

The Feeder's Job: Importance

By Steve Mooney, PhD

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Editor's note: This is the first of a series of monthly articles on feeding management by Steve Mooney, a post-doctoral fellow here at the Institute.

The feeder on a dairy farm is responsible for the management of a dairy's most expensive enterprise and, through feeding, influences most (if not all) aspects of the dairy operation. Given my bias as a nutritionist, the feeder's job is the most important on a dairy.

Feeding the dairy herd can account for 50% of the costs to operate a dairy, and the return on those invested dollars will be influenced by the skills and practices of the feeder. With current economic and regulatory pressures on the dairy industry, accurate mixing and delivery of rations is essential for maximum return and utilization.

The feeder on a dairy farm can have many responsibilities and the tasks assigned vary from farm to farm. The job can be a part-time or full-time depending on the size of the farm and the number of full-time equivalents involved. The feeder manages the feeding program every day and, on any given day, the feeder might monitor feed (quality and quantity), run dry matters, adjust mix sheets, mix and deliver rations, monitor intake and refusals, watch cows, keep records, and communicate information. All these tasks are essential to a high-quality feeding program.

In a high-quality feeding program, the feeder becomes the intermediary between the nutritionist and the cows. The nutritionist provides a ration that the feeder must deliver accurately to the cows. And, in a well-managed feeding system, the cows can provide accurate feedback on the ration that the feeder can deliver to the nutritionist. A feeding program with daily quality control can provide for a two-way communication between the cows and the nutritionist. Ultimately, the feeder is the linchpin that holds the whole feeding program together.

Someone wiser has said that three rations exist on every dairy farm: The ration the nutritionist balances, the ration the feeder delivers, and the ration the cow eats. Three different rations occur when the nutritionist, the feeder, or the cows make mistakes. The nutritionist might balance a ration based on inaccurate analyses, out of date dry matters, or ingredients that are no longer available on the dairy. The feeder might use the wrong mix sheet, select the wrong ingredients, add the wrong amount of a specific ingredient, or underfeed a group of cows. The cows may not eat the amounts predicted on the ration sheet or may sort for or against specific ingredients.

Three rations on a dairy can make conclusions about nutritional "cause and effect" difficult if not impossible. The goal of every feeder must be to eliminate the mistakes and generate only one ration for each group of cattle. The ration mixed and delivered by the feeder must be the same as the ration balanced by the nutritionist and eaten by the cows. Only then can the communication through the feeder between the nutritionist and the cows have any meaning or value.

Miner Institute's dairy operation has established a feeding program with a high level of daily quality control. Our feeders, Ralph and Travis, work hard to maintain one ration for each group of cattle. This program is a strong contributor to our increasing milk production. Using Miner Institute as an example in the next few *Farm Reports*, we'll explore the good, bad, and ugly of a high-quality feeding program beginning with a discussion next month of the Five Priorities of the Feeder.

The Feeder's Job: The Five Priorities and the First Priority

By Steve Mooney, PhD

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Last month we determined that the feeder's job is important and this month, we'll discuss the five priorities of this important job of managing a high-quality feeding program. While at Michigan State, Dr. Herb Bucholtz and I developed The Feeder Training School, a course that focused not on the science of nutrition but on the skills and practices necessary to take the rations balanced by the nutritionist and deliver them accurately to the cows. As we

rode back and forth to Feeder Schools around Michigan, we distilled the feeder's job into five priorities that can be prioritized by importance

- First: Mix correctly
- Second: Maintain the mix sheet
- Third: Observe and plan
- Fourth: Deliver feed properly
- Fifth: Measure dry matter intake

The rank of these skills is important, as each skill is required by the next. The ability to mix correctly allows each of the following skills to produce meaningful results and measurement of dry matter intake has its greatest value if the ration is assembled and delivered with accuracy. If a feeder has all these skills, conclusions about nutritional program can be made with confidence and changes can be made with purpose and focus.

The first skill is the ability to mix correctly, putting the right amount of the right ingredient into the ration. If the feeder can't accomplish this, the value of balanced rations and measured dry matter intake is diminished. Mixing correctly is simple in theory. The feeder needs to identify the correct feed from the choices available, select only edible feed from inventory, and incorporate the clean, correct feed into the ration at the correct amount. In practice, mixing correctly is more complicated. Identifying the correct feed requires a standardized system of labeling feeds that everyone knows and everyone uses. The feeder should set these labels and communicate them to the nutritionist so that rations come back to the dairy with accurate, understandable labels.

The feeder must be able spot and separate out rotten or compromised feeds, only incorporating feed of good quality into rations. Ralph LaBombard, our Feed Technician, uses smell as much as sight from the cab of the loader on these dark, windy mornings. For example, part of the research done here involves sampling silage bags after fermentation. The sampling requires making a hole in the bag and, although the plastic is patched, these sample sites inevitably develop a hemisphere of rotten silage. Getting out of the warm cab and forking rotten silage by headlight on these January mornings is not fun, but the removal of these few hundred pounds of rotten material keeps it out the ration and intake of the lactating cows is maintained at the level necessary to support our production.

Adding the right amount of the feed is the hardest subskill of mixing correctly. Practice is required to operate the feeder's equipment without "thinking" and to learn the flow characteristics of each feed. Some people have more natural talent than others for adding the right amount. One loader operator we give a wide safety margin for fear of losing fingers and toes while another we'd trust to scratch an itch on the tip of our nose. Adding the right amount with a coffee can, scoop shovel or three-yard loader is all about control. With practice, feeders gain control of equipment operation and feed flow and with that control comes accuracy, the most important ingredient in our high-quality feeding program.

An exact weight for each ration ingredient appears on each mix sheet. An exact number is nice in theory but hard to attain in reality without more time and effort than feeders can afford to give. If we try to add an exact amount, our human tendencies will lead us to overfill the ingredient. We fill and get close, add a little more, a little more, just a little more and then, aw shucks, we are over. Feeder should be shooting for a narrow window around the exact amount of the ingredient, to fill until they reach a weight within in the window and stop.

