Miya-Gold®
Pigs
The unique probiotic
**PROBIOTICS**

Probiotics have been defined as **live microbial feed supplements** which **beneficially** affect the host animal by improving its **intestinal microbial balance**.

**Achieving a balanced gut microbiota is critical to intestinal health because of the effect of bacteria on gut morphology, nutrition, intestinal disease and immune responses.**

**MIYA-GOLD®**

Miya-Gold® is a **probiotic feed additive** consisting of a unique genus of bacteria: **Clostridium butyricum MIYAIRI 588**. Clostridium butyricum is a gram positive, strict anaerobic, spore-forming bacterium.

### **MIYA-GOLD® CONSISTS OF SPORES**

The spores of Clostridium butyricum protect Miya-Gold®:
- throughout feed production
- in the highly acidic upper digestive tract
- during enzymatic digestion

In the lower gastro-intestinal tract, the spores:
- germinate
- multiply
- temporarily colonize
- execute positive effect

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**CLOSTRIDIUM BUTYRICUM**

Wirtz spore stain (x 1,000), Blue=vegetative cell, Pink=spore

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**MIYA-GOLD® IS STABLE IN LOW PH**

Viability of several bacteria in adult male human gastric acid.

<table>
<thead>
<tr>
<th>pH</th>
<th>10^1</th>
<th>10^2</th>
<th>10^3</th>
<th>10^7</th>
<th>10^9</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH 1.4 (1hr)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pH 1.4 (2hr)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pH 3.5 (1hr)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pH 3.5 (2hr)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pH 5.2 (1hr)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>pH 5.2 (2hr)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Miya-Gold®** | **Lactobacillus acidophilus** | **Streptococcus faecalis**
MODE OF ACTION OF MIYA-GOLD®

GENERAL

Miya-Gold® establishes and maintains a beneficial microbial population in the gut. This makes the gut environment less conductive to colonization by microorganisms that may have a negative impact on animal performance.

MECHANISMS

1. Competitive exclusion

Miya-Gold® prevents colonization by pathogens through adhesion to the gut epithelium.

<table>
<thead>
<tr>
<th>Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Less colonization by pathogens</td>
</tr>
<tr>
<td>• No disruption of intestinal wall</td>
</tr>
</tbody>
</table>

2. Antagonistic activity

Miya-Gold® demonstrates a direct antagonistic effect against several intestinal pathogens.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Reference</th>
</tr>
</thead>
</table>

Benefits:  
• Securing a healthy microflora  
• Less pathogens in the gut
3. Production of acetic acid
Acetic acid produced by Miya-Gold® inhibits microbial growth by passing across the cell membrane of pathogens, dissociating and acidifying the cell cytoplasm leading to cell death.

**ANTIMICROBIAL ACTIVITY OF ACETIC ACID**

**Bacteria**

RCOOH

Energy depletion

RCOOH ↔ RCOO⁻ + H⁺

**Benefits:**
- Reduction of pathogens
- Acetic acid is an extra energy source for commensals

4. Production of butyric acid
Butyric acid produced by Miya-Gold® possesses anti-microbial activity and shows anti-inflammatory action. In addition butyric acid is the preferred energy source for colonocytes and exerts positive effect on jejunal and ileal epithelial cells.

**MIYA-GOLD® PROTECTS THE ANIMAL AGAINST INDUCED COLITIS**

**Induced colitis-non treated**

**Induced colitis- treated with Miya-Gold®**

**Benefits:**
- Improved gut morphology
- Direct inhibition of pathogens
- Less energy loss through inflammation
**ECONOMICS OF MIYA-GOLD®**

**INCREASING PERFORMANCE**

Miya-Gold® reduces FCR and increases daily weight gain. The improvement of the growth of the animals is achieved through a natural, physiological way, improving digestion by balancing the gut flora.

**MIYA-GOLD® IMPROVES DWG AND FCR IN WEANED PIGLETS**

![Graph showing improvements in DWG and FCR](image)

**RETURN ON INVESTMENT: 1: 2.9**

All trials are conducted in piglets kept under optimal management (28-70 days of age).

**PREVENTING ENTERIC DISORDERS**

Miya-Gold® supports the animal at time of stress and environmental change. In addition Miya-Gold® protects growing animals from colonization by pathogens.

**MIYA-GOLD® PREVENTS THE DEVELOPMENT OF COLITIS**

![Graph showing reduction in ulcer index](image)

*Colitis was induced by adding dextran sodium sulfate in the drinking water of 10 week old rats. One group was supplemented with Miya-Gold® (10^7 cfu per day) 7 days prior to colitis induction. Ten days after induction the size of colon ulcers were measured.*

**MIYA-GOLD® INHIBITS INFECTION WITH ENTEROHEMORRHAGIC E. COLI**

![Graph showing survival rate](image)

*Eight week old mice were infected with EHEC 0157:H7. One group was supplemented with Miya-Gold® 4 days prior to challenge (10^8 cfu per animal), another group got Miya-Gold® 2 days post challenge (10^8 cfu per animal).*
**DOSE RECOMMENDATIONS**

<table>
<thead>
<tr>
<th>Species</th>
<th>cfu Clostridium butyricum/g Miya-Gold&lt;sup&gt;®&lt;/sup&gt;</th>
<th>Recommended dose of Miya-Gold&lt;sup&gt;®&lt;/sup&gt;/mton of feed</th>
<th>cfu Clostridium butyricum/mton of feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weaned piglets</td>
<td>5&lt;sup&gt;10&lt;/sup&gt;&lt;sup&gt;8&lt;/sup&gt;</td>
<td>0.5 kg</td>
<td>2.5&lt;sup&gt;10&lt;/sup&gt;&lt;sup&gt;11&lt;/sup&gt;</td>
</tr>
<tr>
<td>Minor porcine species</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**STABILITY**

Miya-Gold<sup>®</sup> can resist heat and high pressure, thus surviving the steam conditioning and pelleting process routinely used in the feed industry. Miya-Gold<sup>®</sup> has a shelf-life of 24 months.

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Duration (min)</th>
<th>Recovery rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>80</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>95</td>
<td>1</td>
<td>98</td>
</tr>
</tbody>
</table>

Pellet stability of Miya-Gold<sup>®</sup> at different temperatures.

**CONCLUSION**

Miya-Gold<sup>®</sup>:
- Is a probiotic feed additive
- Consists of Clostridium butyricum spores
- Increases performance
- Stimulates gut health
- Is heat stable

*Miya-Gold<sup>®</sup> The unique probiotic*