Ontario

The Dairy Goat Digest

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The Dairy Food Safety Unit at the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) wants to keep you informed of changes and updates to the Raw Goat Milk Quality Program and ongoing quality issues. We hope you find this newsletter helpful and informative.

In this issue:

Summary of Raw Goat Milk Quality Test Results *2004 and 2005*

By Nadean Kennedy, Dairy Food Safety Program Coordinator (A), OMAFRA

Producer Numbers

Currently, there are 163 goat producers in Ontario.

Test Results Summary

A summary of the Inhibitory test results (Table 1) and Standard Plate Count (SPC) Table 2 for 2004 and 2005 of raw goat milk samples, which are conducted once a month on a random basis, are presented in the tables below. The results of additional testing conducted by the goat milk marketing organizations is not included here.

For SPC, 88% of the producers samples tested in 2005 meet the regulatory standard of less than 50,000 cfu/ml. The majority of these samples (82%) had counts of less than or equal to 25,000 cfu/ml. In 2004, 84% of the producers samples tested met the achievable level of less than 50,000. The majority of these samples (76%) had counts of less than or equal to 25,000.

The median (6,450) in 2005 has slightly improved compared to the median (6,650) in 2004. Medians are the “middle of the road” results, in other words, half the results are less than the median, and half the results are greater. Averages are not used to compare test results since averages can be distorted by a few samples with very high counts therefore giving an inaccurate picture of the overall milk quality.

These results indicate an improvement in the overall quality of the goat milk.

However, 13% in 2005, and 5% in 2004, of the test results exceeded 100,000 cfu/ml. Industry experience has shown that the majority of high SPC counts are due to malfunctioning milking systems wash cycles, poor equipment cleaning practices, problems with cooling of the milk and worn rubber parts.

Table 1

Inhibitor Results Summary			
Year	**# samples**	**# samples confirmed positive for inhibitor**	**% Positive**
2005	1823	3	0.17
2004	1852	0	0

Table 2a

SPC Test Results Summary 2005

Median :6,450 cfu/ml

Regulatory *Standard* *<50,000 cfu/ml*

2005 Month	Samples Tested	<25,000	<50,000	>50,000 – 100,000	>100,000	
Jan	144	88%	90%	4%	6%	
Feb	128	85%	91%	4%	6%	
Mar	153	75%	80%	6%	17%	
Apr	155	82%	85%	5%	13%	
May	156	83%	87%	5%	9%	
Jun	149	81%	87%	4%	11%	
Jul	147	78%	82%	7%	12%	
Aug	158	80%	89%	6%	6%	
Sep	166	83%	91%	2%	7%	
Oct	165	88%	92%	3%	6%	
Nov	97	91%	94%	3%	3%	
Dec	107	74%	84%	3%	13%	
Total	**1725**	**82%**	**88%**	**4%**	**9%**	**12 – Month Average**

Table 2b

SPC Test Results Summary 2004

Median :6,650 cfu/ml

2004 Month	Samples Tested	<25,000	<50,000	>50,000 – 100,000	>100,000	
Jan	162	75%	83%	2%	2%	
Feb	182	76%	82%	3%	1%	
Mar	150	73%	83%	3%	3%	
Apr	154	69%	75%	5%	3%	
May	250	80%	84%	3%	3%	
Jun	80	79%	83%	6%	3%	
Jul	162	78%	82%	6%	1%	
Aug	152	83%	89%	2%	3%	
Sep	147	82%	89%	3%	2%	
Oct	137	89%	93%	3%	1%	
Nov	138	85%	88%	6%	1%	
Dec	146	86%	90%	3%	1%	
Total	**1860**	**76%**	**81%**	**3%**	**2%**	**12 – Month Average**

Mimicking Nature's Way
Free-Access Feeding with Acidified Milk for Goat Kids

By Dr. Neil Anderson, Lead Veterinarian – Disease Prevention - Ruminants
Animal Health and Welfare Group, Livestock Technology Branch, OMAFRA

TAKE-HOME MESSAGES

1. Hunger is the prime stressor and health and welfare issue of neonatal dairy goat kids.
2. Freedom from hunger is in our contract with kids.
3. Free-access feeding with acidified milk lets us mimic Nature's way.