Miner Institute's high ration is a 4 to 5 ton batch (depending on dry matters of the feeds) with individual ingredients ranging from 50 to 2500 lbs. Ralph consistently makes a window around the exact weight of ± 25 lbs for forages and ± 5 lbs for grains. This accuracy is confirmed with the download of the truck scale weights at the end of the shift. This ± 25 lbs on forages is less than normal daily variation of dry matters in the forages ($\pm 1\%$ DM on 1200 lbs as fed would change our ration ingredient amount by 30 to 35 lbs). In a sense, his goal is to be more accurate than the forages. What window around the exact weight should your farm use? The answer is specific to each dairy, depending on the skills for the feeder, the size of the batch, and amount of the ingredient. The feeder and nutritionist should collaborate to determine the windows for your dairy.

Mixing correctly, the first priority, allows accuracy when assembling a ration. The day-to-day consistency required for the health and productivity of our lactating cows is achieved through within-day and across-day accuracy. Next month we'll discuss maintaining the mix sheet as part of building a high-quality feeding program.

The Feeder's Job: Second Priority

By Steve Mooney, PhD

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The second priority of feeder's job is maintaining the mix sheet, which serves 3 purposes. First, the mix sheet is a contract, an agreement among the nutritionist, owner or manager, feeder (who may or may not be the same person), and the cows for how things will be done and what is expected. It's also a recipe, a list of ingredients and their weights required for the correct mix. Lastly, it is a record; a written document that details what the feeder did when.

The ration sheet, usually balanced for one animal, shows the details and justifications that don't concern the feeder directly as he feeds groups of animals on a daily basis. The mix sheet is the translation of the ration sheet into something a feeder can use and is the center of the feeder's job. The feeder should be responsible for keeping the mix sheet current and usable.

The feeder maintains both the animal and feed sides of the mix sheet. For the animal side, the feeder tracks feed refused and number of animals in a pen, decides how much will be offered next, and can provide input and adjustments to the description of the animal described on the ration sheets. On the feed side, the feeder monitors feed inventories, decides when new feed analysis is needed, and tracks feed dry matters. The feeder incorporates this information into the feeding program through the mix sheet.

A mix sheet can contain many pieces of information but several are essential. Every sheet should have the date formulated (or date revised), ration description or group name, ingredients with standardized names and associated weights and dry matters, mix totals, and cow numbers. A sheet can contain one mix or multiple mixes at the preference of the feeder. Some mix sheets have adjustments should dry matters change or alternate mixes if cow numbers change, providing proactive solutions to changes the feeder may encounter within a day. Ideally, the mix sheet would have answers for all potential changes but, in reality, include as many as is practical. Overall, the feeder is responsible for keeping the sheet current, readable, accessible, and used on a daily basis.

Mix sheets can either be provided by the nutritionist or composed on-farm by the feeder. Miner Institute's dairy operation has developed a simple, in-house, Excel spreadsheet to maintain the mix sheets for the whole herd (Figure 1). With this spreadsheet, we're able to make adjustments daily, keeping the mix sheet current and accurate with a minimum of calculator time and pencil pushing. Our daily printout contains the elements required in a mix sheet plus individual ingredient codes used by the tracking program on the mixer, and a space for writing the ingredient weights added during research trials. To generate the daily mix sheets, ration formulations are entered on a dry matter basis and the spreadsheet combines this ration information with current dry matter percentages, cow numbers, and number of feedings per day and generates the daily mixes for the whole herd on two fresh sheets of paper. These calculated mixes are also entered into the tracking program on the mixer.

During feeding, adjustments are made to the mixes as needed. At 4 a.m., refusals are weighed and mix totals are adjusted as necessary and recorded on the mix sheet. The Koster tester runs almost constantly measuring new dry matter percentages as Ralph or Travis note changes in the forages. New dry matters are recorded on the mix sheet and, with a calculator, new as fed feed weights are computed and used immediately, keeping the mix sheet current with the feeds being feed. At the end of feeding, all new information is entered into the spreadsheet bringing mix sheet up-to-date and ready for the next day.

Our farm has developed a simple system to keep the daily mix sheets up-to-date and accurate. An accurate mix sheet provides a current contract, recipe, and record and maintaining the mix sheet, the second priority, is required for high-quality feeding program.

Figure 1: A Portion of Miner Dairy Mix Sheet

	A	B	C	D	E	F	G	H
7						High		1st Lact Heifer
8					Pen 1			Pen 3
9				# in Pen	84		64	
10	last % DM	2127107	Koster			lbs		lbs
11	Code		%DM	# Fed	45	loaded	70	loaded
12	MOL	Molasses	60		113		175	
13	MILKB1	Milk Grain -Bin 1	91		1241		1572	
14	FRSHB2	Fresh Grain -Bin 2	90					
15	DRYB11	Dry Grain -Bin 11	88					
16	HEIFB5	Heifer Grain -Bin 5	88					
17		SOY						
18	MEALB4	Corn Meal -Bin 4	88					
19	CITRUS	Citrus Pulp -Bin 3	87					
20	WESTHAY	Rovers Hay	90.5		116		181	
21	HAY	STRAW -Straw 13	93		45		69	
22		Haylage-3 cut bag	34		331		772	
23	COT	Cottonseed-Shed 14	88		141		219	
24		Haylage Atwood	45		640		506	
25		Haylage-1st cut	40					
26	CSBMR6	BMR CS -Bunk 6	28		804		1250	
27	CS2	Corn silage -bag	40		0		0	
28	HCS2	Corn Silage -Bunk 4	36		1688		2139	
29		Total lbs in Load			5117		6883	
30		Refusal (lbs) from Previous Day						

The Feeder's Job: Two Needed Skills

By Steve Mooney, PhD

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Two skills that are essential to a high-quality feeding program are dry matter management and feed sampling. Both on these skills are used extensively in maintaining the second (maintaining the mix sheet) and the third (observing and planning) priorities of the feeder's job.

Dry matter (DM) management involves monitoring the DM of feeds and adjusting the mix sheet as necessary to new DM information. A DM management program should be proactive, with monitoring and adjustment on a regular (at least weekly) schedule plus whenever necessary as the DM changes. Our attention should be focused on the feeds with the greatest variability (e.g. wet feeds exposed to the elements) and the feeds included in the mixes of cows most sensitive to mixing errors (e.g. transition cows).

