

3 Common Calf Barn Ventilation Questions Answered



By Ryan Leiterman, D.V.M.
Director of Technical Services

I have been fascinated with calf barn ventilation for more than a decade; to the point where I have made its study the focus of much of my professional career. Calf raisers around the world often have the same questions when it comes to ventilation and this article will discuss the three most common calf barn ventilation questions I receive. Interestingly enough, the questions themselves are often more complicated than their associated answers.

Question #1: Can Calves Get “Too Much” Fresh Air?

Simply put, no. There is no such thing as “too much” fresh air. In the entire history of the world, no calf has ever died from an overdose of fresh air volume. Conversely, untold numbers of calves die every year from inadequate ventilation leading to poor air quality and subsequent respiratory disease.

Consider calves raised in outdoor hutches. While people may not like the labor issues associated with outdoor calf raising, it is an undisputed fact that calf health performance is excellent in outdoor hutch systems. When those calves step outside of their hutch, they are surrounded by an almost infinite amount of fresh, outside air. No calf raiser has ever said “Doc, sometimes I worry about my calves standing outside their hutches being exposed to “too much” fresh air. Do you think it will hurt them?” Calves raised in outdoor hutches have proven for decades that there is no such thing as “too much” fresh air. It’s a simple answer to a seemingly simple question...but is it really a simple question?

Over the years I’ve learned that when people ask me about calves having “too much” fresh air, rarely



While people may not like the labor issues associated with outdoor calf raising, it is an undisputed fact that calf health performance is excellent in outdoor hutch systems. When those calves step outside of their hutch, they are surrounded by an almost infinite amount of fresh outside air.

are they asking about the volume of fresh air that a calf will breathe. Typically, conversations go like this:

Producer: “Doc, can calves get too much fresh air?”

Me: “What do you mean by “too much”?”

Producer: “Well, I don’t want my barn to be drafty.”

Me: “A draft is a measure of air speed, not volume. Are you concerned about air speed and drafts or the actual volume of fresh air brought into the barn?”

Producer: “I just don’t want my calves to be cold.”

Drafts and cold are the real concerns of most calf raisers. When most people ask the question “Can calves have too much fresh air?” what they are

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really asking is “If it’s cold outside and we bring all that fresh air into the barn, won’t that make my calves cold?” or “If we bring in high volumes of fresh air won’t that make it drafty on the calves?”

We cannot adequately answer the question of “too much” fresh air without answering the draft and cold related questions because that is what the vast majority of producers are actually asking about.

What producers are really asking in regards to fresh air:

A. “If it is cold outside and we bring that fresh air into the barn, won’t that make my calves cold?”

Bringing cold outside air into a barn will make the barn cold...not necessarily your calves. Using management tools like frequent bedding with generous amounts of long-stem lofty straw, calf jackets and increased calorie feeding will keep calves warm and healthy despite cold temperatures in the barn.

B. “If high volumes of fresh air are brought into the barn, won’t that make it drafty on the calves?”

The simple answer: It depends. Some ventilation systems can bring in high volumes of fresh air without creating a draft and others cannot. The ideal calf barn ventilation system should adjust along with seasonal changes to provide heat abatement during periods of heat stress and provide safe, draft-free ventilation when it’s cold.

Question #2: What is a Draft and Should They be Avoided?

Webster’s dictionary defines a draft as “a current of air”. This definition implies that it is neither good nor bad. We know that currents of moving air increase heat removal rates through the convective process. If you burn your finger on a stove, you will probably blow on it. Why? Because we inherently know that by increasing airspeeds over a surface, we can cool the object faster. Moving air has the ability to strip heat off objects. This is the key to understanding drafts as they relate to calves.

In 1986, a paper by the American Society of Agricultural and Biological Engineers titled “*Design*

of Ventilation Systems for Poultry and Livestock Shelters” defined a draft as “airspeeds in excess of 29.5-59 feet per minute”. A definition with this level of precision makes nice lecture material for freshman veterinary students but leaves calf raisers looking for something more tangible. Most ventilation professionals today have universally accepted 60 feet per minute (0.68 miles per hour) as a draft threshold of pre-weaned calves during times of cold weather.

In the case of cold weather, drafts are to be avoided because they will exacerbate cold stress. But, in the case of hot weather, the convective properties of drafts can help calves stay cool.

Young calves have a thermoneutral zone (TNZ) of 50 to 78 degrees Fahrenheit (Wathes et al, 1983) where they burn no additional calories to maintain body temperature. This means that when temperatures dip below 50 degrees Fahrenheit calves begin to burn calories to stay warm and above 78 degrees Fahrenheit, they burn calories in metabolic cooling processes.

