

BEST PRACTICES FOR RAISING LAMBS ON MILK REPLACER

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Abstract

Lambing season can drive a shepherd's long-term success. The health, growth and early performance of a lamb crop directly impacts a flock's future performance in the parlor.

Nutrition is essential in giving lambs a solid start – and milk replacer can be a solution in this early success, with studies showing better growth performance and long-term performance potential than those fed cow's milk or non-sheep milk replacers.¹ However, success is not guaranteed on milk replacer alone. To secure the long-term performance benefits of feeding a lamb milk replacer, follow a total management program.

Critical components of a total management program are offered in this proceedings, as follows:

1. Obtainable goals
2. Newborn care
 - a. Navel disinfection
 - b. Colostrum feeding and management
3. Choosing the right milk replacer
4. Choosing the right milk feeding system
 - a. Bottle feeding
 - b. Lamb bar feeding
 - c. Automated mixing and feeding system
5. Rumens development
6. Weaning management

1. Set obtainable goals

Before the first lamb hits the ground, analyze past performance of the flock and set goals. Setting tangible goals and determining a path for achieving these objectives can help you build on past flock performance.

Consider the following goals:

- **200 percent lamb crop:** Mature and well-conditioned ewes should be able to lamb at least two lambs. Extra lambs (triples and quads) may require additional care to reach their full potential.

¹ Berger, Yves and Richard Schlapper. "Raising lambs on milk replacer." University of Wisconsin-Madison Spooner Agricultural Research Station. http://www.ansci.wisc.edu/Extension-New%20copy/sheep/Publications_and_Proceedings/Pdf/Dairy/Health%20and%20Nutrition/Raising%20lambs%20on%20milk%20replacer.pdf. 24 July 2014.

- **Less than 5 percent pre-weaning mortality:** The industry target for pre-weaning mortality is less than 5 percent. However, it's estimated that nearly 20 percent of lambs are lost before weaning, with 80 percent of those losses occurring during the first 10 days.² These early losses can impact the flock's future by limiting the flock rotation and delaying the inclusion of new genetics in the flock.

2. Newborn care

Newborn care is the first step in achieving the aforementioned goals. The first minutes after a lamb is born can influence its entire life.

Following birth, the lamb is exposed to bacteria and pathogens that its immune system is unfamiliar with. Without protection, the new life can be in danger – leading to an increase in pre-weaning health issues and mortality rates. Two ways to protect lambs against these pathogens are: navel disinfection and quality colostrum.

- Navel disinfection:** Immediately after birth, disinfect the newborn's navel with the proper disinfectant. Ensure the disinfectant covers both the outside and inside of the navel.



A 7 percent tincture of iodine is the first recommendation for a disinfectant. Betadine or Nolvasan has been used however lacks the drying effect. Don Sockett, DVM, Ph.D., at the Wisconsin Diagnostics Laboratory recommends a 50:50 blend of undiluted Nolvasan plus rubbing alcohol as a second best option.

The Land O'Lakes Animal Milk Products' research team has found the use of a syringe or bottle (Figure 1) to be helpful to achieve adequate and consistent navel disinfection.

University of Wisconsin research data shows that the mortality and treatments for pneumonia are significantly reduced in calves, when navels are disinfected, as shown in Figure 2. Similar results may be expected for sheep.

Figure 2

Treatment	No. Of Calves	% Mortality	% Treated for Scours	% Treated for Pneumonia
Disinfected	269	7.1	30.5	5.2
Not Disinfected	132	18.0	22.0	18.9

*Source: Calf Survival Study. Univ. Of Wisconsin

- Colostrum feeding and management:**

Colostrum, or the first milk in lactation, is the primary protection lambs receive against environmental pathogens and bacteria. The immunoglobulins in colostrum are essential because antibodies in the ewe's bloodstream do not cross the placenta.³ The lamb can only receive the protective antibodies by consuming colostrum.

² Schoenian, Susan. "Care of Newborn Lambs." University of Maryland. <http://www.sheep101.info/201/newborns.html>. 24 July 2014.

³ "Sheep management: Colostrum and health of newborn lambs." Iowa State University Extension. June 1995. <http://www.extension.iastate.edu/Publications/PM989X12.pdf> 18 February 2013.

This protection hinges on high quality colostrum fed immediately following birth. Lambs should receive 10 percent of their body weight in colostrum by 18 hours of age. For example, a 10 pound lamb should be fed 1 pound (or 16 ounces) of colostrum in its 18 hours of life. At least half of this volume should be fed within 4 to 8 hours. Colostrum and colostrum replacements should be fed at about 105 degrees F.