A feed can be separated into DM and water. The composition of any given feed's DM changes little but a feed's moisture can come and go, particularly in wet feeds stored outside. Rain, snow, and dew can add moisture to silage and the sun or aerobic respiration on a bunker face can dry it out. The proportion of water or DM of a feed can be measured on-farm with several different drying methods. Regardless of method, some principles remain constant. We want to dry our feed until all water is removed but stop before DM is lost. Under-drying a sample will overestimate the DM content of a feed and the loss of DM in a sample either by burning or spillage will underestimate DM.

Rations are balanced on a DM basis but mixed on an as fed basis. Each new feed DM measurement should be incorporated into the mix sheet immediately. We need to take the old feed weight, calculate the pounds of DM contained in it, and determine the new as fed weight using the correct DM. The equations used to convert as fed weights to DM weights and vice versa may be used on a daily basis by a feeder and should be “second nature” to a feeder. They are:

$$\text{Pound as Fed} = \text{Pounds Dry Matter} \div (\text{Dry Matter \%} \div 100)$$

and

$$\text{Pounds Dry Matter (DM)} = \text{Pounds as Fed} \times (\text{Dry Matter \%} \div 100)$$

Feed sampling, the second skill, is used to get samples for the analysis of DM or nutrient composition. The results of DM and nutrient analysis are used to determine our feeding program so feed sampling shouldn't be haphazard, an afterthought, or rushed. It should be done with effort and care reflective of the significant financial resources that will be allocated based on the analysis of each feed sample. With feed costs representing a large part of the dairy operating costs, feed samples should be collected in a scientific manner.

The goal is to obtain a sample of a feed that is representative of inventory on hand. A typical lab will use a teaspoon of dried, ground feed to measure specific nutrients. This teaspoon of feed must be representative of the tons of feed in inventory so the analysis obtained will lead to accurate rations. Accurate sampling allows the resources of time, money, and energy spent on the feeding program to have to greatest success.

Several methods exist for the proper collection of feed samples. The common theory to all methods is to collect a larger sample than needed that represents all the variation of the feed, to mix this sample completely, and then subsample methodically to avoid biases that will lead to misrepresentation. The more heterogeneous the feed in inventory, the greater the initial sample required and the greater care needed to get a representative subsample. An exact method is hard to describe and is best learned by doing. Work with your nutritionist, feed representative, or extension specialist to make sure you, as a feeder, are taking samples with the accuracy and precision needed for a high-quality feeding program.

Dry matter management and feed sampling are two skills every feeder needs to master. In the next *Farm Report* I'll discuss the third priority, observing and planning.

The Feeder's Job: Third Priority

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The third priority of the feeder is observing and planning. After mastering priorities one and two, application of the third priority, observing and planning, lifts a feeding program up from beginning to intermediate status. This includes watching your program with a critical eye, asking questions about what is and what should be, and answering honestly about what is seen.

Observing focuses on the “here and now.” The feeder should be watching feeds, cows, and equipment and looking for changes and exceptions. Feeds should be checked daily for quality, stability, and changes. Certain other observations should occur regularly. Dry matters should be measured at least weekly and composition samples should be drawn based on variability: The more variable the composition, the more frequent the sampling.

The feeder is an excellent position to watch cows. Physically, the feeder usually rides high and slow past pens as feed is unloaded. The feeder can watch the group to spot patterns and problems. Some questions to focus the feeder include:

- How many cows are in the group?
- Are cows eating, drinking, and ruminating?
- Are they comfortable and clean?
- Are they walking on healthy feet and legs?
- Are cows too thin or too fat?

Also, from this vantage point the feeder can note exceptions by cow and jot down heats, lameness, and illness.

Ralph, our feeder, considers the driver's seat of the mix truck the best place on the dairy to observe the herd. He's constantly monitoring the groups as he feeds. The early morning light this time of year spotlights group body condition as the cows line up to eat fresh feed at the bunk. He also carries a pad and pen to write down cows in heat. And if a waterer is not working he will stop and fix it.

Within the third priority, a feeder also plans. Planning involves regularly-scheduled tasks to maintain a high-quality feed program as well as looking ahead and trying to foresee challenges and opportunities to the feeding program in coming weeks and months. Planning can begin with tracking of feed inventories including much feed is on hand and, at current rates of use, how long it will last. This begins the overall planning of feeding program, projecting when orders should be placed and when program changes are likely to occur. The goal is a proactive approach ensuring that in a timely manner samples are run, rations adjusted, and mix sheets are current. Having projected rations ready for forage changes or hot days can be the difference between consistency and bumps in your feeding program. A proactive plan is the goal of a high-quality feeding program.

With both observation and planning, the feeder is at the center of a high-quality feeding program, collecting and disseminating information to the owner, herdperson, nutritionist, veterinarian, and milkers. A feeder should know:

Who provides the ration balancing feed analysis?

Who provides the ration balancing animal description?

Who provides the ration sheets or mix sheets?

The feeder is responsible for making sure these tasks are completed on-time.

The observation and planning within the third priority take the feeding program to the intermediate level. Delivering feed properly will be discussed in the next *Farm Report*.

The Feeder's Job: Fourth Priority

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The fourth priority of the feeder's job is delivering feed properly. This includes assembling, mixing, and feeding a ration so that cows eat the diet formulated on paper. The goal is an efficient assembly of the prescribed ration in minimum time with ingredients added in a sequence to promote a uniform mix while accommodating the restrictions and requirements of the mixer.

Assembling a ration involves not only choosing good feed and adding it in the right amount (as discussed in previous priorities) but also managing the batch so that the final mix is uniform and complete. The order in which ingredients are added is determined by where the feeds are located and how the mixer works. Often, the forages are located together and concentrates somewhere else. Where you start is determined by the mixer type. Some mixers produce a better mix if forages are added first, others concentrates. Ultimately, the sequence of filling is unique to each dairy and, once established, the sequence becomes standard operating procedure (SOP) for the dairy.

