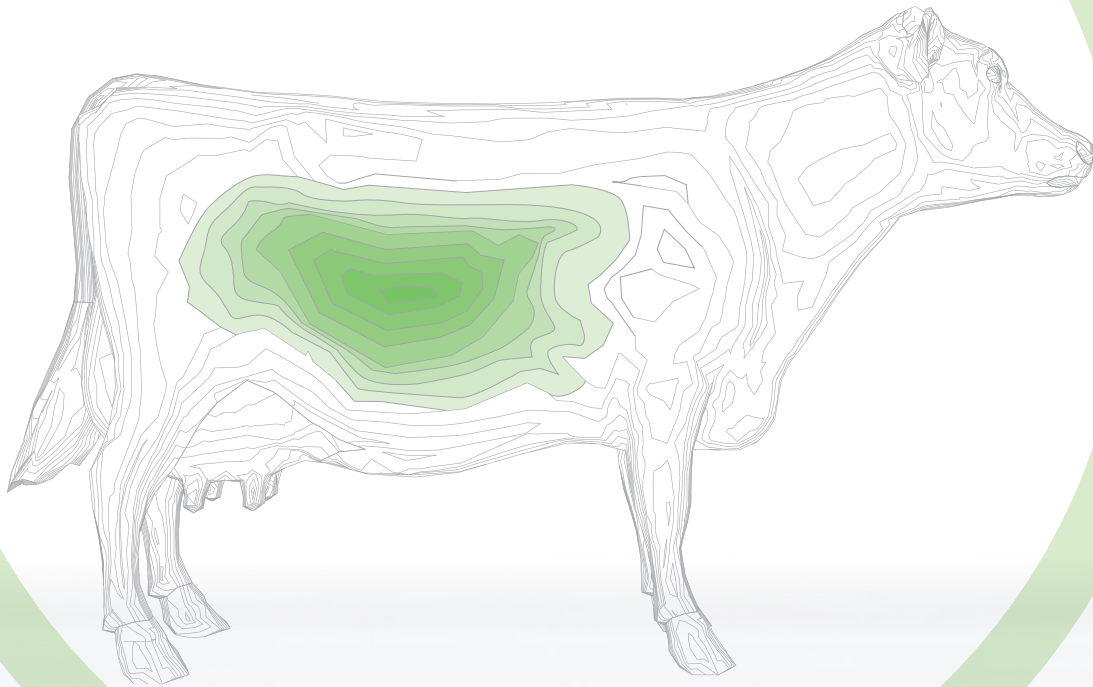


NitroShure[™]

Precision Release Nitrogen

FEED THE MICROBES
THAT FEED YOUR COW



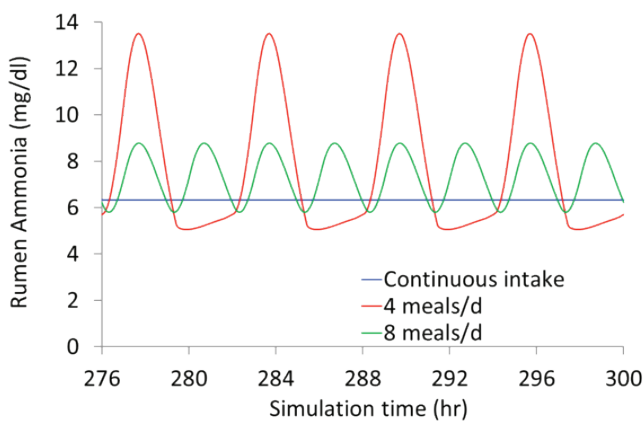
balchem®

NitroShure™

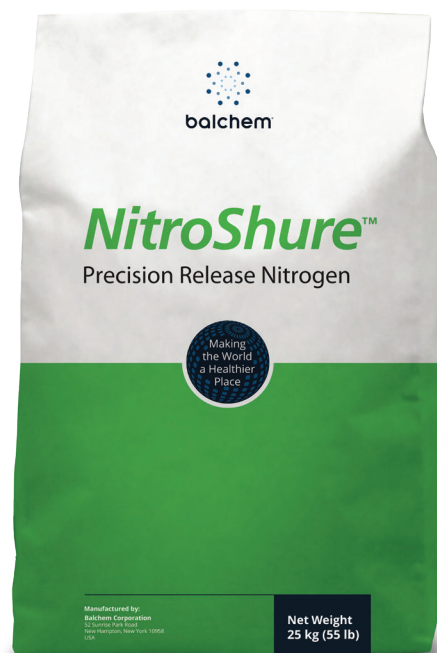
Precision Release Nitrogen – A TMR for her Microbiome

