

# **Microbial Solutions on the Farm to Improve Plant Health, Silage Preservation and Animal Health**

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## **Introduction**

In a perfect world, plants would extract all they need from the sun, soil, air, and ground water to grow to their genetic potential. From harvest through ensiling to the feed bunk, all nutrients would be readily available and stable in the forage you grow and provide. When fed, animals would get from their feed all that they need to grow, reproduce, and produce meat, milk, or eggs, i.e., to function normally. Of course, we don't live or work in a perfect world. Many factors can and will limit the success of our feed crops, including abiotic stressors, like drought. Failure to harvest at the ideal time or to achieve a controlled fermentation can and will significantly limit the availability and preservation of the nutrients in our forages. Suboptimal intake of nutrients can and will negatively affect the performance of the animals in our care.

We, at Chr. Hansen, believe and can provide a great deal of evidence that various microbial solutions can be used to get the most out of your land, labor, and animals. Optimizing content, preservation, and utilization of nutrients is what we aim to achieve with you. We know that adding a microbial soil inoculant can significantly improve the yields and nutrient contents of your crops. Microbial soil inoculants are agricultural amendments that use beneficial rhizospheric or endophytic microbes to promote plant health. Using an effective silage inoculant at harvest can ensure a well-controlled fermentation and preservation of nutrients through feed out. Providing your animals with an effective probiotic can support all normal gut functions to drive efficient production.

## **Effective Soil Inoculants**

Once in the soil, an effective microbial soil inoculant should quickly colonize the rhizospheres of plant root systems, forming mature biofilms. The bacteria that compose those structures should have the capacity to release enzymes into the soil that solubilize plant-unavailable nutrients, like calcium phosphate, making more phosphorous available for the developing roots. When available, plants absorb a higher proportion of those elements needed for root development. With a larger root volume, more nutrients are available for growth and production of energy. Plants with higher rates of nutrient absorption and growth are relatively more resistant to abiotic stress, like drought. Bottom line, by using an effective soil inoculant, you get bigger, better, more drought-resistant crops.

## Effective Silage Inoculants

From field to feeding, more than 50% of the nutritional value of forages can be lost. Dairy producers know by experience that some degree of shrink is to be expected, but it's likely that up to 20-30% of that waste can be avoided using a combination of best management practices and effective silage inoculants. According to McDonald et. al. (1991), the factors that affect the potential nutrient content of your forage are management, fermentation, feed out, top layer spoilage, and feed refusal. Use of effective silage inoculants can positively impact losses in fermentation, feed out, and feed refusal. Focusing on the critical control points in the production of silage can reduce the negative impacts of improper management. A combination of inoculants and good management can address all of the shrink due to top layer spoilage.

## What's Good Silage Worth?

Based on a benefit-over-cost calculator developed in-house at Chr. Hansen, and using prices and values from 2020, the use of our most effective silage inoculant would return 9.5 dollars for every dollar spent. This is based on beneficial gains made in dry matter preservation, aerobic stability, TMR stability, nutrient preservation, savings in concentrates, spoilage of the top layer, and early feed-out. When using prices and values for 2022, the benefit-cost ratio jumped to 15.4.

## Effective Probiotics

Historically, in our industries, whether we're measuring meat, milk, or egg production, we tend to focus on those measures that are relatively easy to obtain by observing groups of animals. Those measures could include weight for age or average daily gain in growing animals and birds. They could include the efficiency of conversion of feed to body or the efficiency of production of eggs based on eggs per hen per day or number of eggs per pound to feed, or they could include the efficiency of milk production, when talking about cows, sows, goats, or sheep. Additionally, these are the typical measures used to validate the efficacy of agricultural supplements and products, such as probiotics. We believe that when you see normal rates of gain and efficiencies, and normal health status and group morbidity, those are the results of a properly functioning digestive system, one where digestion and absorption, the barrier functions and immune functions are all intact and working well. It is our contention, that when you provide probiotics to your animals, you have a much better chance of supporting those normal functions of the gut, and, as a derived consequence, you're going to see improved measures of success, however you assess them.

## Modes of Action

We have evidence that supports the idea that probiotics function through three major types of modes of action. When consumed, effective probiotic bacteria could be interacting with feedstuffs, interacting with other microorganisms, and/or interacting with

the various organ systems of their host. For interactions with feedstuffs, we focus on bioconversion, e.g., the conversions of sugars to acids, and on the yielding of absorbable nutrients from feedstuffs as it moves through the digestive tract. Regarding the interaction with microorganisms, we explore the mechanisms of direct antagonism, robust changes in the gut microbiome, and competitive exclusion of potentially harmful bacteria from intestinal binding sites. Finally, when looking at interactions with their host, we concentrate our efforts to understand the way effective probiotics increase absorptive capacity, support the barrier functions, and modulate the immune system.

### Supporting Normal

The bottom line is that effective probiotics work in a variety of ways to support the normal functioning of the digestive system from mouth to anus or cloaca, including the rumen of ruminants. We believe that the healthy, normal functioning of the gut, coupled with a healthy, robust gut microbiome, enables animals to achieve as much of their genetic potential as their environment and feed sources allow. We also know that the greater the percentage of normal healthy animals in any herd, lot, flow, or flock, then the greater the likelihood of economic success in that operation.

### Summary

Choosing to use effective microbial solutions to optimize the content of nutrients in the foliage of feed crops, to preserve those nutrients from harvest to the feed bunk, and to enable the utilization of those nutrients in the efficient production of meat, milk, and eggs is what we, at Chr. Hansen, believe one must do to get the most out of their land, labor, and animals.

### References

McDonald P, Henderson AR, Heron SJE (1991) The biochemistry of silage. Chalcombe publications.