Cottonseed meets manure screen

by Steve Martin

I OCCASIONALLY measure things at a dairy that make me say, "Well that's interesting, but what's the denominator?" It is important to know the population of anything you count, in order to have a feel for how significant the information is.

I find myself in this quandary when it comes to evaluating whole cottonseed (WCS) that escapes digestion and ends up in manure. We all have seen cotton plants growing around the lagoon, but is this a real problem? Using a manure screen can help offer some perspective.

Whole cottonseed is certainly one of dairy producers' most beloved feeds. In fact, this unique ingredient that is grown only in California and the southern part of the U.S. is fed to dairy cows in all parts of the country.

A quick history lesson reminds us that each boll of cotton contains up to 30 cotton seeds. Before Eli Whitney invented his ginning machine, these had to be removed by hand. Now, with modern cotton gins removing and piling up seeds at a high rate, this byproduct has attained great importance.

Much of each year's crop of WCS is processed by mills to remove the valuable oil inside. The byproducts of that process contribute cottonseed meal and cottonseed hulls to the animal feed industry.

Some of the U.S. cottonseed crop is bought by dairy producers to supply energy, protein and fiber for lactating cow diets. It is this unique supply of three key dairy nutrients that makes WCS so special. Additionally, the unique packaging offered by the hull protects the release of the valuable fat in the seed and greatly increases the value of its energy to a dairy cow.

Works well in high roughage diets

WCS works so well in dairy diets partly due to high-roughage rations fed to dairy animals. Fibrous rations result in a slower rate of passage out of their rumens. The dairy rumen has a large forage raft floating on top that does a great job of catching fuzzy WCS. From it, WCS can be ruminated and delivered back for additional chewing, along with other roughage particles. This process causes the fat in the seed to be released over time instead of all at once, as is common in whole soybeans or even dry distillers grains.

But what happens if WCS falls out of the rumen mat and gets passed into the lower tract?

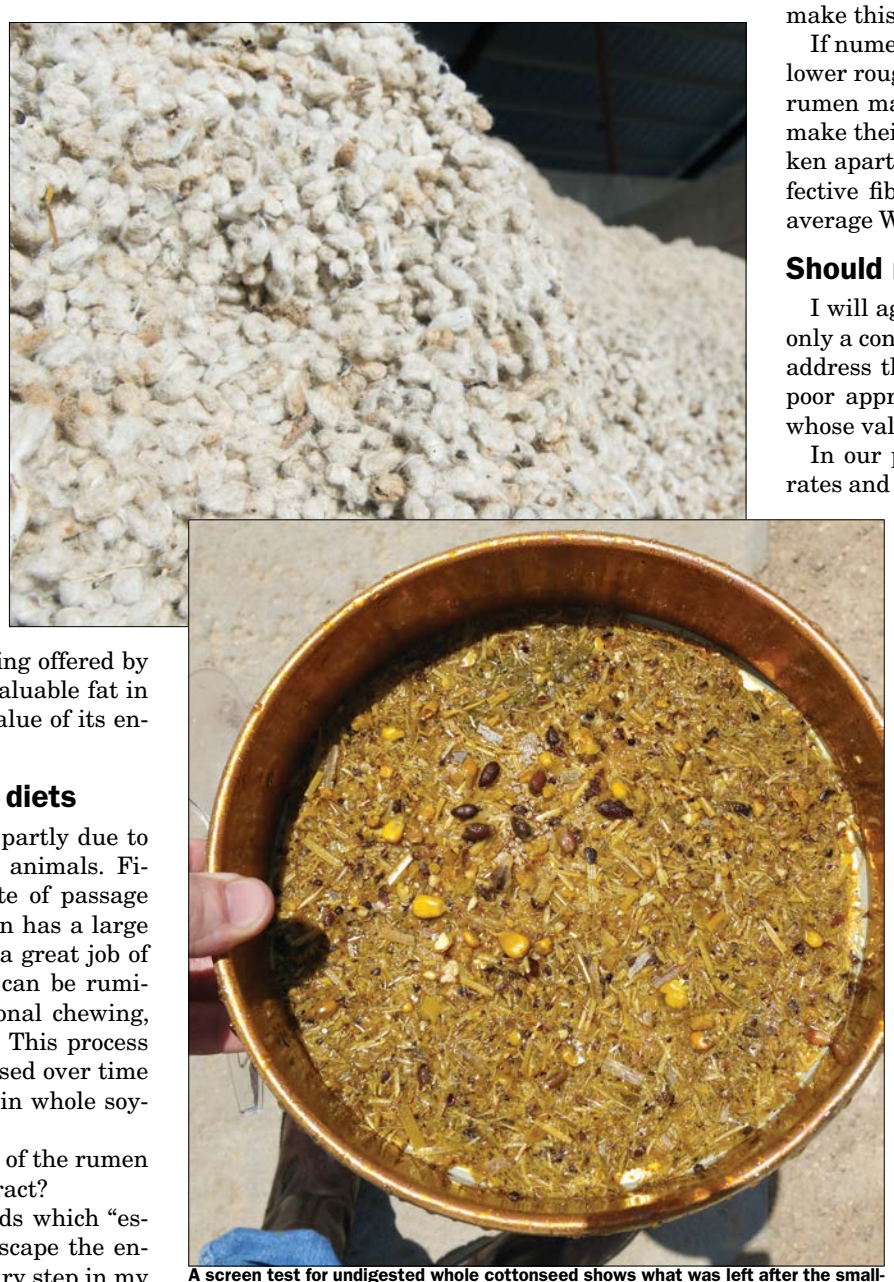
My observations indicate that seeds which "escape" the rumen are also likely to escape the entire digestive system. So as a necessary step in my ration formulation model, I have to do a manure screening test.