At Miner Institute the concentrates are added first. While these concentrates are loaded, the reel-type mixer isn't mixing to allow for the accurate addition of concentrates (± 5 lbs). Then the feed truck is moved to silage bunkers and forages are added. Mixing causes the scale reading to "bounce" as the feeds are tumbled within mixer. This "bounce" is better managed against the greater weights of the forages required in most batches.

With all the ingredients in the mixer, the batch must be mixed uniformly before feeding. The feeder must mix the batch for a time and at a speed that delivers a uniform mix. With each mixer, reading the manual, talking with the dealer, and experience will give a place to start for estimating the time and speed for mixing. From there, observation will help you adjust the mix parameters to improve the mix where necessary. In a well-mixed batch, you should not see clumps, particle size reduction, or changes in color or texture from the beginning to end of the load. If the mix is incomplete, time or speed need to be increased.

Miner Institute doesn't have a set mixing time for each load but, rather, the load is allowed mix while prep work is done for the next batch. The time taken for tasks such as sampling or collecting forages from distance silage bags ensures the batch is mixed before delivery. With this method, the concern is particle size reduction due to over mixing but, with our reel-type mixer, this isn't a concern.

Once thoroughly mixed, feed is delivered to the cows. Each load is unloaded while the truck is driven back and forth the full length of the bunk. The reason for this back and forth is to minimize risk of any variability of the mix. If any differences exist from beginning to end, this variability is spread out the length of the feed bunk instead of laid out horizontally as with one pass unloading. This style of feed delivery is considered an important part of our feeding program. This back and forth also promotes a more uniform distribution of feed the length of the bunk which maximizes the use of the bunk space by putting feed at all headlocks. And, as a bonus, it allows a simple check of the uniformity of the mix as the end of the load is dropped on the beginning and color and texture differences across the load are easy to spot. Granted, this back and forth is much easier with our feed truck than with a tractor and wagon. The goal of the feeding sequence here at the Institute is cows returning from the morning milking to fresh feed, so cows are fed in the order they are milked.

The order in which rations are mixed each day and the order in which ingredients are added to each ration are determined for each farm by considering the nutritionist's requests, the cows' schedule, the feed's location, and the manufacturer's recommendations for the mixer. Regardless of sequence or system, the goal of delivering the feed properly must be a uniform mix presented to the cows. With our uniform ration, we can discuss measuring dry matter intake (the fifth priority) in next month's installment.

The Feeder's Job: Fifth Priority

By Steve Mooney, PhD

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The fifth priority of feeder's job is measuring dry matter intake (DMI). With the first four priorities satisfied, the measuring of DMI becomes a powerful and meaningful exercise providing a clear communication between the cows and nutritionist and elevating the feeding program to high-quality status.

The accurate calculation of DMI requires five numbers: 1) Weight of feed offered, 2) Dry matter percentage of feed offered, 3) Weight of feed refused, 4) Dry matter percentage of feed refused, and 5) Number of animals fed with the feed offered. Weight of feed offered and its dry matter percentage are relatively easy to obtain. With accurate scales, the weight of feed offered to a group is easily tallied. With an up-to-date mix sheet and accurate mixing, the dry matter percentage of the feed offered can be taken off the mix sheet or measured with a quick sample.

Weight and dry matter percentage of feed refused is more problematic. Accurate weight of feed refused requires the gathering and weighing of feed refused by group. A typical system to accomplish this would require a skid loader to gather feed, something solid to push against to get feed into the bucket, a loader with reach enough to get the feed refused back into the mixer for weighing, a pen and paper to record the weight of feed refused, and the time to do it. On many dairies, one or more of these elements may be lacking or inconveniently placed, making the job of weighing feed refused awkward at the start. Getting the weight of feed refused usually means developing a new system with the creativity and ingenuity the farmers have. Each dairy has different obstacles to this measurement. A dry matter on the feed refused adds one more level of complication as an accurate dry matter requires good mixing and sampling.

The fifth number required, number of animals in a group, can be the most difficult to track on a daily basis. Animals move in and out of pens based on production, health, or reproductive events, moves that may or may not be communicated to the feeder. The daily group counts requires special effort and care. The most straightforward method is to count by hand but, as anyone who has tried to count a group of more than 10 head knows, cows can be less than cooperative when we try to count. Timing of this count may be the key to accuracy. Picking a time when animals are relatively stationary (as when group is eating or resting) can make this job easier. If your computer is the source of your numbers, make sure input is up-to-date and that divisions of groups within the computer match those of the herd feeding program. While head counts can be difficult, they are also the most required mathematically by the calculation of dry matter intake.

To calculate accurate DMI, the weight of the dry matter of the feed offered is subtracted from the weight of dry matter refused and this result is divided by the number of animals that consumed that feed. The equation is:

$$\frac{((\text{lbs feed offered})(\text{DM\%/100})) - ((\text{lbs feed refused})(\text{DM\% feed refused/100}))}{(\text{Number of animals fed})}$$

A unit of time is implied in this calculation. Usually, the unit is “day” but unit of time will match the feed refused management system on the dairy. Some dairies remove feed daily. Many do not, preferring instead bunch refusals at one end of the feed line and remove it on a less than daily basis (e.g. every other day, weekly). This will complicate the calculation of DMI but, with adjustments, an accurate answer is still possible.

Next month, this discussion of the fifth priority will continue with a discussion of the more practical uses and concerns of measuring DMI.

ALTERNATE PRESENTATION OF THE ABOVE EQUATION:

The equation is $\frac{((\text{Weight of feed offered})(\text{Dry matter percentage of feed offered/100})) - ((\text{Weight of feed refused})(\text{Dry matter percentage of feed refused/100}))}{(\text{Number of animals fed})}$.

The Feeder’s Job: Fifth Priority (continued)

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“Measure intake daily” is a common recommendation to dairy producers. It sounds simple enough. Measure what the cows eat each day. But, accurate measurement of dry matter intake (DMI) is a challenge on most dairies, requiring a good system built on attention to detail, ingenuity, and daily effort.

