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VETERINARY MEDICINE EXTENSION

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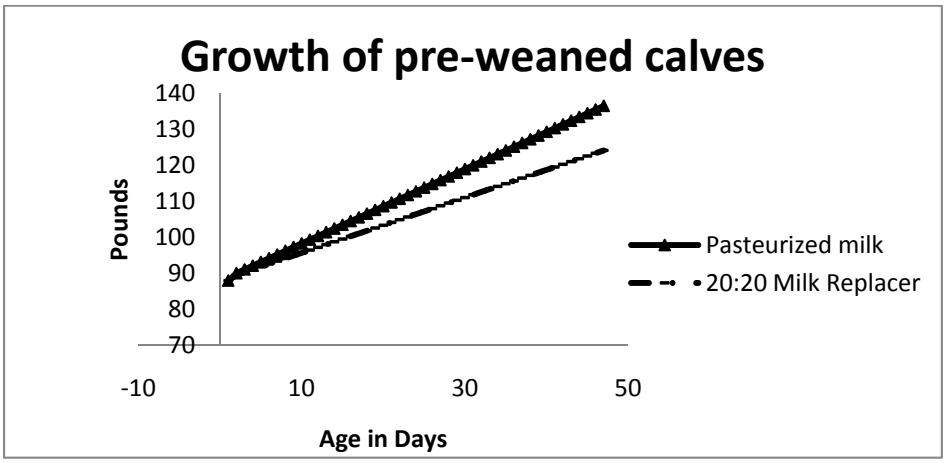
Feeding Quality Non-salable (Waste) Milk to Dairy Calves

From work done by Godden and others at the University of Minnesota, feeding waste milk is cost-effective because of less expense and better growth of calves compared to standard milk replacers. The following graph shows the differences in growth between two groups of calves: one fed pasteurized milk and the other a conventional 20:20 milk replacer twice daily.



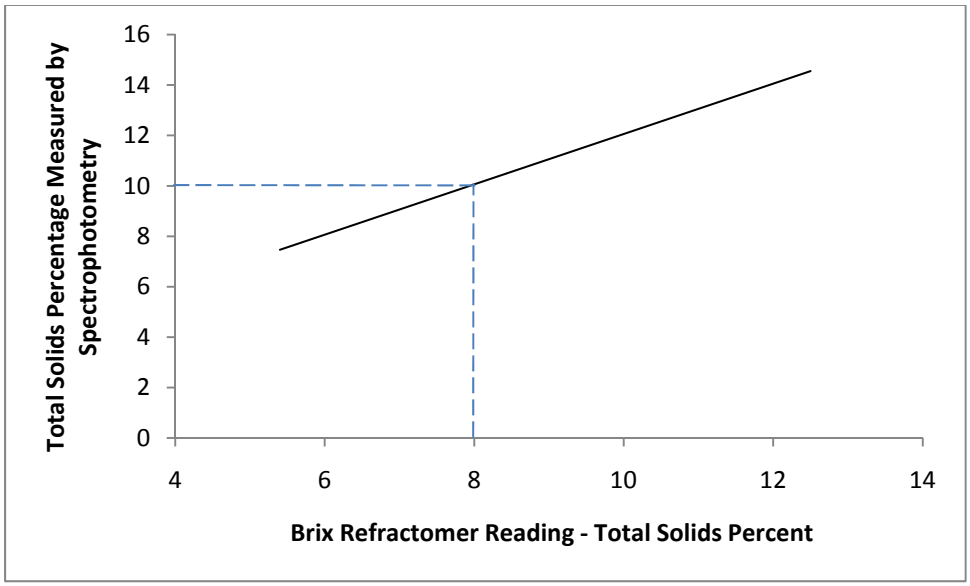
Whole milk is what nature intended for neonatal calves to drink. This is a great reason to feed waste milk to young calves. But just as we handle and monitor milk for human consumption in very specific ways, we need to pay attention to the quality of the waste milk we feed. We know that pasteurization is important to greatly reduce the number of bacteria the calf is exposed to. What else do we have to worry about?

At a large calf ranch, we looked at different measures of milk quality. We selected some techniques that could be done on-farm as well as some that could be done at a veterinary practice to see if there were easy ways to find low quality waste milk among dairies that supplied milk to the ranch. We evaluated bacteria counts (like a bulk tank count) both pre- and post-pasteurization, somatic cell counts (SCC), pH (acidity), and evaluated total solids (nutrient content) of the waste milk using a Brix, hand-held refractometer.

Bacteria Counts – Bacteria counts, just like doing a bulk tank count, can be assessed periodically pre- and post-pasteurization to see if the pasteurizer is working properly. In our investigation, most of the waste milk samples had very large numbers of bacteria in the raw milk but pasteurization was effective at greatly reducing the number. What we don't know, however, is what effect ingestion of large amounts of dead bacteria has on baby calves.

Many large calf ranches and dairies use blood agar plates or Petri film to assess bacterial counts. Keeping plates and an incubator going may not be for some producers so they may want to have their veterinarian or milk quality lab do this for them. Some producers are doing on-farm culturing for mastitis. If they can do a quantitative bulk tank count on the farm, they can also do the pre- and post-pasteurization bacteria monitoring.