Simply put, when it is above 78 degrees Fahrenheit, calves can benefit from high-speed air, 2 miles



An anemometer is a windmill-style air speed meter.



per hour or greater, to assist in heat abatement. In this case, drafts over 2 miles per hour have also been shown to help reduce fly pressure on calves as well as help keep bedding dry. During heat stress, drafts are good for calf health.

When it is below 50 degrees Fahrenheit calves should not be exposed to airspeeds greater than 60 feet per minute in order to prevent excess convective heat loss. There is a grey area about how to ventilate for temperatures between 50 and 78 degrees Fahrenheit. Science has yet to pin down an ideal airspeed vs. ambient temperature relationship. Until that day comes, calf raisers are left to use their experience to guide their decision-making process.

Question #3: What is the Most Important Factor to Consider When Designing a Ventilation System?

There are three major criteria that must be considered when designing a calf barn ventilation system. They are:

1. How much fresh air volume needs to be brought into the barn?
2. How is the air speed at the calf level going to be controlled?
3. How is the fresh air going to be effectively distributed into the calf space?

Of these three criteria, the most important one is effective fresh air distribution into the calf space. Calculating the correct air volume and making it non-drafty in the winter does no good if that fresh air does not reach the calf. All too often people think about ventilating the barn, when what should be addressed is the effective ventilation of the calf space, however that is defined. In a barn with two rows of 25 individual calf pens, the major concern is effective delivery of air into the calf pens themselves. Instead of thinking about ventilating the barn as a whole, envision two narrow rectangles, each of them being 7 feet wide x 4 feet tall x 100 feet long. Those narrow rectangles of calf penning within the barn represent the space in which the calves are living and more importantly, breathing. Everything in the design considerations needs to focus on effective delivery of air into that small space.

When it comes to the science of calf barn ventilation, there is still a lot for us to learn. As our knowledge on this topic progresses, it often seems there are more questions than answers. We are beginning to understand how the interrelationships between air speed, volume, distribution and temperature all impact air quality. Understanding these interrelationships will allow us to create better ventilation systems that ultimately improve calf health.

For a deeper understanding of the differences between varying styles of ventilation systems and their associated pros/cons read "*Winter Calf Barn Ventilation: Can Calf Barns Really Have Too Much Fresh Air in the Winter?*" published in the December, 2017 Crystal Creek® Newsletter.

Dry Cow Nutrition and Management: The Key to Quality Colostrum



By Erik Brettingen, B.S.

Colostrum is one of the most important factors in raising healthy calves. Besides assuring a healthy start to the calf's life, colostrum is known to have positive effects that increase a calf's potential as a 1st lactation heifer. Colostrum

is commonly credited for providing antibodies like immunoglobulin G (IgG), but it also supplies hormones, white blood cells and calories. With colostrum being such a vital component of calf health, it is of paramount importance that cows produce adequate volumes of high-quality colostrum. Dry cow vaccination protocols, management practices, and most importantly, dry cow nutrition, all have far-reaching influences on colostrum production and colostrum quality. Guidelines for measuring colostrum quality can be found in the calf section of Crystal Creek's annual product catalog.

Vaccinations and Colostrum Quality

Successful vaccination of cows during the dry period creates targeted immune responses to common pathogens that cause health issues in calves. When cows produce an immune response, it stimulates the body to create antibodies, ultimately passing those antibodies into the colostrum. Rotavirus and coronavirus are two common scour causing viruses that cows can be vaccinated for during the dry period to give the cow what is needed to protect her calf. Dry cow vaccination does not impact the volume of colostrum produced but it can significantly improve the quality of the colostrum produced.

Dry Cow Management and Housing

Bunk Space and Weigh Back: The pre-fresh dry cow diet is essential for colostrum production, but even the perfect diet will fail if cows cannot

access it freely. Pre-fresh dry cows need 30" of bunk space per cow. Less than this can create competition at the bunk and smaller, or more timid cows, may not be able to spend enough time at the bunk to maintain adequate dry matter intake. Likewise, if the diet is balanced perfectly, but the bunk is empty for 5 hours of the day and the cows have nothing to eat, the diet will fail and fresh cows will not perform, or produce colostrum like they should. Pre-fresh cows should be fed to a targeted 5% weigh back to maximize dry matter intake.

Housing and Cow Comfort: Just like bunk space, resting space is imperative for pre-fresh cows. Rest is critical for rumination and comfort. Never stock pre-fresh cows over a 100% stocking density. No more than 1 cow per stall with free stalls and no more than 1 cow per 100 square feet on a bedded pack. According to Cornell University, an 80% stocking density is ideal for fresh cow performance in order to provide for appropriate colostrum and peak milk production.