INTRODUCTION

Something old is new again – free-access feeding. It's old because it's Nature's way. However, what's new is the way we can fulfill our ancient contract of assuring freedom from hunger for kids in exchange for milk surplus to the kids' needs. Hunger is a major stress in the early days of life for a newborn kid. It may be the main reason kids become weak and sick in the first 7-10 days of life. Our conventional feeding strategies often leave kids hungry. Our methods do not meet the standards of an average doe mother. Since June 2005 in Ontario, several hundred kids have enjoyed excellent health because of free-access feeding with acidified colostrum, milk or milk replacer. Moreover, the free-access feeding scheme has given joy to those caring for kids. This article describes the feeding system

NATURE'S WAY and CONVENTIONAL FEEDING SYSTEMS

Nature's way of feeding kids includes free access, nursing until satiated, frequent meals per day and suckling. Conventional rearing systems often limit access, restrict milk intake per meal, encourage rapid feeding or gorging, restrict meals per day or provide milk in dishes (non-suckling).
Free-access milk-feeding systems include housing with an accommodating doe or unrestricted access to a container of milk. An automatic feeding system programmed for unrestricted access may still restrict access because of an inadequate kid-to-nipple ratio. The origins of free-access feeding (frequency and quantity of milk) may have been from producers or their advisors noticing improved health, greater feed conversion, rate of gain and growth in kids fed in ways that mimic nature. No doubt the producers are looking for methods to decrease labour and improve health.

FINLAND – 8 YEARS OF EXPERIENCE with ACIDIFIED MILK

In Finland, 30% of larger dairy farms and 90% of veal operations choose group housing and free-access feeding with acidified milk or milk replacer. Finnish farmers have eight years of practical experience with free-access feeding of milk acidified with Formic Acid to preserve it for 1 to 3 days. They claim less labour, inexpensive equipment and efficient use of surplus colostrum, transition cow milk or milk from cows under treatment. They also report calves stay healthy, have few bouts of diarrhea and rarely suck on navels or ears. For Finnish farmers, free-choice feeding is an easier feeding method for substitute workers. It allows calves to eat to appetite and satisfies the calves' biological need to suckle. Of course, calves have very good growth with weight gains near 1 kg/day. Closer to home, a New York State study showed a reduction in labour per calf per day, from 10 minutes for calves in individual pens to 1 minute for calves reared and fed in group housing. The basic components of a Finnish free-access feeding system include a reservoir to contain the milk or milk replacer, a nipple, a plastic tube and a check valve Acidification with formic acid preserves the milk for storage at room temperature and allows them to mix batches at 1- to 3-day intervals to save labour. In addition, the milk is fed cool to avoid gorge feeding.

HUNGER – QUANTITY, FREQUENCY, QUALITY

Hunger is a state of discomfort, queasiness or weakness caused by a lack of food. Hungry kids are in need of food. Kids display hunger by their suckling behaviour and searching for a teat or their vocalizations.

A comparison of conventional bottle feeding to suckling their dam or free-access systems shows our conventional feeding practices fall short in quantity and frequency of feeding and thus, missed potential for weight gain. In addition to quantity and frequency, we may fail in delivering milk of sufficient quality to our kids. With milk replacer, the most common error is in mixing an inadequate weight of powder per liter of water or feeding too hot. With whole milk, some choose to dilute it with water. However, bacterial quality may be a more important issue on some farms.

Figure 1. Waste milk, colostrum and prepared milk replacer can be found stored in pails at room temperature on some farms. This milk incubates bacteria and becomes a cesspool for calf feeding. The same can be true for large volumes of milk stored in refrigerators. Without stirring, only milk at the periphery of a pail is adequately chilled while milk towards the center incubates bacteria.

FREE-ACCESS MILK FEEDING

Free-access feeding systems (with reservoirs of milk) require preservation of the colostrum, milk or milk replacer by acidification or by souring with the use of specific bacteria.