As stated last month, the accurate calculation of dry matter intake per cow per day requires five numbers: 1) Weight of feed offered, 2) Dry matter percentage of feed offered, 3) Weight of feed refused, 4) Dry matter percentage of feed refused, and 5) Number of animals fed with the feed offered. Using these five numbers gives us the accuracy research here at Miner requires. But is this accuracy, to the tenth of pound, necessary in a day-to-day production situation? How accurate do we need to be to manage a dairy herd? Can we trade off a number or two, save time or money, and still have a number useable for management purposes? Yes, we can.

Of the five numbers, which do we did need on farm? An accurate number of animals fed is absolutely required. Being the denominator of the equation, it is required mathematically and headcount errors can have a large effect on DMI estimates, particularly in smaller groups. And, more often than not, obtaining a good count is not much more effort than obtaining a bad one. The weight of feed offered and the dry matter percentage of that feed should also be accurate or this exercise of measuring DMI has no point. The weight of feed refused and dry matter percentage of that refusal can be the hardest, most time consuming numbers to obtain but can often be estimated with the least impact on the estimate of DMI.

To track relative (not absolute) day-to-day changes, we can make some assumptions and simplify the equation. For relative changes, we need to measure feed offered, dry matter of that feed, and the number of cows fed, estimate the weight of feed refused, and assume the dry matter of the feed refused. The DMI calculated with these numbers is sensitive enough to show day-to-day changes and trends over time. Estimates of the weight of feed refused can be done by volume with scoop or bucket. If our interest in calculating DMI is to provide feedback to nutritionist, we need to increase accuracy and find a way to weigh the feed refused. This, with an estimate of feed refused dry matter, should generate DMI information very useful to the nutritionist. To establish the best DMI calculation system for your dairy, work with your nutritionist.

At Miner, we calculate daily DMI with 4 measured numbers. The number of lactating cows per group is recorded at each milking in a notebook. Pounds of feed offered is recorded daily by the tracking program. The measured dry matters for each feed with the actual weights for the day are used to calculate the dry matter percentage of the feed offered. Feed refused by pen is weighed each morning before feeding. And when not conducting research, dry matter of feed refused is assumed to be the same as the feed offered. With these 5 numbers, the tracking program

calculates daily DMI by pen with no extra effort by anyone. The DMI generated daily are used primarily to monitor changes and trends for each group. This daily DMI information is also communicated to the nutritionist for comparison and evaluation.

For any system that measures DMI, a dairy needs a system that both collects data efficiently and, just as quickly, converts the data to information. Each dairy is unique and must establish its own standard operating procedures from the calculation of DMI. The simplest system is a spreadsheet that, with the daily input of the five numbers, generates DMI numbers and graphs that can be posted and shared. Other systems can be more elaborate but, whatever the system, the information generated should be used.

The Feeder's Job: When It Rains

By Steve Mooney, PhD

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A heavy rain or snow soaks the face of the bunker silo. Puddles grow at the base of the face, seeping into the silage. The dry matter of this silage no longer matches the number on your mix sheet. What do you do?

Rain and snow can complicate the feeder's job, a complication that's been much discussed at Miner Institute this summer, both at meetings we've sponsored and in our break room. Days of rain and inches of snow add weight to bunker silages but no nutrients. If the feeder doesn't adjust to this dry matter change, water will displace the nutrients of the forage and the final mix won't be what it's supposed to be. In this situation, the loss of fiber from forage is the primary concern. Without adequate fiber the ruminal fermentation is altered and the chances for acidosis, DA, and laminitis increase. Research presented at the National Dairy Science meetings this summer in San Antonio showed that even one day with a "hot" ration can cause problems that will affect the cow for the remainder of her lactation.

The feeder's job is to make sure the ration balanced by the nutritionist is the ration eaten by the cows. When it rains, the feeder must determine the new dry matter of this wet silage and adjust the weight of the silage required in the mix. The feeder should scrape the face and mix, sample, and test the wet silage. However, if the feeder takes the time and effort to do this, the process of feeding the herd may be slowed or even stopped. If the feeder doesn't adjust to the wet silage, problems with cow health will occur. Each of these options has its lack of appeal.

What are the alternatives? The feeder could fudge on the fly, skipping the measurement for the new dry matter. The feeder could increase the silage weights by some predetermined percentage or could add the feed to the mixer by volume instead of weight. Both of these options are less time consuming, less accurate, and more risky. If either of these alternatives is used, the benefits and risks must be fully understood.

Another alternative is the reallocation of the wet silage. A reduction in ration fiber due to wetter silage can affect some groups of cows more than others. Transition cows are probably the most sensitive to this mistake, followed closely by high and first lactation groups. These classes of cows are often fed at minimum fiber levels so a loss of fiber would be detrimental. Other groups of animals such as heifer and low groups receive higher or excess fiber in their diets and may be less sensitive to a temporary fiber reduction. Maybe the wet silage should be allocated to these groups with the fudge factors, saving the unexposed forage for the more sensitive groups.

Ultimately, the answer may be preventing our silages from getting wet in the first place. A nutritionist at a recent meeting here commented that he has clients who leave the covering plastic long enough to cover half or two-thirds of the bunker face, which minimizes weather exposure yet the feeder works under the plastic without complication. Another option is to cover the face when precipitation is expected. The heavy rains and snows that really change dry matter percent rarely arrive without warning. Having a tarp at the ready may be the solution. Another form of prevention is making sure water flows away from the face and not toward it. Silos and their covering systems should be designed so water is directed away from and not allowed to soak into the silage.

In the end, the rainy day feeding strategy should match the dairy's attitude toward time and risk management. Each dairy is unique and the feeder, nutritionists, and cows must be proactive and come to a consensus on the standard operating procedures for rain and snow. The final plan should allow for timely mixing but prevent health problems in the cows.

The Feeder's Job: A Simple Spreadsheet

By Steve Mooney, PhD

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Available at <http://www.whminer.com/farmreport.html>

Over the course of the Feeder's Job series I've suggested that the math required by the feeder could be entered easily into a simple spreadsheet, saving time and tedium. I have assembled a spreadsheet that contains all math described in the series plus a few extras. This spreadsheet is available for free download at our website at www.whminer.org/outreach.html. The simple spreadsheet can assist the feeder with several tasks including sample scheduling, inventory estimation, new feed weight calculation, mix sheet generation, and dry matter intake calculation.

