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## What's Next in Feed Innovations / Additives?


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## Emphasis on Live Cost



1. Poultry (monogastric) versus Dairy (ruminant)
2. Feed Cost is 2/3 of Live cost
  - a. Ingredients
  - b. Milling & Delivery – Not here
    - Logistics, feed inventory
3. Management is 1/3 of Live cost
  - a. Barns (Livability)
  - b. Equipment (Feed Conversion)
  - c. Health (Mortality & Morbidity)
4. Food Safety (Farm to Fork)
  - a. *E. coli*, Salmonella, Campylobacter



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## Feed Ingredients




- By-Products
  - Distillers Dried Grain Solubles (DDGS)
  - Oil seeds
- Amino Acids
- Vitamins & Minerals
- Antibiotics & Antimicrobials
- Enzymes
- Probiotics & Prebiotics
- Fermentation Products
- Others



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## Feed - Amino Acids


- Lysine
- Methionine
  - DL 99%
  - Analogue – 88% (Liquid)
- Threonine
- Valine
- Isoleucine



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## Feed Vitamins & Minerals

- Vitamins A, D, E & C
- Minerals
  - Calcium
  - Phosphorus
  - Sodium
  - Chloride
  - Selenium



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## Feed Antimicrobials

- Feed grade antibiotics
  - Bacitracin methylene disalicylate
  - Bambermycin
  - Virginiamycin
  - Anticoccidials
- Organic Acids (Jones Hamilton, Kemin)
- Aldehydes (Anitox, Kemin)
- Chemicals (ozone)
- Conditioning
- Extrusion
- Logistics & Biosecurity

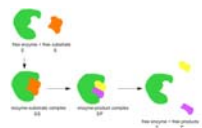
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## Feed Enzymes

*Proteins that facilitate specific chemical reactions*

- Phytase
  - New & improved
- Non-Starch Polysaccharides (NSP)
  - Dry, coated product
  - Post Pellet Liquid Application (PPLA)
  - Substrate specific
  - Synergies
  - Confounded activity




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## Feed Probiotics

*Live organisms (bacteria or yeast) - Believed to improve intestinal function and maintain the integrity of the lining of the intestine*

- Competitive exclusion
- Great theory
- Inconsistent results
- Depends on natural microflora
- Daily consumption entire life of animal
- Several varieties by multiple suppliers





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## Gut Microbiota - Microflora

- Dynamic system
- Changes constantly
- No "Gold Standard"
- Competitive exclusion
  - inconsistent
- A moving target







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## Feed Prebiotics

**By definition** – Substrate or product that elicits antibiotic tendencies. *Prebiotics are not bacteria*



1. Non-digestible
2. Make their way through digestive system
3. Help good bacteria grow and flourish
4. Keep beneficial bacteria healthy
5. Specific nutrients, non-absorbable carbohydrates
6. Found naturally occurring in whole grains, fruits and legumes.



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## Fermentation Products

- New Class of feed additives
  - Fermentation technology
- More animal health than nutrition
  - Healthier animals perform better
  - Some influence on microbiota
- Primary Mode of Action
  - Intestinal morphology
  - The Immune System






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## Fermentation Products

Animal Health

- Supports the Innate functions of GI tract (morphology, phagocytic cells)
- Interacts systemically with Adaptive functions (inflammation, antibody titers)
- Promotes optimal microflora
- Incredibly stable (200° F)
- Long shelf life (years)
- Very concentrated (micro-bins or premix)
- No live organisms, functional metabolites

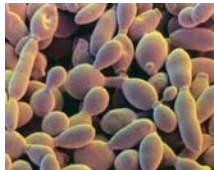



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## Feed - Others

*Primarily intended for improved digestion and gut health.  
Interactions have been reported with the microbiota.*

- Essential Oils
- Yeast culture or Cell wall products
- Yucca plant extract
- Acids (organic products)
- Binders (pellet and Mycotoxin)
- Aldehydes (Feed sanitation)
- Antioxidants







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## Food Safety

- Feed Additives
  - Reduce prevalence and load of pathogenic organisms
- Pre-emptive actions that can reduce incidence to processing





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## Food Safety



- Plant interventions can reduce incoming load by one half
- Vaccinating breeder flocks is one example of farm intervention
- Strategies include multiple interventions



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## Summary

1. New Feed Ingredients – Nutrition & Cost
2. Amino Acids – Growth & Cost
3. Vitamins & Minerals – Health & Performance
4. Antimicrobials – Health & Welfare
5. Enzymes – Digestion & Cost
6. Probiotics – Intestinal Health
7. Prebiotics – Intestinal Health
8. Fermentation products – Immunity & Health
9. Natural products – Gut Microflora
10. Food Safety – The Food We Eat



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## Thank You



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