NitroShure releases nitrogen into the rumen over several hours, synchronizing ammonia availability more closely with readily available sources of carbohydrates like sugars and ground corn, and with carbohydrate sources that take longer to become available, like the fiber found in hay and silage. When ruminal nitrogen and carbohydrate availability are in balance and accessible to rumen microbes, the overall microbial population and biomass increases, leading to many benefits for the cow and improved profitability for the operation.

FIGURE 1
THEORETICAL RUMEN AMMONIA LEVELS WITH VARYING MEAL PATTERNS SIMULATED IN CNCPS V7



Dr. Mike Van Amburgh, Cornell University



NitroShure™

Precision Release Nitrogen

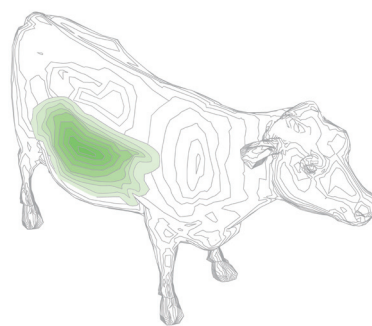
The Care and Feeding of the Microbiome

In many ways, feeding the rumen microbiome is more complicated than feeding the cow. When the nutritional needs of the rumen microbes are consistently met, desirable microbes will flourish, increasing rumen efficiency and microbial protein production while helping to maintain a stable rumen environment. When those needs are not met adequately, desirable microbe populations will decrease, allowing lactic acid-producing microbes to proliferate. These undesirable microbes can reduce rumen pH, leading to acidosis and decreased rumen productivity.

Just like a TMR for dairy cows, a properly balanced diet for the microbiome delivers adequate quantities of important nutrients to the microbes in synchrony, throughout the day. For microbes, these important nutrients include nitrogen sources such as ammonia, which is the preferred source of nitrogen for fiber-digesting bacteria. It also includes carbohydrates like sugars, starch and cellulose that degrade at different rates and thus become available at different times throughout the day. It is important to synchronize the availability of nitrogen in the form of ammonia (NH₃) with the availability of the carbohydrates.



Meet Cows' Needs with Improved Microbial Output



Maximize Microbial Protein Yield and Quality

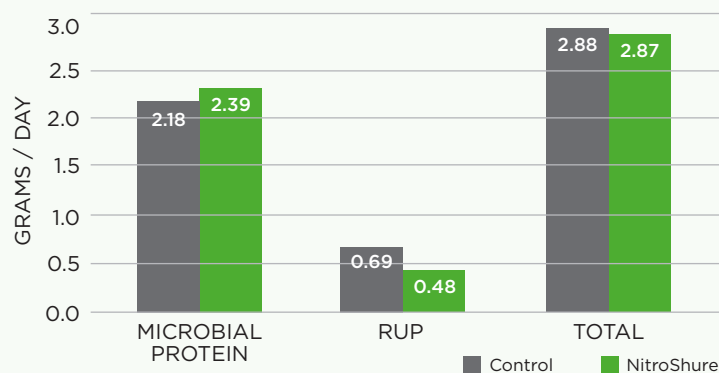
Microbial mass is an important source of metabolizable protein for dairy cows, contributing about one-half to two-thirds of the amino acids absorbed by ruminants.

Microbial protein is the highest quality protein for cows with an amino acid composition very similar to cow's milk and virtually identical to what the mammary gland requires for milk and milk protein synthesis.

When nitrogen and carbohydrate availability are in synchrony and accessible to rumen microbes, the microbial biomass will expand. This increase in biomass creates additional high-value, high-quality, homegrown protein for the cow while reducing the amount of supplemental protein needed in the diet.

Research conducted by Garrett et al. (2005) showed that replacing a portion of the soybean meal with a blend of NitroShure, corn and molasses delivered an equivalent amount of metabolizable protein by generating more microbial mass. This represented 286 grams/day more microbial mass. This represented 286 grams/day more microbial protein in a cow eating 22.5 kg dry matter (Figure 1).