If your farm has a feed sampling schedule, the first worksheet can help keep track of when each feed needs to be sampled next. Three inventory estimators can help monitor your silage inventories and, with additional input, project the number of days of feed remaining. One worksheet will estimate for a top-unloading tower silo and the next will estimate for a bottom-unloading. The third worksheet will provide estimates for a bunker silo (Figure 1). The look-up tables contained within these worksheets are estimates aggregated over a range of conditions and should be used conservatively.

The next worksheets convert wet weights to dry matter pounds and back using user-entered dry matter percents. The following worksheet combines these two equations and will calculate a new wet feed weight when the feeder enters the old wet feed weight, old dry matter percent, and new dry matter percent (Figure 2). These two worksheets can help a new feeder learn the math required for the job.

With the next worksheet, the feeder can generate a batch mix sheet for a group by entering the information found on the nutritionist's ration sheet. After the number of cows, feed identifiers, dry matter pounds of each feed, and dry matter percents are entered, the worksheet will calculate the mix sheet needed for the group which the feeder can print (Figure 3).

Finally, the last two worksheets work together to turn the raw data regarding intake (the five numbers described in August 2007 *Farm Report*) into dry matter intake information. The dry matter intake per cow per day is calculated in the first worksheet and plotted in the next worksheet (Figure 4). These worksheets track one group for one month.

This spreadsheet is generic and should be considered a good start to meet the needs of your dairy. Work with your nutritionist to tailor this spreadsheet to your dairy or to create your own. As comments and concerns arise with this first version, contact me at mooney@whminer.com.