Dry Cow Nutrition

Dry cow nutrition is the main factor in colostrum production and is also the easiest element to change and/or control compared to housing and bunk space. Dry cow nutrition directly impacts immune function, nutrient delivery, and the chance of metabolic diseases occurring that can decrease colostrum production. Vital components in the pre-fresh ration include mineral balance, metabolizable protein levels, and energy level.

Mineral Balance: Mineral balance is key for reducing the prevalence of milk fever and low levels of blood calcium (hypocalcemia). Calcium, potassium, and the overall DCAD (Dietary Cation-Anion Difference) balance help reduce the risk of calcium related fresh cow issues that can reduce colostrum production and fresh cow performance. Trace mineral and vitamin levels are more involved in supporting the immune system of the pre-fresh cow and for antibody production. Zinc, selenium,



and vitamin E are specifically important for immunity and supporting antibody production in colostrum. Crystal Creek® uses 100% chelated zinc as a zinc source and 100% Selenium Yeast as a selenium source to maximize bioavailability of these key trace elements to pre-fresh cows. Crystal Creek® also supplies high levels of vitamin E, a powerful antioxidant that supports antibody production in colostrum, general immunity of the fresh cow, and mammary health.

Metabolizable Protein: Metabolizable protein is one of the most common offenders in pre-fresh dry cow diets when poor colostrum production is an issue. With colostrum being 14% protein, there is a huge amino acid demand on the cow at calving. To correctly balance for metabolizable protein supply to the cow, the nutritionist must have a very accurate understanding of cow size, age and exact dry matter intake. Beyond that, the ration must be balanced using a rumen model. The majority of the metabolizable protein a pre-fresh cow needs is generated by her own rumen microbes. The

amount of metabolizable protein coming from the microbes is completely related to the fiber digestibility of the forages consumed and the other carbohydrates balanced with the rumen degradable protein components of the diet. Without measuring fiber digestibility and using a program that models microbial activity in the rumen, it is very possible for metabolizable protein levels to be inadequate for colostrum production in pre-fresh cows. On the opposite side of the spectrum, with highly digestible forages, you may be over feeding protein and wasting money.

Energy Balance: Energy balance is a “thread the needle” situation in pre-fresh dry cow diets. If too little energy is provided, pre-fresh cows may lose weight and will not have the energy needed to produce 4 quarts of colostrum, which is very energy and calorie dense compared to whole milk. With too much energy, cows will put on weight before calving, adding body fat, resulting in an increased risk of ketosis after calving. Once again, the nutritionist must use a rumen model and have accurate knowledge of dry matter intake. Dry matter intake drives overall energy supply to the cows and the fiber and starch digestibility of forages controls how much metabolizable energy the cow will get from the forage. The goal with pre-fresh cows is to maximize dry matter intake while maintaining an energy balance of 100% to 110% of the pre-fresh cow’s requirement.

If you are having colostrum quality or quantity issues, or experiencing poor transition cow health in general, Crystal Creek® can help. Exploring dry cow management options and providing the proper diet for pre-fresh cows can provide solutions for your herd. Contact Crystal Creek® at 1-888-376-6777 to speak with a nutritionist today.

References available upon request.

Nutrient Deficiencies in Small Ruminants



By Alex Austin, B.S.

A balanced diet is important for the health and productivity of all livestock. This article will discuss some of the more common nutrient deficiencies/imbalances in both sheep and goats. Minerals, specifically, are all connected and

work together to keep animals healthy and productive. An excess or deficiency of one can lead to imbalances in another, causing potential health issues. For example, excess calcium can cause the blood vessels to lose vascular tone and eventually rupture. Potassium works with sodium to regulate the body's water balance. It is important to be able to identify any signs of imbalance in order to correct and prevent issues in a herd.

All nutrients have recommended feeding rates for livestock based off species, life stage, production and performance level. This article will specifically discuss calcium, phosphorous, copper, selenium and vitamin E along with the potential health issues that can arise when they are not fed at the correct amount or ratio. **Figure 1** lists the recommended daily consumption rates of nutrients for sheep and goats as per the National Research Council's edition of 'Nutrient Requirements of Small Ruminants.' Recommendations will vary based on the animal's size and life stage. To learn more about the nutrient requirement differences between

sheep and goats, see the article '*The Myth of "All-In-One" Small Ruminant Feed and Mineral*' from the Crystal Creek® December 2019 Newsletter.

Calcium and Phosphorous: Both calcium and phosphorus are critical for proper growth, production and overall health of the animal. Sheep and goat rations should be balanced to meet the animal's requirements, but careful attention should be paid to the vitamin and mineral ratio as well. The ratio of calcium: phosphorus should be between 1.2:1 to 2:1. Excess and/or imbalances of both can result in bladder stones, leading to urinary issues. This condition occurs commonly in male sheep and goats. While most often seen in castrated males, it can also be seen in intact rams or bucks.