The least expensive equipment includes an electric drill and paint mixer attachment to mix the milk and preservative, a container to hold a reservoir of milk and teats on the container or attached to a feeder bar on a wall. The system may be gravity fed with teats at the bottom of the container or line-fed with teats attached to a plastic line with a one-way valve.

Figure 2. A line-fed system may have teats attached to the reservoir or remotely from the container. The size of container depends upon the number of kids given free access to the milk and the frequency of filling. It could be a 10 or 20-liter pail as shown in the adjacent photograph.

In general, acidified milk may be prepared at 1-3-day intervals and the equipment cleaned twice per week. The use of a preservative (acidification to pH 4.0-4.5 and closer to 4.0 is preferable) and feeding at a cool temperature (to limit intake per meal) are essential to success of these systems.

WHAT IS the PURPOSE of ADDING FORMIC ACID?

Acidification to pH 4.0-4.5 is **to *preserve* the milk**. Once preserved from growth of bacteria and molds, the milk can be stored at room temperature for several days. The preservation permits free-access feeding of milk to kids without the need for refrigeration of the milk. Acidification decreases a kid's exposure to bacteria. It is useful for storing surplus colostrum or waste milk

when refrigeration is not available. There may be merit in acidifying surplus colostrum prior to storage in freezers.

WHY ACIDIFY to pH 4.0-4.5?

Standard text books of laboratory procedures show that many bacteria and molds will not grow at pH less than 4.5, but they survive and reproduce readily at pH levels greater than 4.5. To test the theory that acidification (pH 4.0-4.5) preserves milk, a summer student and I conducted standardized Plate Loop Count bacterial cultures on a control and acidified bulk tank milk sample stored at room temperature. Bacteria multiplied quickly in the control sample and colonies became too numerous to count, whereas the acidified sample showed no bacterial growth after several hours of contact with the Formic Acid and pH of 4.2.

Figure 3. Several bacteria of interest on dairy farms appear in the adjacent table. The optimum and range of pH for their growth, and the pH at which they are inactivated or lose their activity under laboratory conditions also are shown. Many bacteria lose activity or are inactivated at pH 4.0-4.5.

	Optimum	Range	Inactivated / lost activity
Bacillus cereus		4.3 - 9.3	< 4.3 and > 9.3
Clostridium perfringens	6.0 - 7.0	5.5 - 9.0	< 5 and > 8.3
Clostridium botulinum		4.6 - 9.0	< 4.6 and > 9
E coli (STEC)	6.0 - 7.0	4.4 - 9.0	< 4.4
E coli O157:H7	6.0 - 7.0	4.4 - 9.0	< 4.4
Lactobacillus acidophilus	5.8 - 6.6	4.0-4.6-6.8	< 4.4*
Listeria monocytogenes	7.0	4.4 - 9.4	< 4.4
Mycobacterium avium paraTB (Johne's)	6.0 -7.0	5.0 - 7.0	< 5 no growth
Pseudomonas aeruginosa	6.6 - 7.0	5.6 - 8.0	< 5.6
Salmonella	7.0 - 7.5	3.8 - 9.5	< 4.4*
Staph aureus	7.0 - 7.5	4.2 - 9.3	< 4.2
Strep pneumoniae	7.8	6.5 - 8.3	< 4.5
Vibrio cholerae	7.6	5.0 - 9.6	< 4.5

The precise contact time needed to inactivate specific bacteria common in milk, waste milk or colostrum is unknown. Therefore, I recommend 6-12 hours. In practice, milk could be acidified in the afternoon and fed the next morning.

HOW MANY DAYS CAN I STORE the ACIDIFIED MILK?

Bacterial content in milk decreases considerably after several hours of contact with Formic Acid and pH 4.0-4.5. Finnish farmers and advisors recommend preparation of batches every 1-3 days.

DOES ACIDIFICATION ALTER the MILK?

The most obvious change to colostrum, milk or milk replacer (milk) is separation that happens within 10-30 minutes after acidification to pH 4.0-4.5. However, a vigorous stir puts it back into solution.

