

All Feeders Not Equal

If you think that all hay feeders are equally effective at reducing waste, think again.

by Ed Haag

Dan Buskirk, Department of Animal Science, Michigan State University (MSU), is not a person to leave questions unanswered if he can help it. So, when one of his school's livestock educators commented that he had observed marked differences in the effectiveness of various types of round bale feeders at controlling waste, Buskirk decided to look into the matter.

"First, I did an extensive lit[erature] review, because I was sure that somebody has looked at this," he says. "My conclusion was that if someone had done an evaluation they hadn't documented it."

He adds that while no comprehensive evaluations of specific feeding methods had been conducted in nearly two decades, a

study completed in the 1980s showed that losses of hay due to how it was fed could reach 20%-30% of the dry matter (DM) fed.

With several unique designs for large-bale feeders in use and more than one accompanied by claims of reduced waste potential, Buskirk was curious to see if those claims would stand up under scientific scrutiny. In addition, he was particularly interested in how cattle behaved when they were accessing the different feeders, believing that a better understanding of the relationship between feeder design and animal behavior could provide an opportunity for more efficient feed use and enhance animal performance and well-being.

Knowing he would have to provide the ultimate answers to these questions, Buskirk decided to proceed with a study.

Like most others associated with beef production, Buskirk had his own preconceived notions about which feeders would do the best job before he began his study.

"The study would prove me wrong," the field specialist says wryly, adding that what was an even more striking revelation to emerge from the study was the difference between feeders. Results would show a 10% variation in hay waste between the best-performing feeder and the worst-performing feeder.

Three years ago such a spread might have seemed insignificant. In an era of cheap

forage and grain, chasing after a 10% difference in hay waste seemed hardly worthwhile. How times have changed. With discount hay and low-priced feedgrains now history, how much a producer wastes can mean the difference between making a profit and incurring a loss.

"There is no cheap energy out there," says



► The ring feeder proved its worth if not overfilled.



► Michigan study revealed cone feeders provided the least waste.

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Table 1: Effect of feeder type on hay waste and intake by beef cows

Item	Feeder type				SEM ^a
	Cone	Ring	Trailer	Cradle	
Initial cow weight, lb.	1,386.1	1,392.2	1,393.8	1,388.0	9.4
Initial cow body condition score ^e	5.8	5.9	5.9	5.8	0.02
	Dry-matter basis				
Daily hay disappearance, lb./cow ^f	26.4 ^b	26.8 ^b	30.6 ^c	28.4 ^{b,c}	0.9
Daily hay waste, lb./cow	0.9 ^b	1.6 ^c	3.5 ^d	4.2 ^d	0.2
Hay waste, % ^g	3.5 ^b	6.1 ^b	11.4 ^c	14.6 ^c	0.8
Daily hay intake, lb./cow ^h	25.4	25.1	27.1	24.3	0.8
Intake/cow body wt., %	1.8	1.8	2.0	1.8	0.1

^aStandard error of the least squares means.

^{b,c,d}Within a row, least squares means without a common superscript letter differ ($P < 0.05$).

^e1-to-9 scale where 1 = extremely thin and 9 = obese.

^fHay fed less residual hay at the end of the period.

^gHay waste as a percentage of hay disappearance.

^hHay disappearance less hay waste.

Source: Dan Buskirk, Michigan State University.

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David Ames, Department of Animal Sciences, Colorado State University (CSU). “Instead, beef producers have to learn how to fine-tune their feeding program.”

Maintaining beef cows, in particular feeding them when they are not grazing, has always had a significant effect on the profitability of a beef cow herd. Now, because of the scarcity of low-cost feed alternatives during those winter months when pasture grass is not available, the issue is particularly critical.

As of 2006, the Integrated Resource Management (IRM) databank for Northern Plains beef cow herds estimates that winter feed costs are 31%-47% of the total cost of production. It is predicted that rising production costs and record-high feedgrain prices will increase that percentage substantially in 2007.

Buskirk concurs with that assessment, noting that harvested feed is also the largest cost contributor to maintenance of beef cows in the upper Midwest and feed cost is the largest variable influencing profitability of the cow-calf enterprise in his region. He calculates that the 10% spread between the best-performing feeder and the worst-performing feeder translates into a savings of \$15 per cow per season when hay is \$75 per ton.

“With 20 cows accessing each feeder, you are talking about \$300 in a season,” Buskirk says. “That means that the right feeder can pay for itself in one year.”

Seeking answers

After consulting with his colleagues, Buskirk decided he would form a research team to conduct a comprehensive evaluation on four of the most commonly used round-bale feeders — the cone feeder, the ring feeder, the trailer feeder and the cradle feeder. The researchers would also monitor the feeding behavior for each feeder design and the relationship between feeding behavior, feeder design and feed loss.

The team’s first step in examining the effectiveness of the four selected feeders

was to establish a set of research protocols that would satisfy their objectives.