Epiphysitis is another issue that can result from an improper balance of calcium: phosphorous. Epiphysitis is also called bent, or wind-swept legs. It results in bowing of the lower leg bone and can be in one or both legs. Excess calcium in the diet at a ratio of 1.8:1 or greater can lead to this disorder. Rapidly growing kids, young does that are late in pregnancy with multiple kids, or does in early lactation that milk heavily, are the most susceptible.

Copper: Copper is required for red blood cell formation, wool/coat color and texture, connective tissue development and the formation of enzymes. Copper is one of the most significant requirement differences between sheep and goats. Goats require 6x the amount of copper compared to sheep. When sheep consume copper above the required amount, the excess is stored in the liver. Once it builds up in the liver, signs of copper toxicity can occur, including dark urine due to the destruction of red blood cells, liver damage and jaundice. Even though sheep are sensitive to toxic levels of copper, the daily requirement for copper still must be met. Unlike other ruminant species, lambs have a lower blood copper level than their ewes when born. This means, if a ewe is deficient, the lamb will be born deficient or will not have enough reserves and show signs of deficiency within a few days of birth. Common signs of copper deficiency in both sheep

Figure 1

RECOMMENDED DAILY CONSUMPTION RATES OF NUTRIENTS FOR SHEEP AND GOATS

Mature Ewe 176 lb.		Mature Dairy Goat 176 lb.	
Calcium	2.60g	Calcium	2.80g
Phosphorus	2.20g	Phosphorus	2.40g
Copper	5.30mg	Copper	31.00mg
Selenium	0.05mg	Selenium	0.18mg
Vitamin E	424 IU	Vitamin E	424 IU



and goats include discolored, rough hair coat, anemia, diarrhea and weight loss. Molybdenum can decrease the absorption of copper. In high molybdenum areas, extra copper may be needed.

Selenium and Vitamin E: Selenium and vitamin E are listed together because they work together to prevent and repair cell damage in the body. They also play a vital role in lamb and kid vigor at birth, muscle and bone development and immune function. Deficiencies of one, or both, selenium and vitamin E could result in a poor immune response, poor performance in youngstock, fertility issues in ewes and does and white muscle disease. Lambs and kids affected by white muscle disease appear weak with a poor suckling reflex, slow movements and arched backs when laying down. In many agriculture areas, selenium is deficient in the soil, but there are also areas with high levels. Being aware of the selenium level in your area is important. Toxic levels of selenium can result in hair loss, diarrhea and lameness.

When balancing a diet, it is important to know the minimum and maximum amounts of nutrients

recommended, as there can be benefit to feeding more than the recommended daily value. Crystal Creek® utilizes NDS ration balancing software to balance rations for livestock. The program helps the nutritionist see areas of potential deficiencies or excess. Once a ration is balanced, the software program also gives potential average daily gain predictions as well as potential milk production. This is very beneficial when working with producers to meet production goals.

A properly balanced diet, along with bioavailable sources of minerals and vitamins, is required to maximize animal performance. Crystal Creek® offers both a sheep and goat mineral to meet each species specific nutrient requirements. Custom ration balancing comes with the purchase of the mineral to ensure nutrient requirements are met for all stages of production. To learn more about the Crystal Creek® Small Ruminant Nutrition Program, call 1-888-376-6777 to speak with one of our knowledgeable nutritionists or livestock specialists.

References available upon request.

Inoc-U-Lock™ Forage Ensiling Program

Crystal Creek® knows you work hard planting and harvesting your crops. Dry matter retention and feed quality should not be left to chance with a wild, or incomplete ensiling process. Visit us online at <https://crystalcreeknatural.com/videos/> to view the Inoc-U-Lock™ product video, which explains the importance of a rapid, complete fermentation process, or read the article below and talk with your Crystal Creek® nutritionist today.



1



With an entire year's worth of forage on the line, there is too much at stake to let a slow or incomplete fermentation process jeopardize your ensiled feedstuffs.

2



To protect your forage investment, Crystal Creek® is here to help; with an inoculant program that provides a rapid and controlled fermentation process. The faster the fermentation is completed, the better quality forage you will have to feed.

3



That's why the Inoc-U-Lock™ family of inoculants contain specialized strains of bacteria and enzymes that work together to promote a rapid and complete fermentation.

4



The specially selected strains of bacteria used in Inoc-U-Lock™ each serve a specific purpose.