I always pick the highest feed intake pen for my samples, because cows with high intakes have a higher risk of passing undigested particles into their manure. The primary goal of the screening process is to make observations that will help in adjusting starch rates and digestibility, and in evaluating feed processing. Another benefit of the process is seeing how many cottonseed are in the collected manure.

In general, I would guess our consulting group feeds more moderate levels of WCS than is typical for the industry. In fact, over the years I have had clients mention many times that the number of cotton plants growing around manure storage areas are noticeably less since we started doing their rations. Even so, I am continually disappointed at the number of WCS I see in screened manure samples from my clients' herds.

Routine feeding rates of WCS may range from a low of 1 to 2 pounds per head per day, all the way up to 8 pounds. In most cases our rations are in the range of 3 to 4 lbs. I would hope that at this moderate rate we would see very few seeds in the manure. But in cows with very healthy and even conservative manure, a healthy rate of passage, aggressive cud chewing, and respectable butterfat tests, we still see more undigested cottonseed than I think we should.

So what is that about? Maybe the seeds have changed. I have heard some suggest that over time, plant breeders have worked towards smaller seeds in cotton bolls. I suspect that smaller seeds would have a higher chance of indigestibility. But there must be more. Maybe it has been this bad all along, and without the benefit of a manure screen we haven't noticed them.



A screen test for undigested whole cottonseed shows what was left after the smaller and more soluble parts of one spoonful of manure collected from each of 10 different cows was washed with water in a number 8 grain screen. It also shows how important kernel processing is for corn silage.

When I do manure screens, I take a heaping plastic spoonful of fresh manure from each of 10 cows. After using water to wash the sample, I sometimes see as many as 10 undigested cottonseeds. That's one seed per spoonful, and it is shocking to me. That much undigested cottonseed should make you stop and think. A few seeds are even still covered with lint. Based upon that, I know they did not spend adequate time in the rumen.

Now back to the lack of a denominator. To make this really meaningful we would need to estimate how many spoonfulls of manure each cow makes per day, and then count how many cottonseeds are in the cow's 3 to 4 pounds per head per day ration feeding rate. This sounds like a great master's degree thesis project for an aspiring dairy nutritionist still in graduate school.

You can find many digestibility studies on WCS in the literature. What I haven't found, however, is one that measured digestibility over increasing feed rates. I have a suspicion that as you go from 1 pound per cow per day to 8 pounds, seeds escape digestibility at an increasing rate.

In other words, 1, 2 or 3 pounds of WCS may be be nicely handled via healthy rumination, but as you move higher you may overwhelm the rumen's ability to get those valuable seeds processed. I also suspect that low-end forage levels in diets would make this problem worse.

If numerous byproducts are used in a ration and lower roughage value in a diet results in a smaller rumen mat, perhaps more individual seeds would make their way out of the rumen before being broken apart. If that is true, then rations with low effective fiber might also want to have lower than average WCS feeding rates.

Should not ignore indigestibility

I will agree that much of this is speculation and only a controlled research project could adequately address these questions. However, it seems like a poor approach to simply ignore the errant seeds whose value is lost in the manure.

In our practice we have decided to reduce feed rates and see if we can clean up this issue. It might not take much, since I don't think any significant indigestibility issue exists with the first few pounds. I also think we should work to build better rumen mats and encourage more chewing and rumination to not only help break up and digest WCS, but all of the other particles in the diet as well.

I have been tempted to weigh a pound of WCS and then count the individual seeds so I can estimate the total number of seeds a cow consumes daily. Then I have thought of calling my friends on the manure management and permitting side of the dairy industry and find out what the average wet manure output from a lactating dairy cow is, and determine how many spoonfulls that is.

Maybe this is a count that doesn't need a denominator to see how significant it is. For sure, fewer is better and more is worse. We will work with that for now. It is not necessary to do math on everything; sometimes general visual observations are just as valuable.

With WCS pricing soaring in the western U.S. due to the California drought and the Texas spring floods, we might be living on the low end of normal feeding rates anyway. But that situation won't continue forever. WCS will eventually be affordable again and dairy producers will want to increase feeding rates again.

What I can say for sure is that investigating manure helps me feed cows better. It is not the end-all or tell-all, but it is one more piece of information that can help me watch cows more closely and thus feed them better. This is a part of nutrition work that can't be done over the phone. Someone is going to have to get dirty and it might as well be me. Obviously, any undigested grain particle in the manure was a feed cost investment without the expected milk income returned.

Being sure that cottonseeds, along with all the other ingredients in your ration are being digested at the expected rate, is part of being sure that you are truly feeding for the bottom line. *WEST*

The author is the founder of Dairy Nutrition and Management Consulting LLC, which works with dairies and heifer growers in Texas, New Mexico, Kansas, Colorado, Washington and California.