One hundred sixty nonlactating pregnant beef cows ($1,391 \pm 172$ lb.) from the MSU campus herd were used to evaluate the quantity of hay loss and feeding behaviors from the different round-bale feeders.

These animals were split into eight groups of 20 and assigned by weight and body condition score (BCS) to one of eight pens with the four feeder designs being evaluated. All feeder types provided approximately 37 centimeter (cm) linear feeder space per animal.

Two lots of second-cutting hay, one a legume (alfalfa) and the other a cool-season grass (orchardgrass), were baled in June. The twine-wrapped round bales were approximately 122 cm in width \times 150 cm in diameter. Within 24 hours of baling they were removed from the field and were placed in an enclosed barn for storage until fed.

Prior to feeding, the round bales were weighed and sampled. During the study the hay that fell onto the concrete surrounding the feeder was considered waste and was collected and sampled daily. After seven days, each feeder type was assigned to a different pen for seven more days.

Because Buskirk felt that any discrepancy in waste between the feeders would probably be traced back to cattle interaction around the units, he added an animal behavior component to his study. “I knew if we had differences, the next question would be ‘why,’” he says. “So at the onset of the

project, working with our animal behaviorist, Adroaldo Zanella, we set up video cameras to record the cattle interaction around the feeders.”

On four consecutive days in each period, animal behavior was recorded using a time-lapse video system. Data was collected from 5-minute observational intervals of the videotapes every half hour each day. Feeder access, occupancy rate and occurrence of antagonistic interactions were noted.



►The trailer feeder offered mobility at the cost of waste.

Cow ergonomics 101

For Buskirk and his research team, there was no shortage of surprises once the data from the study was processed. The feeder to receive the highest marks was the cone feeder, with a DM hay loss of 3.5%. The next was the ring feeder, with 6.1%, followed by the trailer feeder with 11.4% and the cradle feeder at 14.6%.

“My guess before the study was that the cradle feeder would prove the best at reducing waste, because any hay that wasn’t consumed over the feeder would drop back down to the bottom of the cradle,” Buskirk says, adding that what he hadn’t calculated when making his prediction was that boss cow behavior

would trump what seemed like a well-designed system.

What was learned from the behavioral side of the study was that cows feeding from the cradle feeder had nearly three times the antagonistic interactions and four times the frequency of entrances compared to cows feeding from the other feeder types. Feed losses were positively correlated with antagonistic interactions, frequency of regular and irregular entrances, and feeder occupancy rate.

“We found that with the cradle feeder cows tended to walk along side of it and butt several cows out of the way at the same time,” Buskirk says. “When that happens, a cow backs up and drops half of what she is eating on the ground.”

He points out that this behavior was observed with both the cradle and the trailer feeder, but was nearly absent with the cone and the ring feeders.

“A cow at a round feeder isn’t necessarily inclined to walk around knocking other cows out of the way,” Buskirk says. “She

“With 20 cows accessing each feeder, you are talking about \$300 in a season. That means that the right feeder can pay for itself in one year.”

— Dan Buskirk



►Researcher’s pick proved to generate the most waste.

might push the cow beside her out of the way but that would be about it.”

Buskirk notes that his team observed other behaviors that appeared to affect feed waste. “The round feeders were set lower, which allowed the cattle to put their heads directly in the feeder,” he says, pointing out that this seemed to offer a more natural grazing position, which in turn seemed to motivate cattle to keep their head in the feeder throughout much of the feeding process. “Whereas with the flat-sided feeders they tended to reach in, grab a mouth full of hay and pull their head out to chew it. In the process, some of the hay ended up on the ground.”

It was also observed that the cattle that kept their heads in the round feeders were less likely to waste hay by tossing it over their backs or along their sides. This

behavior also seemed to be discouraged in systems that required cattle to feed under a top rail such as was present in the cone, ring and trailer feeders.

Saving time doesn't necessarily save money

Buskirk points out that insights on hay waste generated by the study weren't exclusive to animal-feeder interaction. Human behavior also affects the feeding process.

“What I see often with producers is that they put a 5-foot-diameter bale into a 5-foot-diameter ring,” he says, noting the importance of not overloading a feeder. “In that scenario, if the cow is dropping any hay, it has to drop on the ground, because she is outside the feeder when she is chewing.”

His view is that it is better to use an oversized feeder so that the cattle are

encouraged to feed with their head inside the ring.

Buskirk notes that while job logistics often encourage less-frequent feeding, what a rancher saves in time he often loses in financial return.

“For example, in Michigan most producers have a job in town, and they feed the cattle in the evening. I know they would rather feed them every three days rather than every day,” Buskirk says. “With that, the feeders get overfilled, and that contributes to a lot of waste.”

Buskirk adds that the best solution is to purchase additional rings, which would allow for the feeding of three days supply of hay without overloading the feeders.

“At today's hay prices you would probably be surprised at how fast those extra rings will pay for themselves,” he says. 