Researchers at the University of Maryland recently stated that, when feeding the first colostrum, within “30 minutes is optimum while 18 hours is a must.”⁴ Timing is crucial because the protective antibodies found in colostrum can only cross the intestinal wall and enter the bloodstream during this time. The intestinal wall begins to stop passive transfer of antibodies hours after birth, so immediate feeding of colostrum is desired.

To ensure proper consumption in the necessary time, colostrum can be hand-fed via bottle or stomach tube. The necessary levels can be fed in increments of 3-5 ounces at 3-4 hour intervals throughout the first 18 hours. Once in the system, the maternally-derived antibodies help fight off infections, while the lamb builds its own stable immune system.⁵

Though colostrum is a necessary ingredient to newborn lamb success, fluctuations in colostrum quality and quantity produced by the ewe are probable. Recent research shows large variability in colostrum production, with older ewes often producing higher levels of the protective first milk.³ Research also indicates ewes that produce larger litters are often unable to naturally produce adequate protection for bonus lambs – often leaving bonus lambs unprotected.⁶

One way to ensure all lambs receive high-quality colostrum, free from any disease, in adequate quantities is through a colostrum replacer. When selecting a colostrum replacement product, look for a product labeled to raise IgG concentration above 10 mg/ml. These products are typically made of dried bovine colostrum and contain at least 75 grams of IgG per liter as well as high levels of natural colostrum fat, protein, vitamins and minerals needed by the newborn lamb. In the United States, these products are regulated by the U.S. Department of Agriculture Center for Veterinary Biologics for quality control. Look for the U.S. Veterinary permit on the label.

Beyond this measure, selection of colostrum replacers should be based on research. Analyze the product for research results and determine if the supplier is a reputable source. In addition, the product should be made specifically for small ruminants (lambs and kids).

⁴ Schoenian, Susan. “Colostrum: Liquid Gold.” University of Maryland Extension. <http://www.sheepandgoat.com/articles/colostrum.html>. 18 February 2013.

⁵ Nowak, R., and P. Poindron. *From birth to colostrum: Early steps to lamb survival*. Reproductive Nutrition Development. Volume 46, pp 431-446. 2006. <http://vetsci.co.uk/2012/01/23/the-importance-of-colostrum-for-new-born-lamb/>.

⁶ Lindsay, D. R., R. Nowak, I. Gede Putu, and D. M. McNeill. 1990. Behavioural interactions between the ewe and her young at parturition: A vital step for the lamb. Pages 191–205 in *Reproductive Physiology of Merino Sheep. Concepts and Consequences*. C. M. Oldham, G. B. Martin, and I. W. Purvis, ed. School of Agriculture (Animal Science), The University of Western Australia, Nedlands, Perth.

When a high-quality colostrum is fed in the right quantity, it can impact long-term performance. This is shown in a research study in the dairy cattle industry. Data shows that calves with failure of passive transfer had delayed time to first calving (Can Vet J., 1986, 50:314); decreased average daily gain (Nocek et al., 1984; Robison et al. 1988) and decreased milk and fat production at first lactation (DeNise et al., 1989).

Inadequate colostrum intake has also been shown to reduce long-term performance of dairy heifers (Faber, et. al. 2005).⁷ In this study, Brown Swiss heifers fed 2 liters of colostrum vs. 4 liters, over the course of 6 to 8 feedings; had reduced average daily gain (1.76 lbs vs. 2.2 lbs), increased time to first conception in months (14 vs. 13.5), reduced survival through 2nd lactation (75.3 vs. 87.1%) and over 2000 pounds less milk production through the second lactation (35,297 vs. 37,558).

3. Choosing a Lamb Replacer

After lambs are fed a high-quality colostrum for the first feedings, they can be transitioned onto a milk replacer. Milk replacer selection can impact lamb growth.

When lambs are fed high quality milk replacer they can perform at least as well as when on the ewe. Figure 3 shows a recent Cornell study by DiPastina (2015) that demonstrated this using a commercially available lamb milk replacer (LAND O LAKES® Ultra Fresh® Optimum).⁸

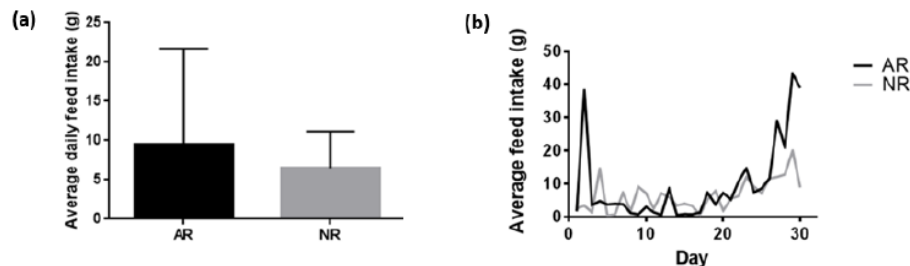
When selecting a milk replacer, first be sure it is made specifically for lambs. This is because an all-purpose, multi-specie milk replacer is built on compromise. Calves, lambs, kids, pigs, alpacas, puppies and kittens do not all have the same nutrient requirements. For example, the fat content of sheep milk is much higher than cow's or goat's milk and the lactose content is lower.¹

Milk replacers formulated for lambs are better able to provide the nutrients lambs require because they closely mimic the composition of ewe's milk. Composition of sheep's milk on a dry matter basis is at least 25 percent protein and 30 percent fat. The solids level of ewe's milk on as-fed basis is approximately 18 percent solids solution.

