Nutribiosis to address pig production challenges

Mr. Aart Mateboer and Dr. Milan Hruby
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DUPONT INDUSTRIAL BIOSCIENCES AT A GLANCE:
DIVERSE AND GLOBAL BUSINESS

Revenue by Major Product Group

2017: $2.1B Sales

- Bioactives, including Animal Nutrition: 51%
- Biomaterials: 23%
- Clean Tech: 13%
- Biocides (Microbial Control): 13%

By Region

<table>
<thead>
<tr>
<th>Region</th>
<th>% 2017 Sales</th>
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</thead>
<tbody>
<tr>
<td>Americas</td>
<td>49%</td>
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<tr>
<td>Europe, Middle East and Africa</td>
<td>25%</td>
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<tr>
<td>Asia Pacific</td>
<td>26%</td>
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</tbody>
</table>
WORLDWIDE AND WORLD CLASS PEOPLE, SCALE AND CAPABILITIES

~ 2700 dedicated colleagues worldwide
7 global R&D sites
6 applications labs
23 operations sites
ANIMAL NUTRITION
FEED ADDITIVES FOR SUSTAINABLE ANIMAL PRODUCTION

- Enzymes
- Betaine
- Essential oils
- DFM’s

- Improve gut health
- Lower feed costs
- Reduce environmental footprint
- Improve farm productivity
- Promote animal welfare
KEY ANIMAL PRODUCTION CHALLENGES

- Volatility in feed cost prices
- Feed efficiency
- Disease control
- Growth performance & consistency

Source: DuPont interpretation of regional/country regulatory frameworks

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DUPONT INTRODUCES NUTRIBIOSIS: A STATE DESCRIBING INTERACTIONS

Nutrition

Gut and immune function

Microbiome
NUTRIBIOSIS DRIVES OUR RESEARCH

Building on our extensive, in-depth understanding of feed additive applications

Microbiome research

In-field Analysis and Applied Research, with guts sampled from pig farms

Advanced omics technology, In vitro Gut Simulators
UNFAVORABLE NUTRIBIOTIC STATE

= Poor intestinal health & Suboptimal performance

Nutrition

Gut and immune function

Microbiome

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FAVORABLE NUTRIBIOTIC STATE

= Good intestinal health & optimal performance

Nutrition

Gut and immune function

Microbiome

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UNFAVORABLE NUTRIBIOTIC STATE
PHYTATE

Ultimately these factors will interact with each other to reduce animal performance

Gut and immune function
- Increase acidity in the stomach can damage the gut absorptive surface and requires more buffering through release of sodium bicarbonate
- The increased demand for sodium negatively effects gut function by depleting sodium levels in cells, reducing the functionality of the sodium pumps required for key nutrient such as glucose and amino acids absorption

Nutrition
- Phytate binds protein in the upper GIT, making it unavailable to the animal

Microbiome
- Potential of high level of protein fermenters
FAVORABLE NUTRIBIOTIC STATE
Axtra® PHY

Ultimately these factors will interact with each other to give positive effects

Nutrition
- Breaks down phytate quickly before it binds the protein avoiding the anti-nutritive effect
- Improves nutrient uptake

Gut and immune function
- Less undigested protein reaches the caeca or hind gut

Microbiome
- Reduces protein fermentation
- Potentially reduces ammonia
UNFAVORABLE NUTRIBIOTIC STATE
SWINE DYSENTERY

Ultimately these factors will interact with each other to reduce animal performance.

Nutrition
- High energy high and/or protein diets
- Low nutrient digestibility
- Too much or too little carbohydrate fermentation in the hind gut

Gut and immune function
- *B. hyodysenteriae* induces extensive inflammation
- Necrosis of the epithelial surface of the caecum and colon

Microbiome
- Increased prevalence of *Brachyspira hyodysenteriae*
FAVORABLE NUTRIBIOTIC STATE
Syncra® SWI

Ultimately these factors will interact with each other to give positive effects

Nutrition
- Release of fiber bound nutrients
- Increased protein digestion and amino acid utilization

Microbiome
- *Bacillus* adapt to the diet and produce fiber degrading enzymes to help nutrient digestion
- Reduction in undigested proteins so less substrate for non-beneficial bacteria
- Production of prebiotic AXOs
- Reduced protein fermentation so less ammonia produced
- Increase in *Lactobacillus* populations, indicating a beneficial shift in the microbiota
- Increase fiber fermentation resulting in higher SCFA (e.g. butyrate)

Gut and immune function
- Improved gut barrier strength through tighter junctions
NUTRIBIOSIS SUPPORTS THE INDUSTRY

- Clearer decision making on feed additives
- Promote Animal Welfare
- Improve Gut Health
- Improve Animal Performance

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QUESTIONS?

Nutribiosis

Nutrition

Gut and immune function

Microbiome
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