Figure 1: Inventory Estimator for Bunker Silos

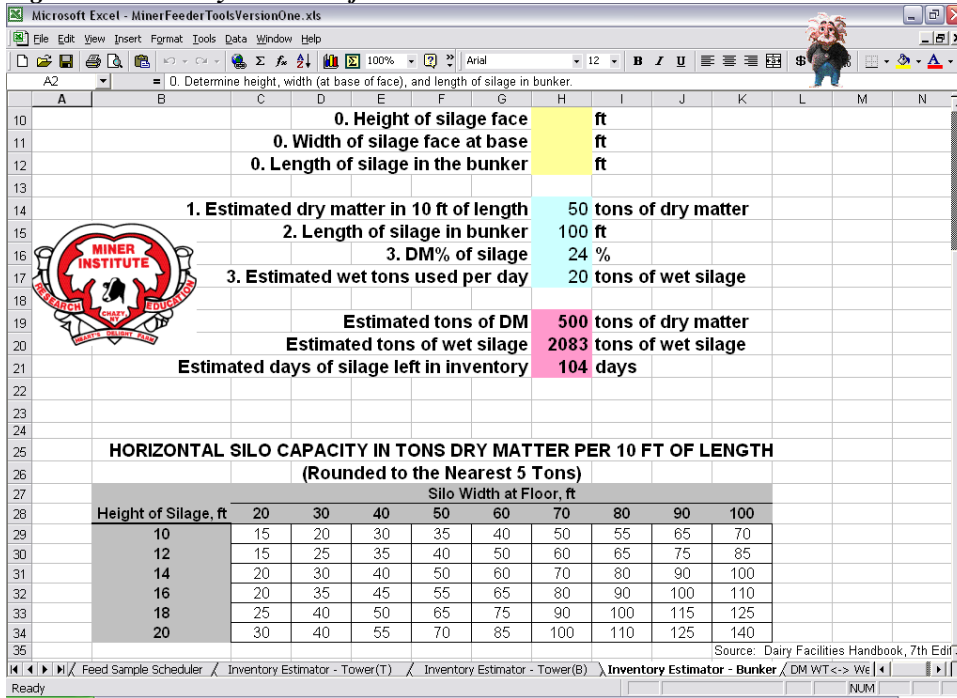


Figure 2: New Feed Weight Calculator

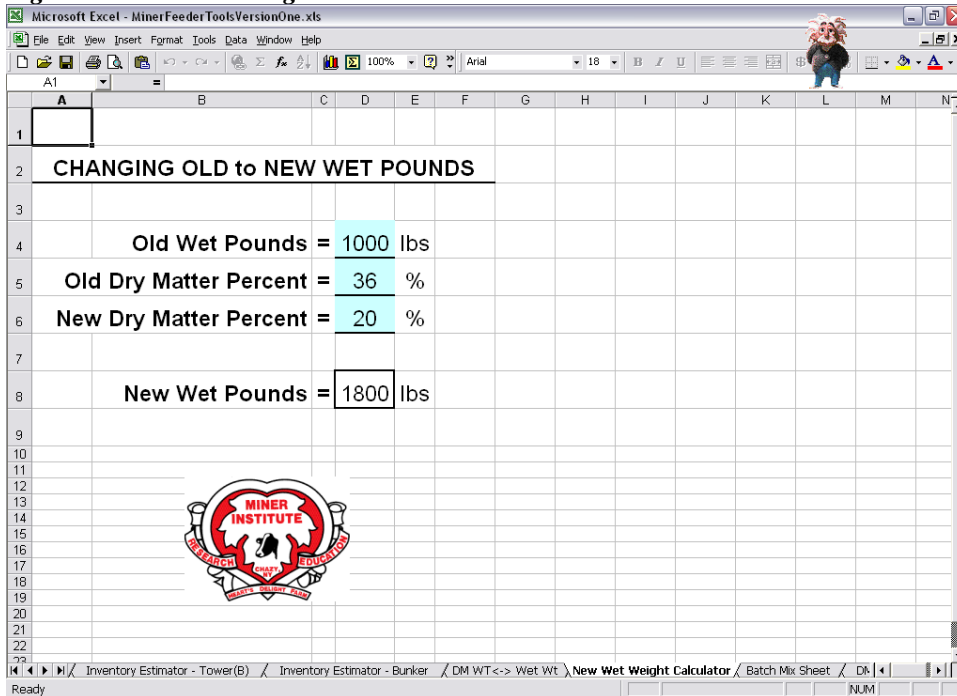


Figure 3: Mix Sheet Generator

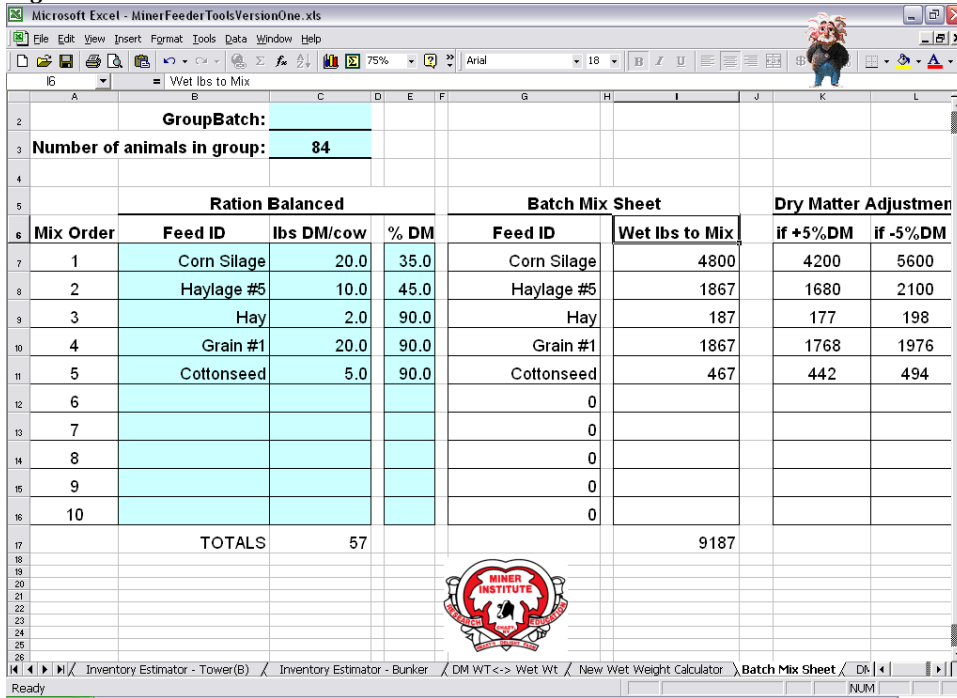
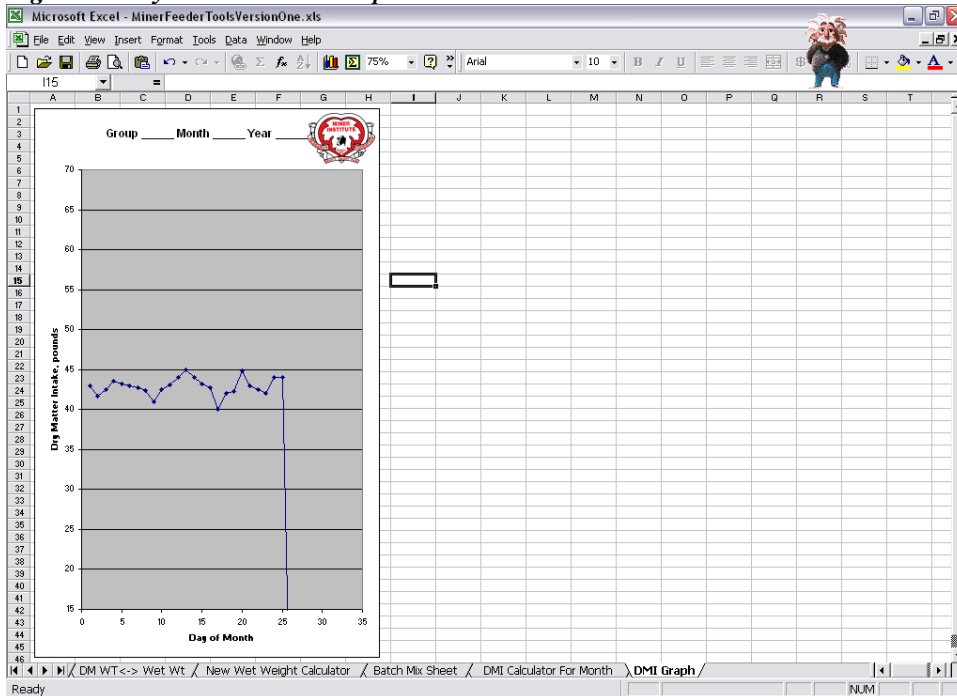


Figure 4: Dry Matter Intake Graph



The Feeder's Job: Scales

By Steve Mooney, PhD

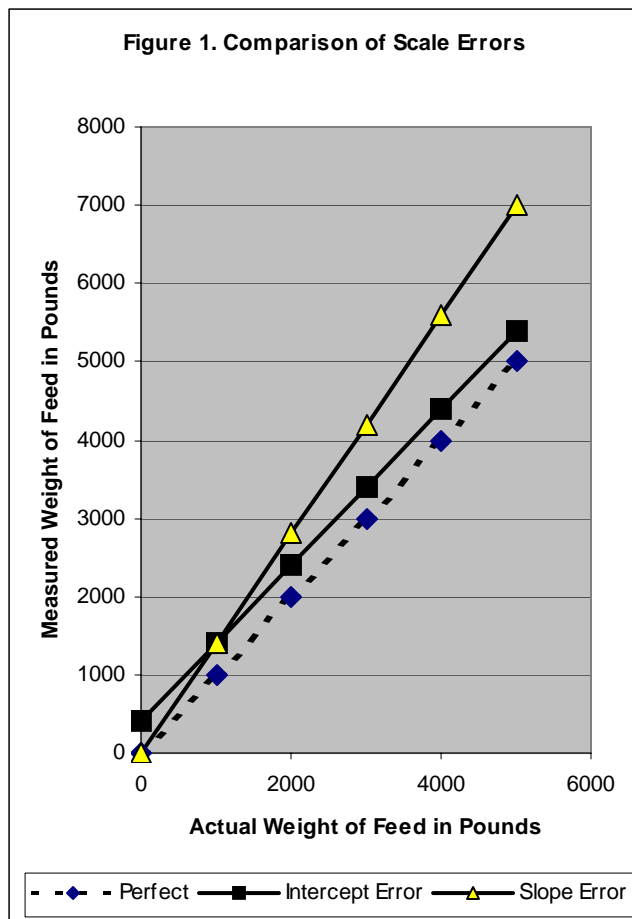
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Underlying the feeder's work are scales. Scales are used when feeding cows individually, measuring dry matters, or filling feed trucks and working. Accurate scales are an essential component of a high-quality feeding program. Without scales, the feeder will not be able to achieve the 5 Priorities for feeding dairy cattle.