Acidified milk (includes colostrums, hot milk, cold milk, milk replacer) must be stirred about 30 minutes after preparation. Subsequently, the milk will separate again after several hours. Therefore, it is necessary to stir vigorously 2-3 times per day thereafter. Published research reports show no harmful effects of acidification to colostrum or fat, protein or lactose in milk. At a recent on-farm demonstration, a volunteer tasted acidified and unacidified milk replacer and stated the unacidified sample would be his first choice. Nonetheless, calves drink the acidified milk readily. Any slight change in taste may be beneficial to limit intake in free-access feeding systems.

Figure 4. The photographs show the separation that occurs when milk replacer is acidified to pH 4.2. Similar separation occurs with colostrum, milk or waste milk. The

separation is more rapid with warm milk. The milk replacer used in this test was an all milk product, 22% Protein and 17% Fat and mixed at 150 g/L. All samples looked like the control sample after a vigorous stir. It is essential to stir acidified milk 2-4 times per day to keep the constituents in solution.

In the 6-8 hours immediately following acidification, milk will separate again and require stirring. However, when stirred vigorously 8 hours after acidification, I found milk and milk replacer stayed in a uniform mix for 12 to 18 hours. A practical approach would be the use of an automatic mixer set on a timer. An alternative when hand-mixing would be to prepare the acidified milk in the morning and serve it in the evening following a good stir.

Figure 5. The photograph on the right shows the control sample and Formic Acid and AgriAcid samples at 7:30 a.m., 15.5 hours after a vigorous stir at 4:00 p.m. the previous day. Although not shown, the AcidPak samples looked similar.

WHY IS the MILK FED at a COOL TEMPERATURE?

The milk is fed cool to limit intake, to avoid the risks associated with gorge feeding and to avoid diarrhea. Although I have no research related to kids, researchers have compared health, feed conversion and rate of gain in calves fed cool and warm milk. The calves fed cool milk had the best performance in all three categories. Closer to home, one producer on the pilot project fed his calves warm milk. They developed scours within 24 hours. The diarrhea stopped within a day after removing the heater from the milk. At another pilot project, the milk container was exposed to direct sunlight, the milk felt hot to touch and the calves developed diarrhea. The scours stopped when the milk container was shaded from direct sunlight and the milk cooled. These experiences strongly suggest shade for containers of milk and feeding at temperatures closer to 20-25 °C.

DOES FREQUENT SUCKLING BENEFIT KIDS?

Anecdotal reports confirm frequent suckling has been a benefit for kids on pilot project farms. Since I haven't found research results related to kids, let's look at some information pertaining to calves that could apply. Prevention of abomasal ulcers or abomasitis in suckling calves presents challenges to veterinarians and their clients. The commonly proposed etiologies for abomasal ulcers or abomasitis include mechanical abrasion from coarse ingesta, infection with *Clostridium perfringens* Type A, trace mineral deficiencies and stress. Because of sudden deaths or unrewarding treatments, it is important to control or prevent ulcers or abomasitis. Feeding frequency could be a preventive measure because frequent suckling reduces the number of hours per day that the abomasal lining is exposed to low pH. In addition, with eight feedings per day, the abomasum of a calf will have a pH less than 5.0 for the entire day. A quick look back to the table in **Figure 3** shows that *Clostridium perfringens* prefers a pH of 5.5–9.0 for optimum growth. Frequent suckling assures that the optimum pH for growth of *Clostridium perfringens* is not achieved. Further to the argument, free-access feeding of acidified milk could be of benefit because the milk entering the abomasum is at a pH less than 4.5. It is reasonable to predict similar abomasal pH with goat kids suckling several times per day.

HOW OFTEN WILL the KIDS SUCKLE WHEN OFFERED FREE-ACCESS to MILK?

I don't know for kids but I have some observations for calves. In the summer of 2005, we recorded on video tape the feeding activity for 8 calves on free-access feeding. On average, our study calves ate 7 meals and suckled for an average of 48 minutes per day. The calves clustered many meals at dawn and dusk with fewer meals throughout the day. The calves were in groups of 4 with 3 nipples per 4 calves.

HOW MANY TEATS SHOULD BE AVAILABLE to a GROUP of KIDS?