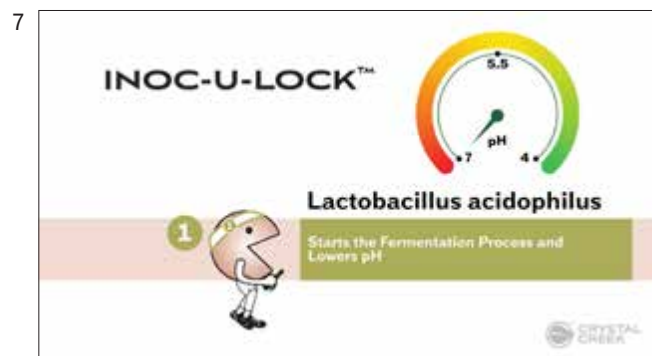
5

INOC-U-LOCK™	
5 STRAINS OF BACTERIA	OPTIMAL pH RANGE
Lactobacillus acidophilus	8.5 to 3.5
Pediococcus pentosaceus	7.5 to 4.2
Pediococcus acidilactici	7.5 to 4.2
Lactobacillus plantarum	7.8 to 2.0
Propionibacterium freudenreichii	6.5 to 4.0

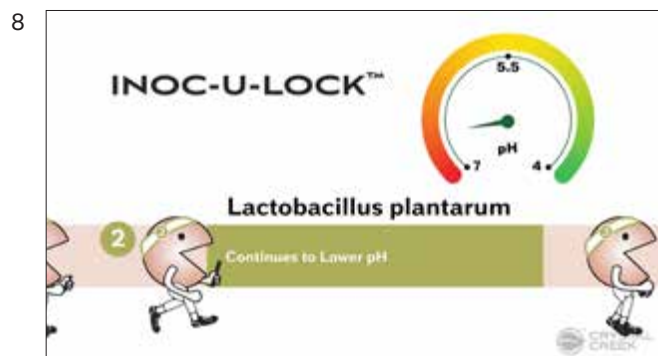
Each strain of bacteria has an optimal pH range that it thrives in.



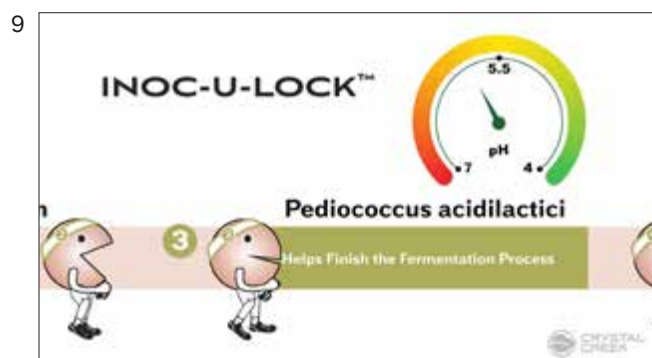
Think of the Inoc-U-Lock™ fermentation process like a relay race, with the finish line being a stable, preserved forage.



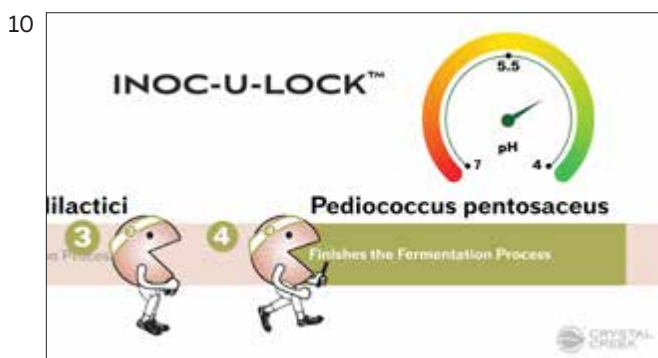
The first strain of bacteria activates in the high pH of fresh forage ...



... and drives the pH down into a lower range,



activating the next strain of bacteria.

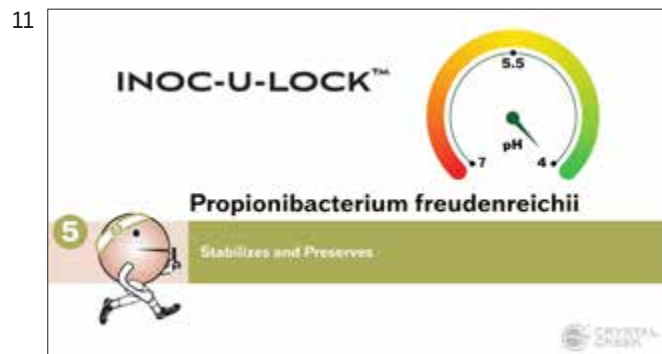


This process continues ...

