AMAFERM®
POWER UP PERFORMANCE.
MAXIMIZE DIGESTIBILITY.
AMAFERM®
WORKS
BEST WHEN
ENERGY
IS LIMITED.
What is Amaferm®?

Amaferm® is a natural feed additive, that acts as a prebiotic increasing digestibility to maximize the energy value of feed.

Amaferm® is an extract of a non-pathogenic strain of the fungus Aspergillus oryzae. Our selected proprietary strain is obtained from a deep culture, multi-stage fermentation method, at a Safe Feed/Safe Food, HACCP and FAMI OS-certified facility. The product is considered by the United States Food and Drug Administration as GRAS (Generally Recognized as Safe).

Ruminants are herbivores that have developed the ability to digest all of the plant polysaccharides (cellulose, hemicellulose, starch, pectin, and simple sugars) through the activities of their highly specific population of ruminal bacteria, protozoa, and fungi which are capable of releasing substrate-specific enzymes.

There are approximately 1-10 billion bacteria in each milliliter (mL) of rumen contents. Rumen bacteria digest feed by attaching to the feed particles and releasing enzymes.

If there is sufficient nitrogen and essential nutrients available to the bacteria, then any process that increases the surface area available for bacterial attachment increases the number of bacteria digesting feed at any one time. This increases the rate of digestion.

Rumen bacteria can replicate in 20 minutes to 2-3 hours, depending on the species. The time it takes for this division to occur is often referred to as doubling time. If the doubling time is reduced, the rate and extent of digestion are increased.

In addition to the bacteria, there are rumen protozoa that engulf (swallow) soluble sugars and starch. There are normally around 1 to 10 million protozoa per mL of rumen contents.

There are also rumen fungi, which number in the tens of thousands per mL of rumen contents. These fungi are responsible for breaking the lignin-hemicellulose bonds of forages, making more hemicellulosic cellulose available to the rumen bacteria.
In the rumen, bacteria and protozoa are found in greater numbers than fungi. Bacteria are responsible for the vast majority of digestion. However, the fungi have a crucial role in fiber digestion, as they are the only organisms capable of breaking the lignin-hemicellulose bonds, which act as physical barriers to the bacteria, limiting both the rate and extent of digestion by preventing bacterial attachment. Since bacteria digest cellulose and hemicellulose, having the fungi create more surface area for bacterial attachment is critical to maximizing digestion.

Amaferm® stimulates the morphology and physiology of the rumen fungi as well as the enzymes they secrete necessary for digestion. This creates more attachment sites and supply more substrate and surface area to the rumen bacteria. Amaferm also increases the numbers and speed of doubling of the bacteria, therefore increasing their effectiveness in further breaking down the feed.

The illustration to the left shows the branching of fungi (blue) and breakdown of feed (green) with subsequent attachment of bacteria (red).
**EFFECT ON FUNGI**

Amaferm® accelerates both the rate and extent of digestion through increased growth of the rumen fungus *Neocallimastix frontalis EB188*, thus functioning like a prebiotic in stimulating the activity and branching of fungi that break lignin-hemicellulose bonds leading to enhanced digestion (Chang et al., 1999).

Amaferm also accelerates the enzyme production of the rumen fungus *Neocallimastix frontalis EB188*, resulting in a 37% increase in carboxymethyl cellulase, a 162% increase in β-glucosidase, and a 306% increase in amylase, showing that the effects of Amaferm are not limited to enzymes responsible for fiber digestion, but also starch.

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**SEM Analysis of Amaferm® treated Fungi**

<table>
<thead>
<tr>
<th>Dose</th>
<th>Stem*</th>
<th>Branch*</th>
<th>Total*</th>
<th>S/B ratio</th>
<th>Sporangia *</th>
<th># of branches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>73.4</td>
<td>17.6</td>
<td>91.0</td>
<td>4.17</td>
<td>68.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Amaferm®</td>
<td>84.9a</td>
<td>78.8a</td>
<td>163.7a</td>
<td>1.08a</td>
<td>81.5a</td>
<td>14.1a</td>
</tr>
</tbody>
</table>

* area in microns

'a' notates a significance within column p < 0.05

Source: Chang, et al., 1999
Amaferm® resulted in a 79% increase in the total number of ruminal bacteria and a 188% increase in the number of cellulolytic bacteria compared with the control treatment lacking Amaferm (Frumholtz et al., 1989).

Amaferm increases the growth rate of the fiber digesting bacteria in the rumen, Fibrobacter succinogenes S85 and Ruminococcus albus 7 as well as several strains of the lactate utilizing bacteria Megasphaera elsdenii, Selenomonas ruminantium, and Selenomonas lactilytica (Beharka and Nagaraja, 1998).

### Amaferm® Impact on Bacterial Growth Rates

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Amaferm®</th>
<th>Control</th>
<th>Amaferm®</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fibrobacter succinogenes S85</strong></td>
<td>0.26&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.35&lt;sup&gt;a&lt;/sup&gt;</td>
<td>155</td>
<td>125</td>
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<tr>
<td><strong>Megasphaera elsdenii B159</strong></td>
<td>0.32&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>130</td>
<td>99</td>
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<tr>
<td><strong>Megasphaera elsdenii T81</strong></td>
<td>0.30&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>150</td>
<td>115</td>
</tr>
<tr>
<td><strong>Megasphaera elsdenii LC1</strong></td>
<td>0.29&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.32&lt;sup&gt;c&lt;/sup&gt;</td>
<td>141</td>
<td>129</td>
</tr>
<tr>
<td><strong>Ruminococcus albus 7</strong></td>
<td>0.58&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>72</td>
<td>60</td>
</tr>
<tr>
<td><strong>Selenomonas ruminantium D</strong></td>
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<td>0.71&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
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<td>0.75&lt;sup&gt;a&lt;/sup&gt;</td>
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<td><strong>Selenomonas lactilytica PC18</strong></td>
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<td>0.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>73</td>
<td>60</td>
</tr>
</tbody>
</table>

(per hour) (minutes)

<sup>a,b</sup> means within a row with different superscripts differ (P<0.01)

<sup>c,d</sup> means within a row with different superscripts differ (P<0.05)

Source: Beharka and Nagaraja, 1998
Amaferm®’s impact on bacteria AND fungi is research proven to consistently show significant improvements in the rate and the extent of digestion. This increased digestion creates more energy and protein available to the animal.

The resulting energy comes from the enhanced VFA production. VFAs are absorbed into the bloodstream and carried to the liver where they are converted to glucose and fat for energy use by the animal. Amaferm has been shown to increase total VFA production by 16%.

Any increase in the production of rumen microbes not only results in an increase in digestibility, but also in an increase in the amount of protein available to the animal. In fact, this microbial protein is considered to be a near perfect protein. Amaferm has been shown to increase microbial protein yield by as much as 34%.
How would you like to include Amaferm® in your line?