

CHR HANSEN

Improving food & health

Bovamine[®] Dairy Plus

BOVAMINE[®] Dairy Plus is a science-based, research-proven probiotic:

- Improves immune response and herd health
- Ensures more complete total tract digestion of fiber and starch
- Increases healthy surface area for absorption of nutrients
- Establishes competitive exclusion of pathogenic organisms
- Reduces risk for reinfection



Overview

Building upon the 16-year, industry-leading history of **BOVAMINE® Dairy**, Chr. Hansen, the global leader in *Essential Microbial Support™*, has complemented that product with two highly-researched, unique strains of Bacilli. This new combination improves the capacity of dairy cattle to get nutrients from their feed, to absorb those nutrients throughout a healthy digestive system, and to reduce the energy-robbing, milk-reducing impact of harmful bacterial infections in their gastrointestinal (GI) tracts.

The Best of Both Worlds

BOVAMINE® Dairy Plus combines the science-based, research-proven **BOVAMINE®** strains, *Lactobacillus animalis* (LA-51) and *Propionibacterium freudenreichii* (PF-24), with two highly researched Bacilli, *Bacillus licheniformis* (CH200) and *Bacillus subtilis* (CH201), that are new to the dairy cow sector. The specific probiotic bacteria in **BOVAMINE® Dairy Plus** are four of the most extensively researched strains of probiotics for animals, with over 700 research trials conducted and more than 165 abstracts and peer-reviewed articles published during the last 25 years.

What Producers and Nutritionist want from an Effective Probiotic

In a recent survey of dairy producers and nutritionists, results showed their three highest priorities for feeding a direct-fed microbial (DFM) product (figure 1a; 1b). Taken collectively, clearly the emphasis for a new DFM to the dairy market should be to improve the health and efficiency of dairy cows by supporting their normal, stable GI functions, including the digestive, absorptive, barrier, and immune functions.

Figure 1a: Responses from DAIRY PRODUCERS

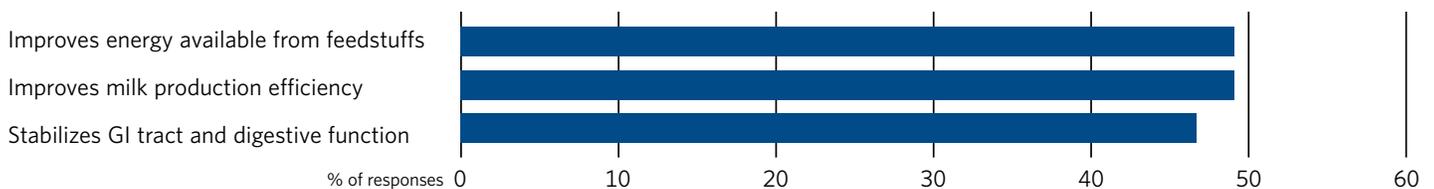
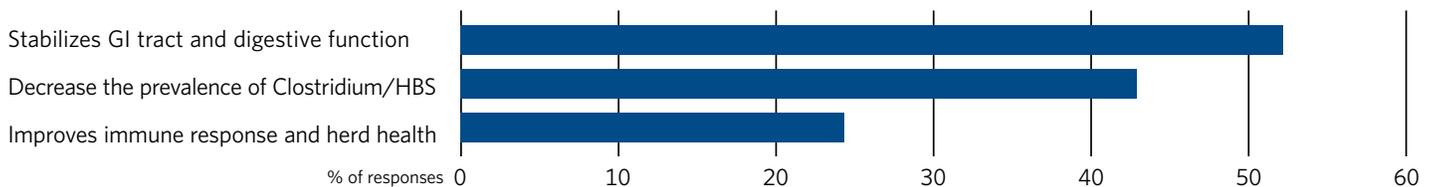


Figure 1b: Responses from DAIRY NUTRITIONISTS



Demonstrable effects of BOVAMINE® Dairy Plus

Getting the most out of their feed

- Increased volatile fatty acids produced in the rumen
- More complete total tract digestion of fiber and starch
- Normal, healthy ruminal papillae and intestinal microvilli
- Increased healthy surface area for absorption of nutrients

