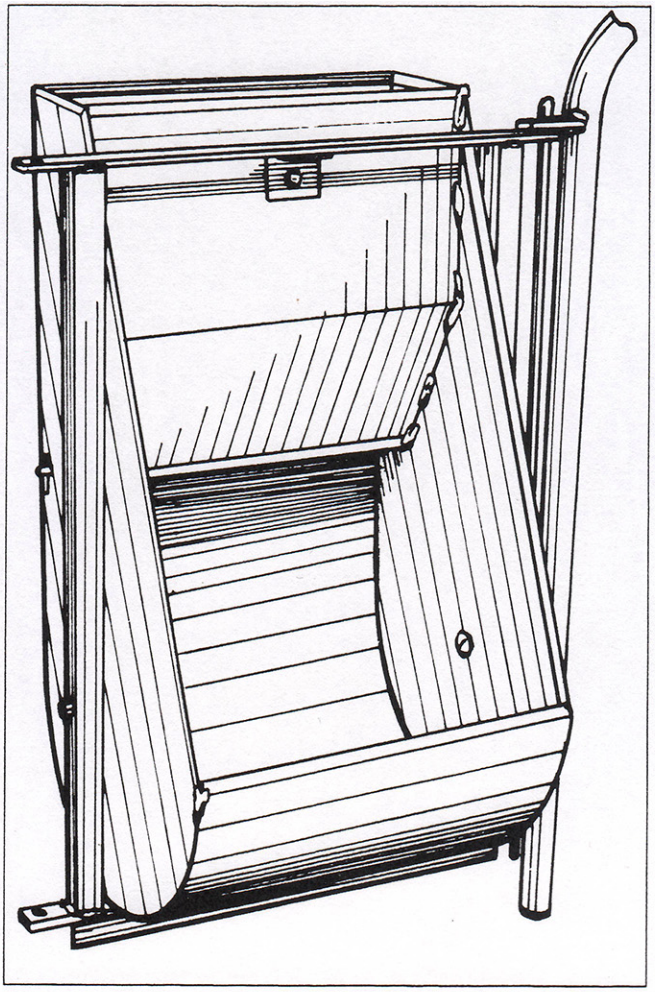
► Feed disturbed by eating movements is automatically recollected in a location accessible to the sow. Feed should not leave the feeder. There should be no blind corners.

► Feeder is free of protruding bolts, nuts, sharp edges and other places where insufficient clearance is allowed the sow's head and neck structures.

Based on these findings, we have designed a sow feeder that encourages comfortable, noninjurious, nonwasteful eating by the sow. Feed wastage on this design averaged only .2% (range .01%-.7%). Marked progress has been made in a relatively short time because now we understand more about the sow's needs and preferences.

New Feeder Design

The Illinois team designed this "ideal" feeder with plenty of space for sows to eat comfortably, prevent spilled feed, a delivery system providing fresh feed on demand, and free of protrusions and sharp edges.



About the authors: Ian Taylor is a graduate research assistant working toward a doctorate emphasizing animal equipment design. Stan Curtis, professor in the Department of Animal Sciences at the University of Illinois, has spent over two decades conducting animal environment research, much of which has been focused on hogs. ◇