Since kids have the herd instinct to eat and rest as groups, it is advisable to provide ample teats for feeding. In a group of 10 kids, about 4 nipples should be enough. The youngest kids explore what the older kids are doing and quickly learn from them. Free-access feeding implies a teat and milk are available when wanted and, in general, there should be no waiting for milk. Research (calves) from British Columbia showed reduced time on teats, reduced daily milk intake and increased competitive displacements from teats with reduced access to teats (4 teats: 3 calves vs. 1 teat: 3 calves).

Figure 6. An abundance of teats assures that smaller and timid kids will not be displaced from nursing opportunities. Older kids teach young kids by example. Jim's job of training kids to the nipple is easier with a foot-valve on the lines because milk is readily available when suckling starts.

HOW MUCH MILK WILL the KIDS DRINK?

Kids should consume about 20% of their body weight as milk every day. They could suckle about 700-800 ml daily the first week of life, 1200 ml daily the second week and 1500 ml daily the third week. This intake may be considerably more than milk provided by conventional hand-feeding systems. Rate of gain and feed conversion will be exceptional. Of course, the proof is in the body condition of the kids.

WILL FREE-ACCESS FEEDING RESULT in GREATER REARING COSTS?

Overall, no. There will be greater costs associated with milk or milk replacer. However, reports from calf-rearing research show the investment in milk or milk replacer is offset by better health and fewer treatment costs, thus giving the advantage to the free-choice feeding compared to restricted feeding.

WILL RAPID WEIGHT GAIN at a YOUNG AGE HARM KIDS?

Once again, I have no research reports about this for kids. However, researchers suggest a benefit to the immune system from enhanced feeding of young calves. The weight gain during the first 4-6 weeks of age has no harmful effect on future milk production. The calves will be taller than those on restricted feeding. In addition, calves will show estrus about 2 weeks earlier and subsequently breed earlier. Calves raised on 'accelerated' milk replacer programs have been shown to produce more milk during their first lactation. It would be nice to find similar results with kids.

DO the KIDS NEED WATER and GRAIN WHILE on FREE-ACCESS FEEDING?

Yes. The Finnish system stresses free-access to clean water and a starter ration of grain or pellets at all times while on the acidified milk feeding program. This advice is the same as for other milk-feeding systems. The intake of grain will increase noticeably during the fourth week of age. From calf research, we know calves on free-access feeding do not consume as much starter as calves on restricted feeding. However, post weaning, the free-access calves quickly consume quantities of starter similar to calves on restricted feeding. Recent research indicates that offering hay is not harmful to rumen development of calves contrary to commonly held beliefs from earlier research studies.

HOW ARE KIDS WEANED from the FREE-ACCESS FEEDING SYSTEM?

Weaning can either be abrupt or gradual. Calves on free-access feeding of acidified milk are weaned abruptly at 5-6 weeks of age. Producers report some separation anxiety from the teat. However, the calves appear to suffer no greater setback at weaning than calves weaned from conventional feeding systems. Gradual weaning is also an option.

WHAT ARE the HEALTH CHALLENGES with GROUP REARING?

Unlike calves, goat kids commonly are raised in groups. Respiratory disease and diarrhea are considered the greatest health issues associated with group rearing of calves. Indeed, hutch-housing became popular as a way to separate calves and diminish the risk of diseases. Recent research from Sweden looked at the effect of group size on health and growth rate of Swedish dairy calves housed in pens with automatic milk-feeders (Svensson and Liberg, Prev. Vet. Med. 73, 2006). The authors stated that "calves in pens for 12–18 calves had a higher incidence of respiratory illness (Odds Ratio: 1.4) and grew 0.022 cm/day less than calves housed in groups of 6–9 animals (equivalent to approximately 40 g/day). We detected no differences between calves kept in the small-sized versus the large-sized groups in terms of risk of diarrhoea." I am unaware of research related to group size and health for kids. The limiting factor may be access to nipples at peak feeding times during the day.

Most pilot project farms with dairy calves have small groups of 4 to 9 calves. Those farms are having very good success. At one farm with a controlled environment calf barn, tearing from eyes and coughs were common. When the relative humidity was lowered from 65% to 50% and the temperature set at 10-11°C, the symptoms stopped. We should pay particular concern to humidity levels and temperature in barns for rearing kids.