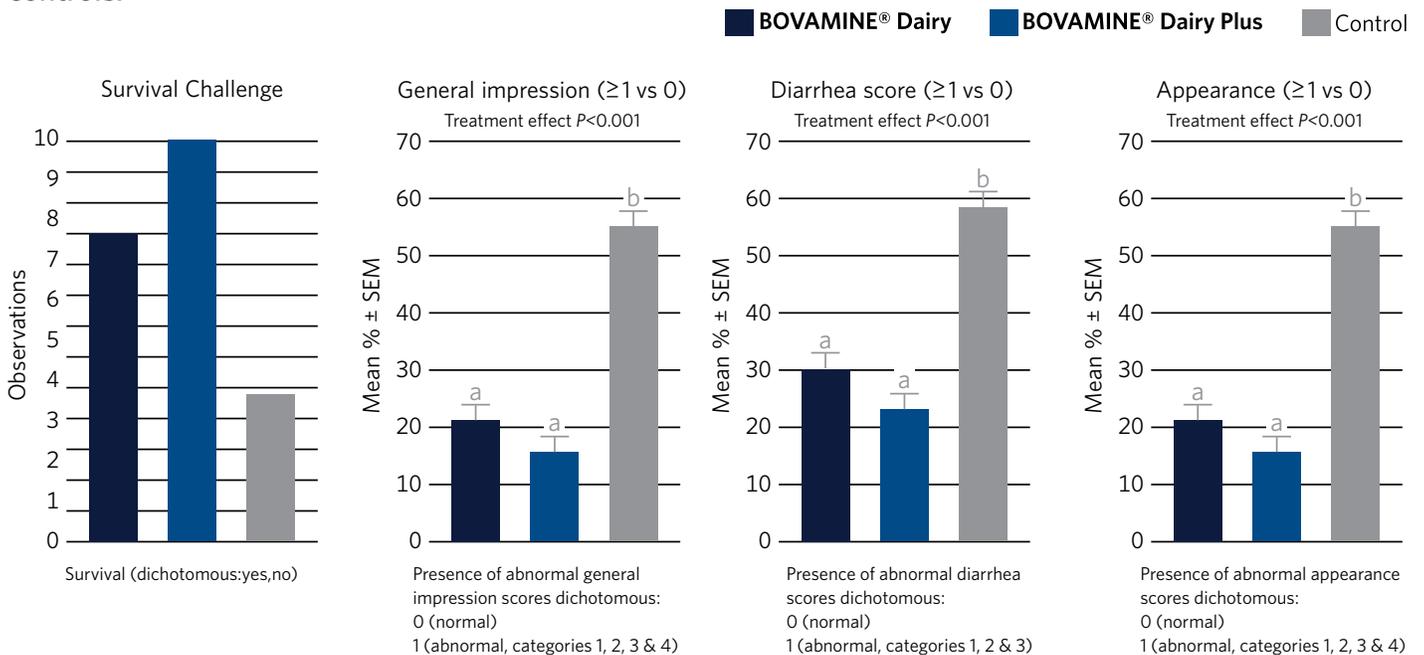
Reduced risk of damage and dysfunction caused by pathogenic organisms

- Competitive exclusion at binding sites in the mucosal and epithelial layers of the intestines
- Increased mucus production
- Improvement in the quality of the intestinal barrier (tight junctions)
- Support of normal immune functions
- Reduced shedding of pathogenic organisms
- Reduced risk of reinfection

Supporting Normal Function by Reducing the Impact of Pathogens

In a well-controlled *in vivo* study, the effects of **BOVAMINE® Dairy Plus** on the health and well-being of calves challenged with *Clostridium perfringens* Type A was assessed (see figure 2). For each measure of health examined, specifically, survival of the challenge, general impression, diarrhea score, and appearance, a greater percentage of calves fed **BOVAMINE® Dairy Plus** survived and were normal.

Figure 2: A greater percentage of calves fed **BOVAMINE® Dairy Plus** were normal compared to untreated controls.



When pathogenic organisms, such as *E. coli* or *Salmonella*, are present in high numbers in the GI tract to the point where they begin to act in concert to exert their negative impacts on the host animal, then a first point of attack can be the lining of the intestines. When this protective barrier is breached, harmful bacteria, toxins and other deleterious materials can move from inside the GI tract to inside the body.