Total Solids - The Brix refractometer we used measured total solids in the 5 to 15 percent range (Reichert Brix 35HP). The refractometer manufacturer indicated that we first needed to compare our refractometer readings with a gold standard measurement of total solids for calibration purposes. We compared Brix total solids readings with spectrophotometry estimates of a large number of milk samples (some with added water) at a milk quality laboratory and developed the following graph:



If we read 8 percent total solids on the refractometer, that meant we actually had about 10 percent total solids in the milk sample. Many of the waste milk samples from dairies in our investigation were very low in total solids, including the pooled milk (about 11%). This told us that the calves were not getting the nutrients we expected they would from whole milk; normally at12.5-13 percent total solids. The most likely way to have low solids is through dilution of the waste milk with water.

Milk Spoilage -- Estimating the pH of waste milk using a handheld pH meter is the easiest way to assess spoilage. The pH of milk will drop initially and then rise depending on the stage of spoilage, time, temperature and the types and number of bacteria present. Spoilage can affect the odor and taste of the milk, which could affect intake, but also can affect nutrient content. In our investigation, pH was correlated with nutrient content: the lower the pH, the lower the total solids measurement. Although intentionally-acidified milk (such as by adding organic acids) has been fed to calves successfully, feeding spontaneously acidified (spoiled) milk may not have the same effects. Normal milk pH is about 6.5. Out of our investigation samples, almost half had a pH less than 6.1, which could explain some of the low total solids.

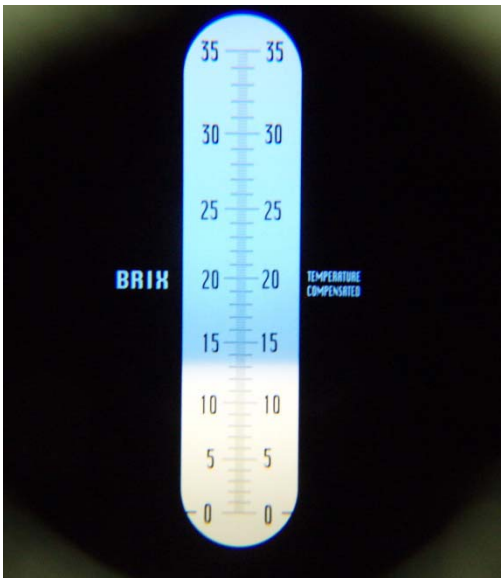
Somatic Cell Counts – Somatic cells come primarily from cows with mastitis that are milked into the hospital tank. The somatic cell counts of our samples were all very high. Monitoring SCC may not be a cost-effective way to assess milk quality because of the cost of the counter. However, high somatic cell counts are associated with low total milk solids and low milk protein and may have contributed to the low total solids seen in some of our samples. Bottom line – if you are feeding milk from mastitis cows, the total solids of the milk might be low.

Setting Up a Monitoring Program – There appear to be some easy ways to monitor the waste milk being fed to calves.

1. Identify spoilage by using a pH meter – discard milk with a pH less than 6.3 or greater than 7.0
2. Identify the total solids in the waste milk – If the milk is not spoiled, but may have been diluted with water, estimate the total solids of the milk to be pasteurized and consider adding solids by way of a milk replacer powder.
3. Periodically, assess the total bacteria count of pooled milk both before and after pasteurization to make sure the pasteurizer is functioning properly.

Correcting the Total Solids – To help ensure that young calves get the nutrients they need, we set up a chart for the calf feeders on the calf ranch.

The calf feeder needs to first place the waste milk sample on the Brix refractometer* and read the total solids percentage. They then can go to the chart and read the column on "%TS estimate" to find the "actual" content. If the desired total solids level is 13 percent, and the milk is in a 100 gallon tank, and the Brix reading is 8 percent, the feeder will need to add about 29 lbs of milk replacer powder to the waste milk in the tank (based on a standard 20:20 milk replacer – 20 percent crude protein:20 percent crude fat).



Looking through the Brix refractometer – 13% total solids reading.

Milk Tank Gal	Brix Reading	%TS Estimate of Waste Milk	%TS wanted	Lbs MR Needed	# bags of milk replacer	Addi-tional cost	Cost/calf/ Feeding$
100	4	6.07	13	67.75	1.36	$60.98	0.15
100	5	7.07	13	57.99	1.16	$52.19	0.13
100	6	8.07	13	48.23	0.96	$43.41	0.11
100	7	9.07	13	38.47	0.77	$34.62	0.09
100	8	10.06	13	28.71	0.57	$25.84	0.06
100	9	11.06	13	18.94	0.38	$17.05	0.04
100	10	12.06	13	9.18	0.18	$8.26	0.02
100	11	13.00	13	0.00	0.00	$0.00	0.00

The additional costs given in the other columns are based on a 50 lb bag of milk replacer costing about $45.00. There may be a cost breakpoint at which you would want to go back to try to tighten up the waste milk handling procedures rather than add milk replacer powder.

References

Godden SM, Fetrow JP, Feirtag JM, Green LR, Wells SJ. Economic analysis of feeding pasteurized nonsaleable milk versus conventional milk replacer to dairy calves. *J Am Vet Med Assoc* 2005 May 1;226(9):1547-54.

Moore DA, Taylor J, Hartman ML, Sischo WM. Quality assessments of waste milk at a calf ranch. *Journal of Dairy Science*. 2009;92:3503-3509.

*One caveat to using the refractometer with waste milk is that you need to clean the lens with alcohol to remove any fat residue left from previous samples or the lines you see will appear very fuzzy. Our conversion table may work only for the Brix refractometer we used (Reichert Brix 35HP, which reads in the range of total solids for milk).