FIGURE 1
IMPACT OF PARTIALLY REPLACING SOYBEAN MEAL (CONTROL) WITH A MIXTURE OF NITROSHURE, CORN AND MOLASSES (NITROSHURE) ON NON-AMMONIA NITROGEN FLOW



Garrett et al., 2005

Improve Fiber Digestion and Dry Matter Utilization

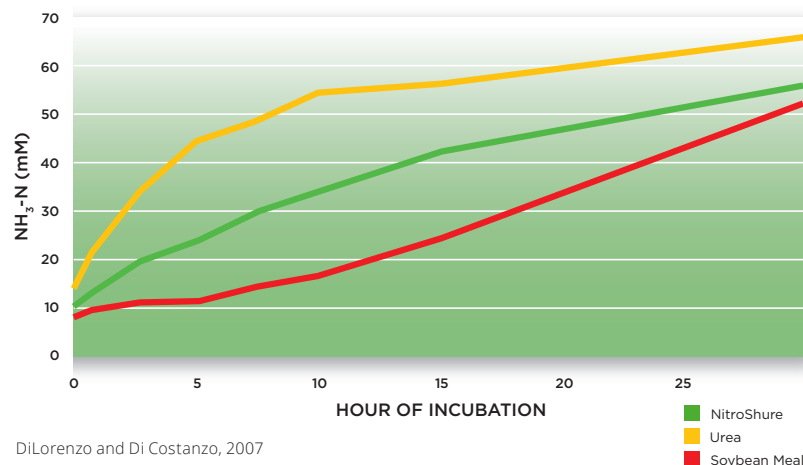
Ruminal fermentation produces volatile fatty acids (VFAs), which provide approximately 70% of the total energy requirement for ruminants. The primary VFAs (acetate, propionate, and butyrate) are used by the microorganisms for reproduction and growth, with the balance of the production being used by the animal.

Synchronizing nitrogen with carbohydrate availability provides the balanced nutrition required by fibrolytic bacteria, accelerating population growth and fiber fermentation while increasing the VFAs (energy) available for the cow.

Furthermore, some of the more abundant fibrolytic bacteria species like *Megasphaera elsdenii* metabolize lactate as an energy source, which has the added benefit of raising rumen pH.

NitroShure is proven to fill the gap between fast-release urea and the slower nitrogen release of traditional protein sources to better balance nitrogen and carbohydrate availability in the rumen (Figure 2). This balance can increase rumen microbial populations and fermentation efficiency, improving fiber and carbohydrate digestibility and microbial protein yield.

FIGURE 2
ABILITY OF NITROGEN SOURCES TO PROVIDE NH₃-N FOR RUMEN MICROBIAL PROTEIN SYNTHESIS



DiLorenzo and Di Costanzo, 2007

Make the most of your homegrown forages and optimize the rumen microbiome. Include NitroShure™ *Precision Release Nitrogen* in your ration to maximize microbial protein yield and quality, improve fiber digestion and dry matter utilization, lower your farm's carbon footprint and reduce your out-of-pocket feed costs. Visit Balchem.com/NitroShure or contact your local Balchem representative to learn more.

Maximize Homegrown Feeds and Reduce Out-of-Pocket Feed Costs

In an era of volatile milk prices and escalating input costs, success depends on efficiency. The ruminant animal is the model of efficiency when it comes to the ability to convert fibrous feeds, low-quality protein and non-protein-nitrogen into valuable nutrients.

Replacing less dense sources of protein with NitroShure can create up to two pounds of dry matter space in the ration. The additional space can be used to increase dietary levels of forage, non-fiber carbohydrates or other key ration ingredients to improve milk and milk component production.

This strategy can also reduce out-of-pocket feed costs. By more efficiently utilizing homegrown forage, producers can reduce other purchased protein sources. In a research experiment conducted by Garrett et al. (2005), dry matter, NDF and total carbohydrate digestion increased when a portion of the soybean meal within the diet was replaced with NitroShure (Table 3). This increase in digestibility of key nutrients leads to more total energy for the cow.