This pathological phenomenon is known as “leaky gut”. While daily feeding of an effective probiotic can reduce the number of pathogenic organisms and thereby reduce the risk of leaky gut, it is also well-demonstrated that effective probiotics can help shore-up the intestinal barrier in the face of an attack from pathogens. At Chr. Hansen, we utilize an *in vitro* assay system that enables us to assess the impact of various microorganisms on the integrity of a single layer of intestinal epithelial cells, using a combination of changes in electrical resistance (TEER) and the passage of relatively large molecules (FITC-Dextran).

In this assay, *E. coli* (ETEC F18) negatively impacts the integrity of a single layer of intestinal cells, resulting in an 80% reduction in electrical resistance and 13-fold increase in the passage of molecules across the compromised barrier. In contrast, *Lactobacillus animalis* LA-51, found in **BOVAMINE® Dairy Plus**, completely mitigates the negative impact of ETEC F18 in both measures (see figures 3 and 4).

Figure 3: Change in transepithelial electric resistance over time.

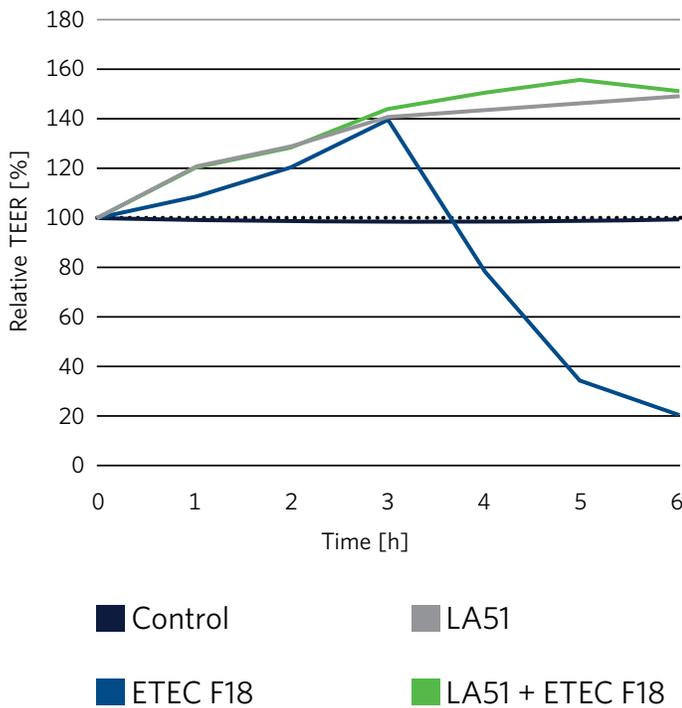
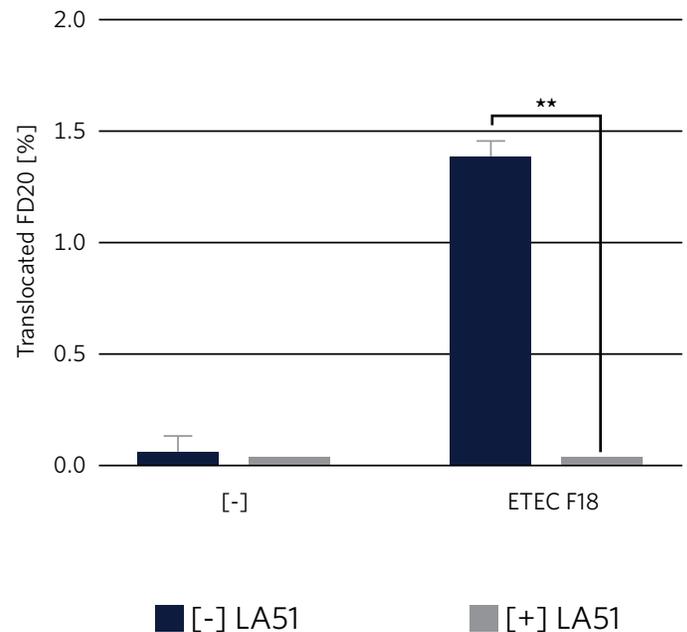


Figure 4: Movement of FITC-Dextran across epithelium.