Figure 3

Rearing method	Average growth rate (kg/day)
Artificial	0.30 ± 0.004
Natural	0.28 ± 0.004

No significant difference existed between growth rates of AR and NR lambs.



⁷ Faber, S.N., Effects of Colostrum Ingestion on Lactational Performance, Prof. Anim. Scientist, 2005

⁸ DiPastina, Ann. "Evaluating the growth of lambs under artificial and natural rearing methods." Honors Thesis, Cornell University. May 2015.

A lamb's milk replacer should closely match these numbers, with similar protein, fat and total solids.

A simple formula for calculating total solids in the final solution based on the mixing instructions for the lamb milk replacer is:

- $(\text{Weight of Powder} \div (\text{Weight of Water} + \text{Weight of the Powder})) \times 100 = \% \text{ Solids of Final Solution}$

Comparing feed analysis tags on various lamb milk replacers can be confusing. Although the ingredients and specifications may be similar based on the feed analysis tag, it is difficult to truly tell the differences between the product based on this comparison. For example; sometimes tags will have differences in vitamin A (i.e. 30,000 vs. 20,000 IU/lb.). If there is a higher guarantee on one product compared to another, does that make it better? Not necessarily since some nutrients in excess can cause issues.

A more informed decision can be made by asking some key questions of the supplier or manufacturer:

- What research has been done to prove this formula performs in lambs? Ask for a summary of those results.
- Do the ingredient sources utilized in the formula meet human food grade quality standards?
- What are the fat sources and has any consideration been made to formulating not only to a fat level, but to provide the lamb with a specific fatty acid profile?
- Copper considerations: The lamb milk replacer should contain copper at 7 to 11 ppm, since the lamb requires that for normal growth. Molybdenum should also be included in lamb milk replacer.

4. Choosing the right feeding system

There are three primary means of feeding lambs on milk replacer. Bottle feeding, free-choice feeding via a "lamb bar" or an automated system. Choosing the right milk feeding system should be based on which system best fits the lamb raisers facilities, size of operation, labor situation and performance objectives.

Regardless of the feeding strategy, consider the following guidelines:

- Assist lambs for the first few feedings as needed.
- Avoid placing younger lambs with older lambs to prevent competition.
- Hang a light over the milk replacer self-feeding devices for added visibility and warmth.
- Ensure lambs are housed in an area that is clean, dry, well-bedded and well-drained with enough bedding for the lambs to nest.
- Keep ammonia levels low by providing drainage and ventilation.
- Keep feeding systems clean to prevent bacterial build-up. A recommended process is: warm water rinse, hot alkaline detergent solution rinse, acid rinse, dry and disinfect.

Following is a breakdown of feeding strategies⁹:

- **Bottle feeding**
 - Pros
 - Ensures an appropriate controlled volume of (usually warm) milk replacer
 - Useful for rearing small numbers of lambs
 - Cons
 - Very labor intensive feeding and cleaning of the equipment
 - Must feed at the same time each day

- **Lamb bar feeding**
 - Pros
 - Provides opportunity for several lambs to feed ad-lib, so they can drink several times a day
 - Milk can be fed warm or cold
 - Meals can be smaller and more frequently, thereby reducing the potential for digestive upsets
 - Faster growth rates compared with bottle fed lambs
 - Less labor involved: milk replacer is mixed in bigger volumes and it doesn't require holding bottles
 - Cons
 - Diseases can spread more easily through shared nipples
 - Teats and tubing should be cleaned daily
 - Buckets must be emptied and cleaned regularly to reduce the risk of the build-up of pathogens and risk of scours
 - Requires milk replacer to include a preservative

- **Automated mixing and feeding systems**
 - Pros
 - Milk consumed in small quantities and often
 - Low risk of digestive upsets
 - Highest growth rates
 - Cons
 - Highest set up cost
 - Best hygiene critical. Tubing and mixing bowl must be cleaned daily and the machine calibration checked at least once a week

5. Rumen development

The rumen is the main site for nutrient breakdown and absorption in the animal and in other species has been highly correlated to health and performance of the animal.