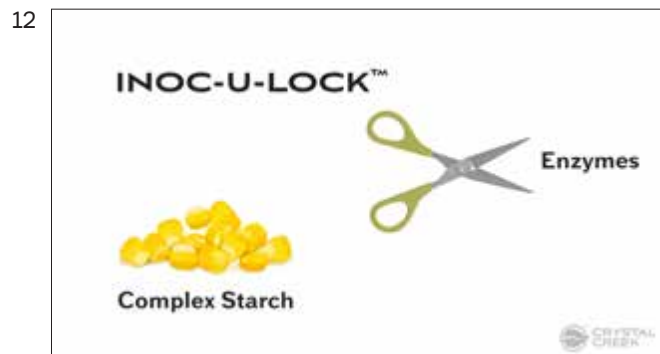
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Inoc-U-Lock™ Forage Ensiling Program

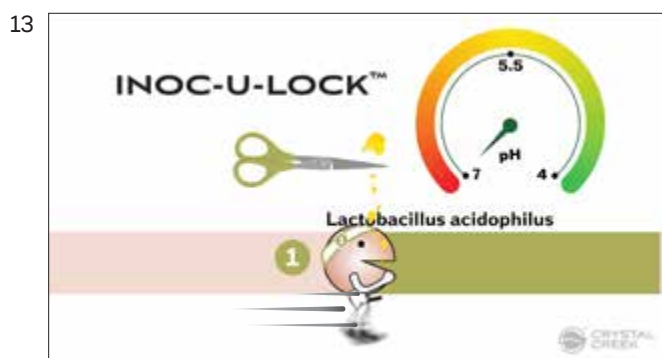
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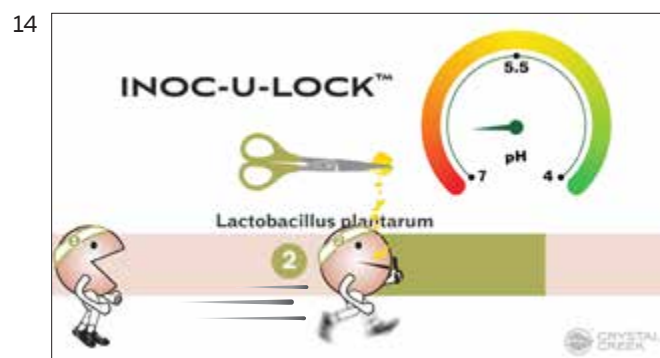
... with each strain of bacteria driving the pH of the forage down.



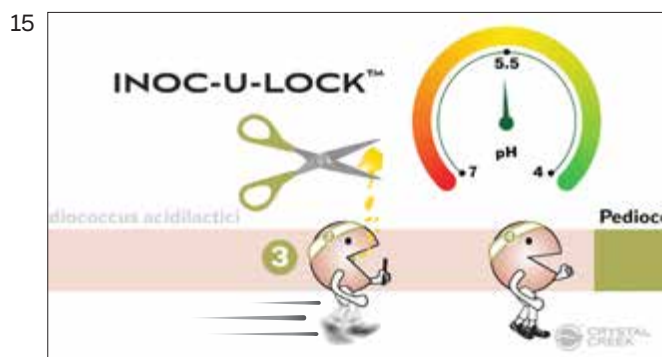
The enzymes in Inoc-U-Lock™ support a fast fermentation process by breaking up the plant's complex starches into simple, soluble sugars.



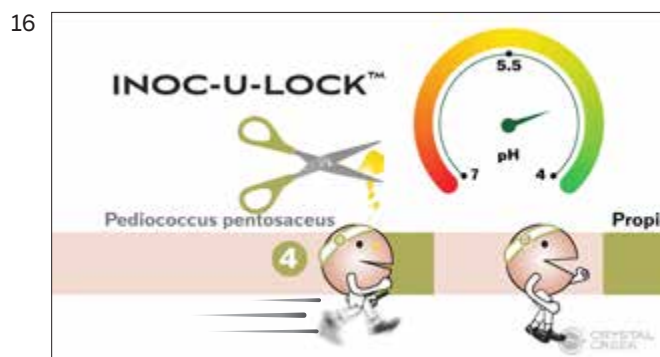
These soluble sugars feed the Inoc-U-Lock™ bacteria ...



... allowing them to produce ...

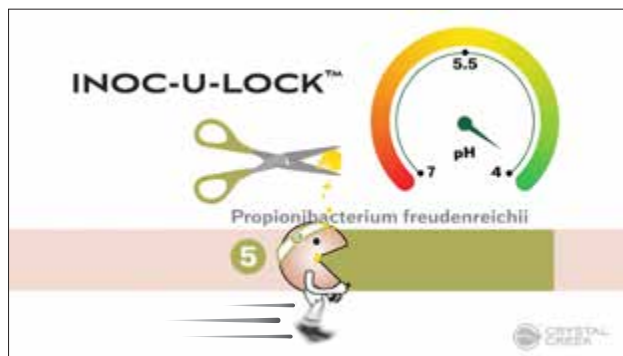


... the fermentation acids more rapidly.