Supporting Normal Performance in the Field

The impact of **BOVAMINE® Dairy Plus** was tested in the field using observations made on approximately 110,000 dairy cows (Jersey and Holstein) from 14 commercial dairies in three states. Data were collected from one week before and through 90 days during the daily-feeding of **BOVAMINE® Dairy Plus**. The continuous use of **BOVAMINE® Dairy Plus** increased fiber (NDF) and starch digestibility by 6.5% and 1%, respectively, and reduced the variation of these two metrics of digestive efficiency (see figures 5 and 6).

Figure 5: Feeding BOVAMINE® Dairy Plus improved apparent digestibility of NDF (NDF-D) and reduced its variation (NDF-D CV) through day 90.

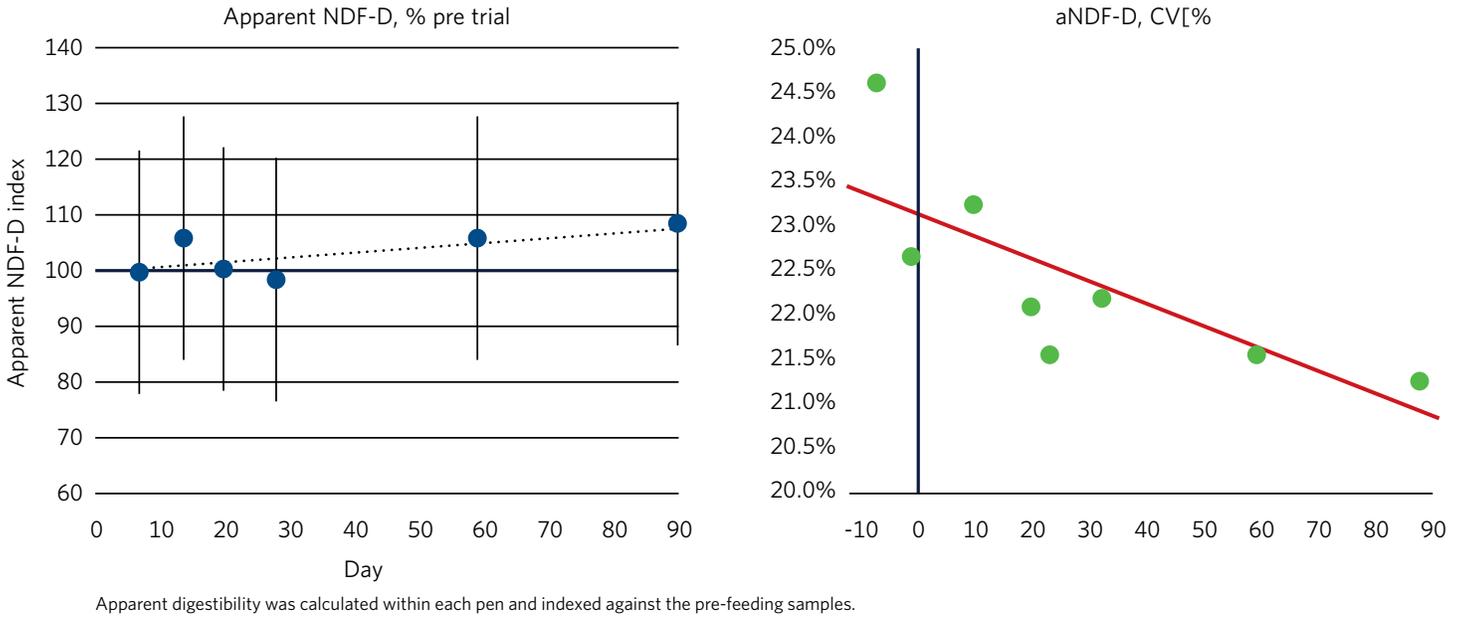
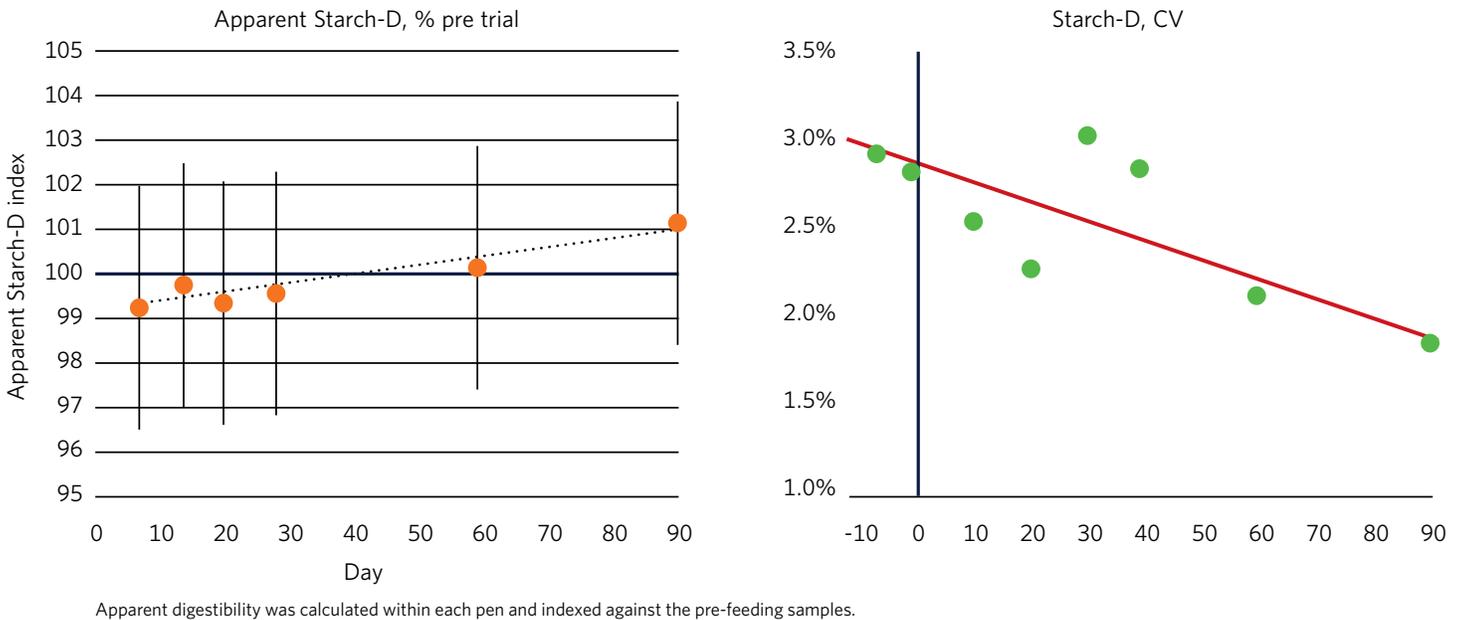
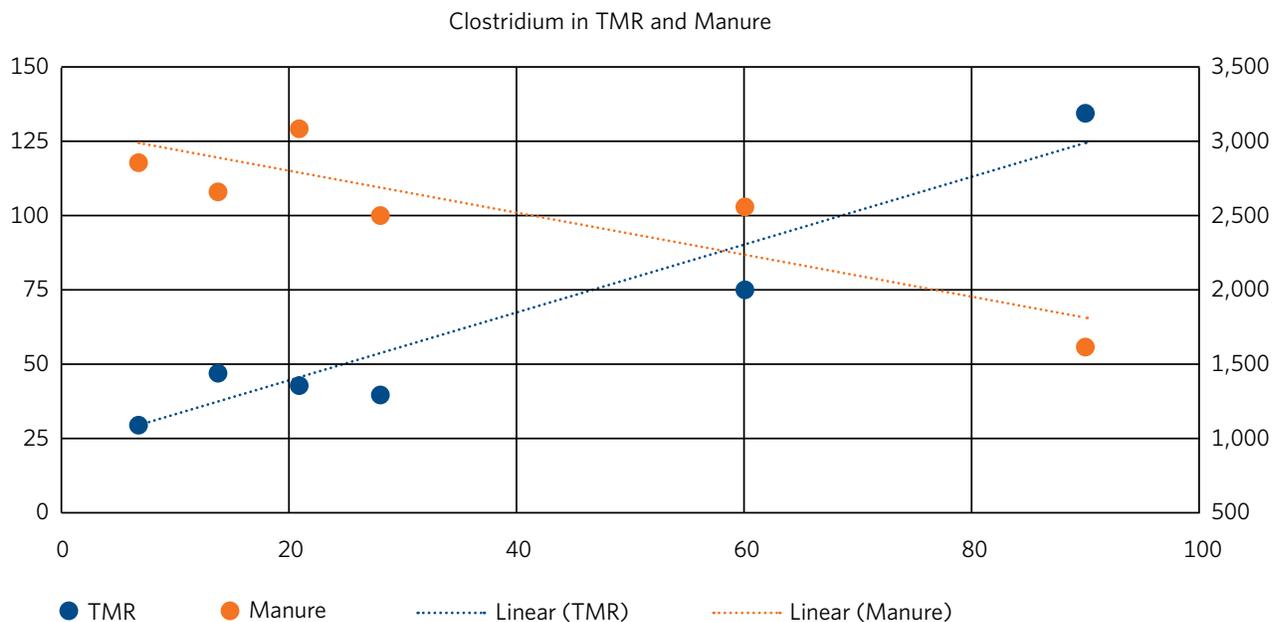