At one goat dairy, the barn for kid-rearing barn has been regulated to a temperature of 13°C. At this temperature, the kids do not bunch up as they commonly do at lower temperatures. This barn has very good ventilation to assure constant changes of air.

WILL ACIDIFIED MILK PREVENT SCOURS or OTHER DISEASES?

In Finland, advisors recommend feeding acidified milk for farms experiencing diarrhea problems in their calves. They claim acidified milk prevents diarrhea. Calves can eat as much as 9 to 12 liters a day with free choice feeding. At these feeding levels, the consistency of feces is loose but the situation is different from a serious diarrhea caused by bacteria. Diarrhea has not been reported as a problem on the pilot project farms. Indeed, owners report scours as a rare event with free-access feeding. The exception has been 3 pilot project farms where acidified milk was fed warm or hot. Since acidification lowers bacterial counts, the risk of scours from contaminated milk should be lower for calves consuming acidified milk. Some dairy goat producers adopted the feeding scheme because of diarrhea in their kids and now report that diarrhea is no longer an issue.

In a previous section about frequent suckling, I argue that milk acidified to pH 4.0-4.5 should have a benefit for calves, especially when one considers *Clostridium perfringens* Type A. This bacterial agent is being diagnosed with increasing frequency in calves with abomasitis and sudden death. Since its optimum range for growth is pH 5.5-9.0, milk entering the abomasum at pH 4.0-4.5 should produce an inhospitable environment for Clostridial growth and sporulation in the abomasum. For sure, some research would be helpful to prove or disprove this theory. At best, frequent feedings or feeding acidified milk should be considered as a prevention strategy because other means of prevention have been unrewarding.

Viruses are notoriously resistant to acids. Although I cannot find research related to CAE virus, one might predict that it will tolerate pH 4.0-4.5. In another 6 months, we should have an assessment of the health status of the first group of kids reared with acidified colostrum and goat's milk.

EXPERIENCE with FREE-ACCESS FEEDING of ACIDIFIED MILK for GOAT KIDS.

My first experience with the feeding system was with goat kids at a dairy that milked several hundred does. Death loss in the kids was 32% and most deaths were related to scours that started at 7-10 days of age. Challenges with colostrum quality (late harvest), under nourishment (thin body condition), engorgement stress (pot bellies after feeding) and diarrhea were identified and addressed with a feeding protocol designed to mimic the normal feeding behaviour of ad libitum suckling. The goal was to have kids consume small quantities at each of many feeding episodes. The intention also was to improve consumption of colostrum and transition milk in the first few days of life and to overcome the stress of hunger.

Free-access feeding of acidified goat's milk, cow's milk and milk replacer to goat kids has been very successful on several Ontario farms. The adoption of this feeding scheme seems to be more rapid in the dairy goat industry than with dairy cattle producers.

Figure 7. Newborn goat kids are shown suckling acidified colostrum with free access. After implementation of a new feeding scheme at this farm, death loss dropped from 32% to 3% in 2005. The owners are feeding acidified colostrum, milk and milk replacer for the first 3 weeks of age in the 2006 kidding season. A recent report showed 200 kids born in about 30 days and only one death (from entrapment).

WHAT FEEDING PROTOCOLS ARE BEING USED from BIRTH to WEANING?

Free-access feeding provides an opportunity to feed newborn kids several smaller meals during the first 12 hours when they easily absorb immunoglobulins for passive immunity. The following protocol has been working successfully on pilot project farms. The protocol takes full advantage of the benefits of colostrum and fresh milk. It may not be applicable to those on CAE or Johne's control programs. One might substitute acidified cow's colostrum, milk or milk replacer for rearing kids in CAE control herds.

Nature's way does not include 4, 6, 8 or 10 hour intervals between meals for newborn kids. It is essential to provide free-access to milk from birth. For sure, you may wish to give a first feeding with a nipple bottle. However, the kids must be trained to the nipples and bonded to them. Do not wait several hours.