Are your scales accurate? An experienced feeder will spot big errors easier, but what about smaller or creeping errors? Scales should be checked against known weights as part of the regular routine of the feeder and, when the scales are off, adjustments should be made immediately.

In theory, two types of errors can occur with a scale, "slope" and "intercept". These terms come from the high school algebra equation for a line, $y=mx+b$. For this discussion, x will equal the actual weight of the feed and y will equal the measured weight of the feed. If the measurement of the weight of the feed is accurate, then the slope (m) of the line comparing the actual and measured weights will be 1 and the intercept (b) will be 0 and the actual weight (x) will equal the measured weight (y) as described by the dotted line with diamonds in Figure 1. A "slope" error occurs when $m \neq 1$ or when the scale is always off by the same percentage. (The triangles in Figure 1 show a scale that is always off by 40%.) An "intercept" error occurs when $b \neq 0$ or when the scale is always off by the same amount. (The squares in Figure 1 show a scale that is always off by 400 pounds.) To distinguish between the two errors, the feeder must check the scales at two weights. Note in Figure 1, the two errors give the same measured weight at 1000 pounds but diverge as the actual weight goes up.



Knowing the difference can be helpful to a feeder while waiting for repairs. With “slope” error, a TMR can be mixed in the correct portions but accurate DMI cannot be calculated. With “intercept” error, the weight of one ingredient (usually the first) will be messed up but the feeder could fudge in the appropriate direction.

In reality, the scales are just wrong. With defective load cells or bad wiring, problems are often intermittent, it works for a while then not which leads to a mix of “slope” and “intercept” errors. So, check your scales and fix them immediately because when you have a problem quick repair is essential for maintaining the high quality of your feeding program.

The Feeder’s Job: Orts Management

By Steve Mooney, PhD

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Orts. What are “orts?” “Orts” is the scientific name for weighback or refusal, coming from the dictionary definition of “ort” as “a small scrap or leaving of food after a meal is completed.” What do you do with your milking herd orts? Do you feed so you have none by the next feeding? Do you throw them out? Do you give to them other animals to eat?

For a variety of reasons some dairies feed their cows so the bunks are empty by the next feeding. This may be necessary or practical but this practice does come with a cost for lactating dairy cows: Limited intake and, therefore, reduced milk.

To insure full intake, we in research feed 10 to 15% of orts but in any commercial setting this practice is too expensive. Ralph, our Feed Technician here, feeds our milking pens for $\leq 5\%$ orts. This, with frequent feed push up, ensures that quality feed is always within reach.

So, if you have 5% orts, what should you do with it? Given feed costs, the orts are expensive and it would be a shame to just throw them away. Given the chemical composition, the orts are probably too rich or variable for heifers and steers without a lot of daily adjustment and dilution. If your orts are of good quality, consider re-feeding them to the same group.

Like leftovers from your dinner, orts could be re-fed if the quality is good. In a high-quality feeding program, mixing will be accurate and sorting by the cows should be minimal so the chemical composition of the orts will be similar to what was fed. In these coming winter months, the orts should stay fresh enough to re-feed the next day.

Re-feeding orts can be done two ways: Simple way or more controlled. The simple way is to push the orts to a part of the bunk where the cows seem to feed the most (the location depends on the barn and the cows), adjusting the total mix for the weight of the orts remaining, then filling the rest of the bunk with fresh TMR. The more controlled way is to incorporate the orts back into the new daily TMR. If a system can be established where the orts can be judged as “still good”, easily put back into the mixer, and weighed as an ingredient in the TMR with specially-designed mix sheets, the re-feeding of orts may be profitable. If you’re interested in re-feeding your orts, work with your nutritionist to develop an SOP that fits into your high-quality feeding program.

The Feeder’s Job: Checklist for Five Priorities of Dairy Feeder (On Following Page)

By Steve Mooney, PhD

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CHECKLIST FOR FIVE PRIORITIES OF A DAIRY FEEDER

For each of the following items determine who is responsible and how often

FIRST PRIORITY: Mixing correctly

- Standardize names of feed and/or storage spaces
- Determine if feed is good enough to feed
- Determine the range for each feed ingredient

SECOND PRIORITY: Maintaining the mix sheet

- Determine sampling schedule for all feeds
- Determine dry matter measurement schedule for all feeds
- Take feed samples and run feed dry matters
- Collect current information for mix sheet:
 - Ration(s)? Dry matter(s)? Batch size(s) or cow number(s)? Feed analyses?
- Update and deliver new mix sheet
- Maintain records
- Decide when new ration is required

THIRD PRIORITY: Observing and Planning

- Determine storage capacities
- Calculate current feed inventory and project supply at current rate of use
- Monitor water supply for each group: quality and quantity
- Monitor animal intake, body condition, locomotion, rumination, and manure
- Deliver information to the ration balancer (feed analysis and animal description)
- Notify when problems and changes occur
- Make changes and fix problems

FOURTH PRIORITY: Delivering feed properly

- Evaluate and remove (or reuse) orts
- Sets fill sequence and mixing time for loads
- Practice good bunk and silo management during feedout
- Confirm proper ration was delivered

FIFTH PRIORITY: Measuring dry matter intake (DMI)

Measuring what the cows eat each day. Only meaningful when the above are satisfied.

Collect input for DMI equation calculation for groups:

$$\frac{(\text{Pounds of feed offered}) \times (\text{DM\% feed offered}/100) - (\text{pounds of feed refused}) \times (\text{DM\% feed refused}/100)}{\text{number of cows}}$$

- Calculate DMI for groups
- Evaluate DMI
- Check accuracy of scales
- Keep records and communicate information

More Details in The Feeder's Job Series in Miner Farm Report at

<http://www.whminer.com/farmreport.html>