Figure 6: Feeding BOVAMINE® Dairy Plus improved apparent digestibility of starch (Starch-D) and reduced its variation (Starch-D CV) through day 90.



During the trial, the concentration of *Clostridium perfringens* increased in the TMR nearly 7-fold, from 11.7 to 80.8 cfu/gram of feed (on a dry-matter basis). In contrast, the concentration of *C. perfringens* being shed in the manure of cattle being fed daily with **BOVAMINE® Dairy Plus** decreased from 2,827 to 1,646 cfu/g of manure (on a dry matter basis, see figure 7).

Figure 7: Daily feeding of BOVAMINE® Dairy Plus reduces the shedding of *C. perfringens* in the face of increasing contamination of the feed (correlation coefficient: -91%).



Summary

Daily feeding of an effective, science-based, research-proven probiotic, like **BOVAMINE® Dairy Plus**, is an excellent choice to ensure that your dairy cattle function normally, that is, to produce milk, to grow calves in their bellies, and to defend themselves from stressors in their environment. That all starts with their capacity to get nutrients from their feed, to absorb those nutrients throughout a healthy digestive system, and to reduce the energy-robbing, milk-reducing impact of harmful bacterial infections in their GI tracts.

BOVAMINE® Dairy Plus

is available in two forms: standard (frozen) and stabilized.

Package: Package size of standard product:

- 2000 head/day (500g) - 250mg/head/day
- 500 head/day (1000g) - 2g/head/day
- 1000 head/day (1000g) - 1g/head/day

This product can be added directly to a TMR in the mixing device or via micro-ingredient applicator.

Package sizes of stabilized product are: 8000 head (1lb, 453.6 g) and 8000 head (2lb, 907.2g). The 8000 head package is designed for use in feed mills and is blended into vitamin trace mineral (VTM) packs or other types of dry pre-mixes. Proper feeding of any **BOVAMINE® Dairy Plus** product provides 11.8×10^9 CFU of *Lactobacillus animalis*, *Propionibacterium freudenreichii*, *Bacillus licheniformis* and *B. subtilis* per animal daily when label instructions are followed.

Storage: Standard **BOVAMINE® Dairy Plus** should be stored at -4°F (-20°C) in a commercial freezer. Stabilized **BOVAMINE® Dairy Plus** should be stored at 36-77°F (2-25°C) in a dry place.

Shelf-life: Shelf-life of **BOVAMINE® Dairy Plus** products is 12 months, when stored as specified.

Handling: Standard **BOVAMINE® Dairy Plus** should be stored in a freezer. Place any unused contents in a sealed container and store in a freezer.

Stabilized **BOVAMINE® Dairy Plus** should be stored in a cool, dry area for maximum stability. Avoid leaving pouch open for extended periods of time. Place any unused contents in a sealed container. Avoid inhalation of dust. In case of inhalation, skin contact, or eye contact, rinse with water.