NitroShure is a cost-effective protein source for dairy rations and can reduce the reliance on vegetable protein sources, which can be more expensive and volatile in price.

TABLE 3
NUTRIENT DIGESTION COEFFICIENTS FOR A DIET CONTAINING SOYBEAN MEAL (CONTROL) OR REPLACING A PORTION OF THE SOYBEAN MEAL WITH A MIXTURE OF NITROSHURE, CORN AND MOLASSES (NITROSHURE)

| Item | Control | NitroShure™ | Difference |
|---------------------------------|---------|-------------|------------|
| Dry Matter | 60.0% | 65.6% | 9.3% |
| Crude Protein | 77.6% | 84.8% | 9.3% |
| NDF | 53.7% | 59.4% | 10.6% |
| ADF | 52.5% | 55.3% | 5.9% |
| Total Carbohydrate ¹ | 46.6% | 50.7% | 8.8% |

¹gNDF + g NSC digested per day
Garrett et al., 2005

Make the World a Healthier Place

Our world population is growing at a mind-boggling pace of 200,000 each day and is expected to exceed 9 billion by the year 2040. We are already overusing our planet's ability to regenerate resources by 160%.

As a leader in animal feed technologies, Balchem is perfectly positioned to help drive the innovations that will change our future. We are helping livestock producers accomplish more with less and discovering unique products that will produce food most efficiently. We're focused on moving toward a more secure and sustainable future.

NitroShure helps cows better utilize homegrown forages, reducing the amount of land required to support profitable milk production while also reducing the amount of nitrogen excreted into the environment. NitroShure also lowers the carbon footprint of a ration by replacing high-carbon ingredients like soybean meal that carry a high carbon burden, while still maintaining high production.

Supplementation of NitroShure can increase efficiency by improving milk component yields as compared to feeding raw urea. In a 2010 study by Highstreet et al., feeding NitroShure versus urea improved overall lactation performance (Table 4).

TABLE 4
EFFECT OF FEEDING NITROSHURE VERSUS UREA ON LACTATION PERFORMANCE OF DAIRY COWS

| Variable | Control - Urea | NitroShure™ | P Value |
|-------------------------------|----------------|-------------|---------|
| High Cows DM Intake, lb/d | 62.6 | 63.3 | NS |
| High Cows Milk Yield, lb/d | 103.4 | 105.0 | 0.14 |
| High Cows Fat Yield, lb/d | 3.66 | 3.81 | 0.01 |
| High Cows Protein Yield, lb/d | 2.86 | 2.95 | 0.01 |
| High Cows Milk Fat % | 3.57 | 3.67 | 0.01 |
| High Cows Milk Protein, % | 2.78 | 2.82 | 0.01 |
| MUN, mg/dl | 13.3 | 13.6 | 0.11 |

Highstreet et al. (2010), *Livestock Science* 129:179-185.

THIS IS ANIMAL NUTRITION & HEALTH

RUMINANT

ReaShure®
Precision Release Choline

AminoShure®-XM
Precision Release Methionine

AminoShure®-L
Precision Release Lysine

NiaShure™
Precision Release Niacin

NitroShure™
Precision Release Nitrogen

VitaShure®-C
Precision Release Vitamin C

KeyShure®
Chelated Minerals

KeyShurePlus
Amino Acid Chelated Minerals

MONOGASTRIC

PuraChol
Choline Chloride

KeyShure®
Chelated Minerals

KeyShurePlus
Amino Acid Chelated Minerals

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TURNING IMAGINATION INTO REALITY

**POROSITY & TEXTURE
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KeyShure®
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Balchem Animal Nutrition and Health is the global leader in choline production, mineral chelation and encapsulation technology. With a growing portfolio of nutrition products and a dedication to innovation and industry sustainability, Balchem is leading the charge to meet the nutritional needs of ruminants, monogastrics and companion animals.

WE ARE:

Real People

With a passion for animal nutrition, we are intense advocates for our customers and the animals they feed. You can count on us to provide honest, candid advice to address your toughest challenges.

Real Science

Balchem delivers proven science backed by years of success. Our products are some of the most extensively researched in the industry, further supported by documented on-farm results.

Real Results

In the end, it all comes down to results. We deliver real results you can count on – results that exceed your expectations and deliver value to your customers and your bottom line.



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