⁹ Sheep Management Feeding Systems, Mole Valley Feed Solutions Ltd, Head Office, Station Road, South Molton, North Devon EX36 3BH www.molevalleyfarmers.com

Rumen papillae are the finger-like projections inside the rumen that are responsible for absorbing digested nutrients. If a lamb does not have well-developed rumen papillae the potential is there that it may not be able to capture all of the nutrients that are made available to it through the diet.

When a lamb is born, the rumen is not fully developed and neither are the papillae inside the rumen. Growth of the rumen papillae and rumen development can be correlated with what the lamb eats pre-weaning.

There are five requirements to achieve optimal rumen development:

- Substrate (a high quality grain mix)
- Liquid (water, saliva)
- Establishment of beneficial bacteria in the rumen
- Absorptive ability of the tissue (papillae)
- Outflow of material from the rumen (muscular action)

Acetate, propionate and butyrate are the main volatile fatty acids (VFAs) produced from ruminal fermentation. Research demonstrated that calves fed milk and high-quality hay diets to 6 weeks of age had minimal papillae development compared to calves fed milk and grain only.^{10,11} Forage-based diets result primarily in the production of acetate rather than propionate and butyrate which is not optimal for papillae growth. Butyrate or butyric acid is implicated in the stimulation of papillae growth.¹¹

In lambs, papillae development is initially triggered as the lamb begins to nibble on starter. During this period, adequate water in addition to starter is critical to create a rumen environment that supports fermentation and production of VFAs which in turn stimulate the beginning of rumen development.

Promote rumen development by starting lambs on high-quality starter feed at early in life and provide ample high quality clean, fresh water supply at all times.

If the rumen is not developed appropriately, weaning can be delayed, or unsuccessful. Remember, water is a critical ingredient in the development of bacterial growth and the beginning of rumen fermentation.

In addition to the significant calf data that supports the feeding of grain vs. forage for encouraging rumen development, G.A. Abou Ward (2008¹²) reports that creep (grain) fed lambs had heavier ($P < 0.05$) rumen fresh weight (82%) relative to the total fore-stomach weight in

¹⁰ W.P. Flatt, R.G. Warner, J.K. Loosli. Influence of Purified Materials on Development of the Ruminant Stomach, *Journal of Dairy Science*, Volume 41, Issue 11, Pages 1593-16000, Nov. 1958.

¹¹ Baldwin, R. L., VI and K.R. McLeod. 2000 Effects of diet forage concentrate ratio and metabolizable energy intake on isolated rumen epithelial cell metabolism in vitro. *J. Anim. Sci.* 78:771-783.

¹² G.A. Abou Ward, *American-Eurasian J. Agric. & Environ. Sci.*, 3 (4): 561-567, 2008 Effect of Pre-Weaning Diet on Lamb's Rumen Development

comparison with only 70.2% for the solely milk-fed group. The papillary length was in favor of the creep fed lambs (2.24 mm vs 1.15 mm). The creep fed lambs also had higher ($P<0.05$) circumference (mm), surface area (mm^2) and total papillary surface area.

6. Weaning Management

Lambs are ready for weaning when they consume an equivalent of 1.5 percent of their body weight of a high-quality creep feed along with adequate water. This is typically when lambs are near 30 days of age or 35 pounds of weight. At weaning time, each lamb should have consumed at least 25 pounds of lamb milk replacer powder.

Rules of Thumb for Weaning

1. Clean, fresh water available -- always
2. Creep feeding before weaning will encourage a smoother transition
3. Lambs may be weaned when eating at least $\frac{1}{2}$ lb. of creep feed daily.
4. Provide a very high quality, high protein diet at weaning (18 to 25% protein). Some animal or other very high quality protein is required. Utilize partially processed grains in weaning systems; processing may be discontinued as animals reach 50 lbs of body weight
5. The diet must be highly palatable, more so than in any other stage of life. 4 to 6% molasses may be useful to minimize dust and sorting, and may improve palatability. A commercial pelleted diet may be considered to reduce sorting, but intakes tend to be lower than with molasses enhanced, rolled grain diets
6. Consult and follow the guidelines of a lamb ration program as set out by a qualified nutritionist

Steps to Weaning

1. Plan weaning protocol, timing and facilities 14 to 21 days prior to weaning
2. Ensure animals are consuming creep feed
3. Ensure animals are utilizing water
4. Remove milk replacer or ewe (weaning)
5. Feed high protein ration (18 to 25% Crude Protein).

Conclusion

Successfully raising lambs on milk replacer involves implementation of a total management system. Provide newborn care and colostrum, a lamb-specific milk replacer along with quality housing, feed and water to each newborn lamb. By setting goals and outlining attainable action steps throughout the process, sheep producers can help their lambs thrive from day one, setting them up for long-term success.