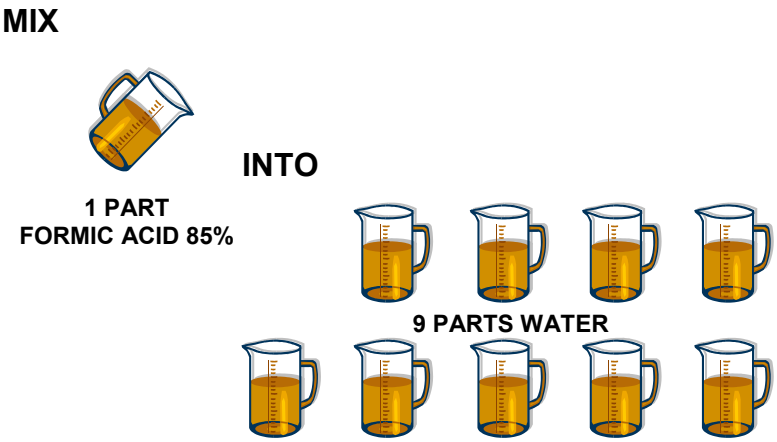
Free choice water and grain must be provided at all times to kids on free-access feeding with acidified milk. The grain is essential to early development of the rumen.

Figure 8. Kids exhibit group feeding behaviour. There should be enough teats available to enable several kids in a pen to suckle at the same time. Frolicking is common in kids that are not hungry.

HOW to ACIDIFY COLOSTRUM, MILK or MILK REPLACER

a) Prepare dilute acid

- Mix 1 part concentrated Formic Acid 85% into 9 parts water.
- For example, put 9 L water into a container; then add 1 L of Formic Acid 85%. Mix. (**Figure 9**) →



- Label clearly – Dilute Formic Acid. Caution – Irritating to skin, eyes and lungs. Keep out of reach of children. Mixing Directions: While stirring vigorously, add 30 mL to 1 liter whole milk or milk replacer. Mix 40 - 45 mL to 1 liter colostrum. Check pH 4 to 4.5.

b) Cool the colostrum, milk or milk replacer before adding dilute acid

- To avoid clot formation.
- Warm milk may be acidified, but it separates quicker and requires vigorous and more frequent stirring.

c) **Mix dilute acid into colostrum, milk, or milk replacer**

- Mix 30 mL dilute acid into 1 liter (1000 mL) milk or milk replacer. Add 40 to 45 mL dilute acid to 1 liter colostrum. Check pH 4 to 4.5.
- Mix 150 mL dilute acid into 5 liters milk.
- Mix 300 mL into 10 liters
- Mix 450 mL into 15 liters
- Mix 600 mL into 20 liters

d) **Stir vigorously while adding acid. Stir again within 30 minutes and, then, 3 times through the day. Use a paint mixer and low speed on a cordless drill. (Figure 10)** →

e) **Check to assure within the range of pH 4.0 to 4.5 when mixing is complete. (Figure 11)** →

f) **Feed at ambient temperature in the summer. Feed at 20-25°C in winter. Do not warm the milk.**

g) **Store in closed containers for 1 to 3 days. Keep flies/cats out.**

h) **Clean nipples, valves, lines, and container with warm water and dish washing detergent.**

i) **Provide clean water and grain free choice.**

Mount nipples at a convenient height above floor level in the pen.

SUMMARY

Conventional milk-feeding systems may work well when caring for a few kids. However, doe numbers and kid numbers are increasing as our goat dairy farms increase in size. There is considerable labour devoted to feeding of individual kids and the labour issue has producers looking at alternative feeding systems. Mob feeders, free-access feeding and automatic (computerized) feeders are choices to consider for feeding kids as groups. The main challenge becomes the prevention and control of respiratory disease in group housing systems. Confinement housing, with controlled heat and ventilation, includes additional expense in rearing and challenges with respiratory disease. Kids thrive in cooler temperatures hovering near 13°C but the milk might be best served at 20-25°C. That's where we need some innovations to make free-access or automated feeding a viable alternative on larger farms. Several owners and managers of dairy cattle and goat farms implemented pilot projects to further our understanding of free-access feeding. They have been excellent on-farm researchers and teachers.

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