This process ensures the pH of the forage ...

17



... is driven down quickly and effectively.

18



Additional bacteria stabilize the feed when oxygen is reintroduced during facing and feed-out.

19



Rapidly fermented forages have been proven to retain more dry matter and protein ...

20



...while having increased palatability and digestibility
...leading to increased profitability for your operation.

21



The Inoc-U-Lock™ family of forage inoculants can be used in conjunction with different applicator styles and comes in both dry and water-soluble formulas. Don't leave your forage quality to chance. Crystal Creek® has an effective, economical solution for preserving and stabilizing your forage inventory.

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For more information, contact Crystal Creek® or your local Crystal Creek® dealer. We'd be happy to discuss how our forage preservation products can work on your operation. Call 888.376.6777 or visit us online at crystalcreeknatural.com.

Colostrum: More Than Just Antibodies



By Cassidy Golburg, B.A.
Livestock Specialist

The benefits of colostrum in regards to antibodies are well known. Colostrum has many other qualities to offer including high calorie content, valuable white blood cells and certain naturally occurring hormones. All of these components can have

positive effects on a calves' gastrointestinal health, growth, development and immune health.

Antibodies

The intestine is more receptive to absorbing large molecules such as antibodies within the first few hours after a calf is born. Absorption is

optimal within 4 hours of birth. Absorption will start to steadily decrease after six hours. Feeding enough colostrum to provide the calf with 200 IgGs within the first few hours of birth will have the most benefit. Using a Brix refractometer will help ensure the quality of the colostrum to maximize those assets. Colostrum should ideally have a minimum 23 percent Brix reading.

Nutrients

Colostrum is high in calories and contains a higher fat and protein content than milk. Feeding a newborn calf 4 quarts of colostrum can provide the nutritional requirement needed for an 85 pound Holstein. If the calf is under any heat stress, cold stress, or experiences a difficult birthing, the nutritional requirement may be higher.





The fat content in colostrum is 6.7%, compared to 3.9% in whole milk. Likewise, crude protein is at 14% compared to 3%. The high fat content, which is easily absorbed by the calf, can provide vital energy to the calf to help it regulate its body temperature. Colostrum also contains higher amounts of vitamins and minerals including vitamins A & E, and minerals such as magnesium, iron, zinc and calcium.

Figure 1 shows information collected in a case study designed to evaluate the effects of feeding two different volumes of colostrum immediately after birth. Feeding 4L of colostrum, rather than 2L, had a positive effect. Not only did the animals have a higher average daily gain but they produced

more milk in both the first and second lactation. The animals also had reduced veterinary costs compared to those who received 2L of colostrum.

Leukocyte White Blood Cells

Colostrum contains many types of beneficial cells, including leukocytes. Leukocytes are white blood cells that are transported to an area of infection or inflammation. A study conducted in 2006 found that the white blood cells from a dam are modified in the mammary gland to be more functional to the calf. Another study done in 2008 found that when the white blood cells from the mother are absorbed by the calf, they help immune cells to mature faster and improve the ability of the immune cells to recognize certain antigens. Dams in this study were vaccinated against BVDV (Bovine Viral Diarrhea Virus) with an inactivated vaccine and then the calves were exposed to pathogens. The calves given colostrum from the vaccinated dams had a stronger immune response than those not given the colostrum. Calves given maternal colostrum also had improved respiratory health during the course of the study. These findings all support the importance of having a colostrum management protocol, resulting in optimum calf health and performance.

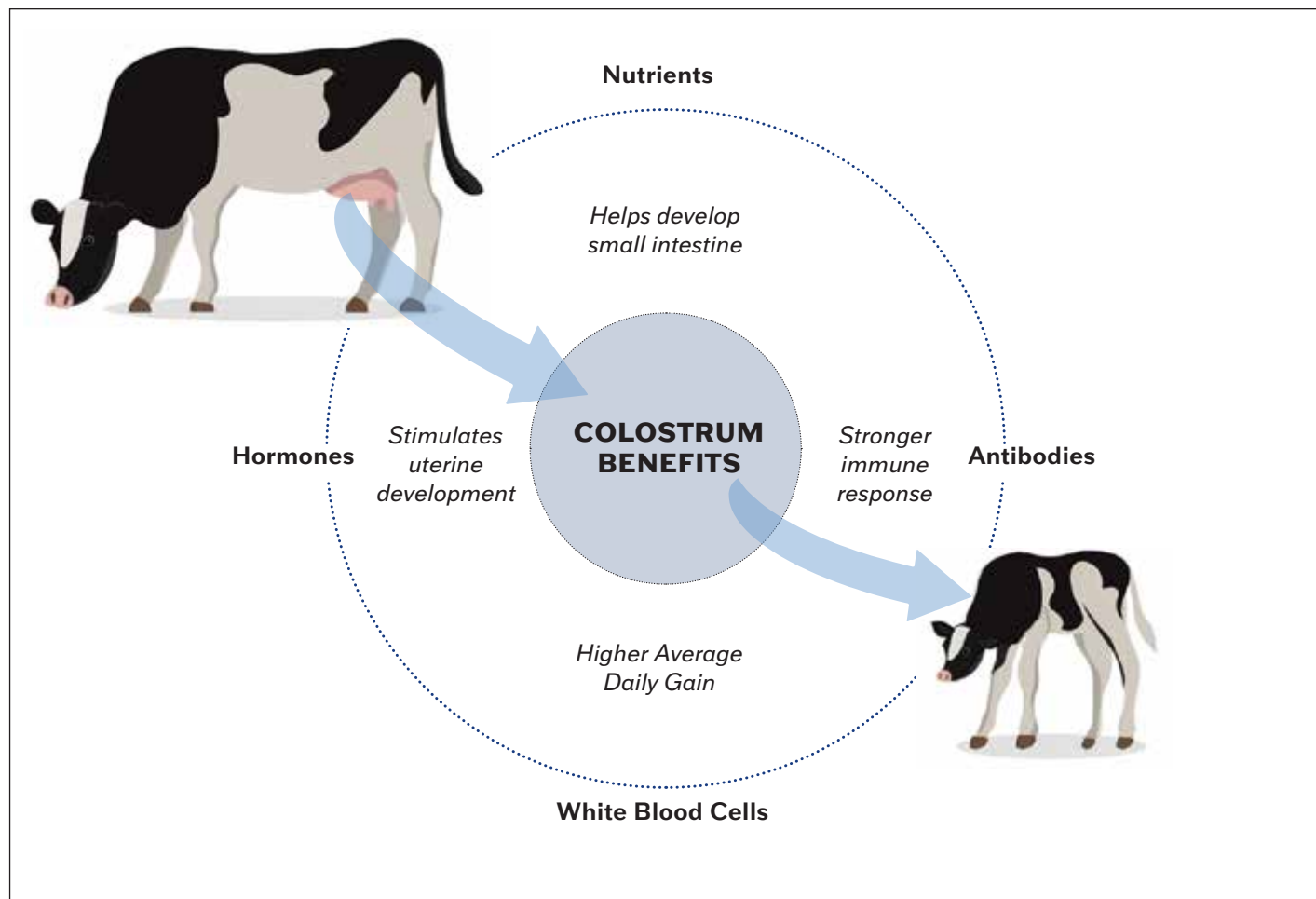
Figure 1 BENEFITS OF FEEDING
2 Liters vs. 4 Liters OF COLOSTRUM ON LACTATIONAL
PERFORMANCE OF BROWN SWISS

	2 Liters	4 Liters
Daily Gain	1.76 lb./hd./day	2.2 lb./hd./day
Age at Conception	14 months	13.5 months
Survival Past 2 nd Lactation	75.30%	87.10%
Milk Yield 1 st & 2 nd Lactation	35,297 lb.	37,558 lb.

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Colostrum: More Than Just Antibodies

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Naturally Occurring Hormones

Colostrum contains several naturally occurring hormones that have a direct impact on a calf's gastrointestinal and reproductive systems.

A study conducted in 2010 showed that calves fed colostrum six times over the first three days of life showed a stronger development of the small intestine than calves not given colostrum. This study also showed stronger development when the calf was given colostrum only once. Development of the small intestine allows calves to absorb nutrients more effectively, leading to higher average daily gains and improved post weaned intake.

These hormones also influenced the growth of a calf's reproductive system. The hormones present in colostrum stimulate the growth of the uterus

leading to a younger age at conception. One study found that heifers fed colostrum had larger, more actively cycling ovaries at 14 months of age compared to similar age heifers that received colostrum replacer powder as baby calves.

The benefits of feeding high quality colostrum can affect calves in many ways including improved gastrointestinal development, earlier breeding potential and increased herd longevity. Simple management practices including feeding calves the appropriate amount and quality of colostrum at the right time will help ensure healthier calves. Call Crystal Creek® and learn how you can get the most out of your colostrum program.

References available upon request.



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