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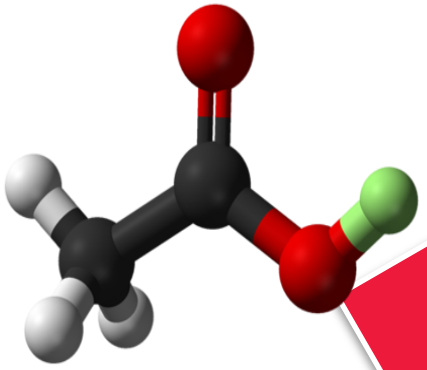
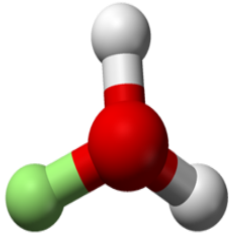
Role of Organic Acid in Poultry



Practical Experience

Recommendation



By, Buis Ebbinge
MD Daavision BV, Holland
Place- CTICC Cape Town
Date- 6th December 2014

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Topics Covered

- Introduction of Organic Acid
- Reason for antibiotic ban
- Usage,application,mode of action & efficacy of feed acidifiers
- Experimental Trial of Acidifiers
- Factor affecting consistency in results , Risk Factor & Solution
- Overview of global feed acidifiers market
- Summary & Conclusion

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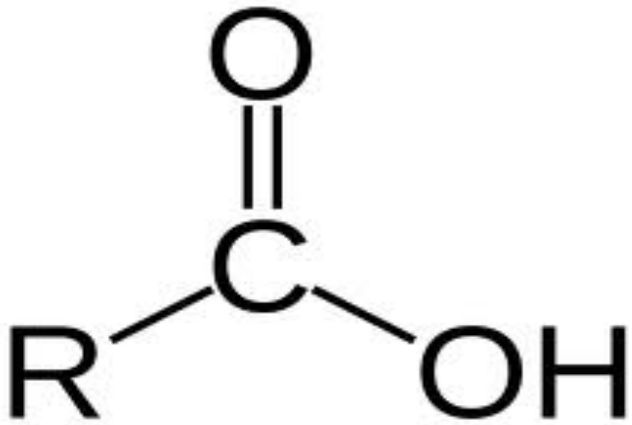
Organic Acid

What is an Organic Acid

What is Organic Acid

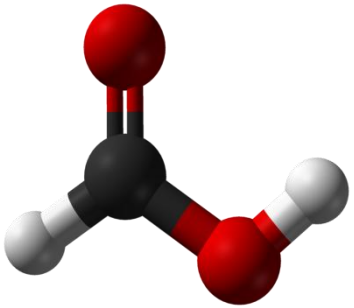
- **Organic Acid is an Organic Compound with Acidic properties associated with their Carboxyl group –COOH**

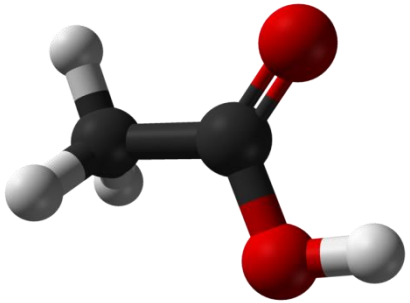


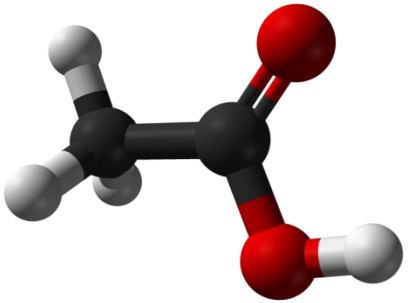
Organic Acid

- **In General Organic Acid are considered to be any carboxylic acid including fatty acid & amino acid.**

Organic Acids are weak Acid & do not disassociate completely in water







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Usage of Organic Acid

- **Organic Acid usage started initially for Oil & Gas well stimulation treatments be cause of their much less reactive properties with metal than the strong mineral acids like HCL & HF Acid, for this reason, organic acid are used at a high temperatures when long contact times between acid & pipe are needed.**

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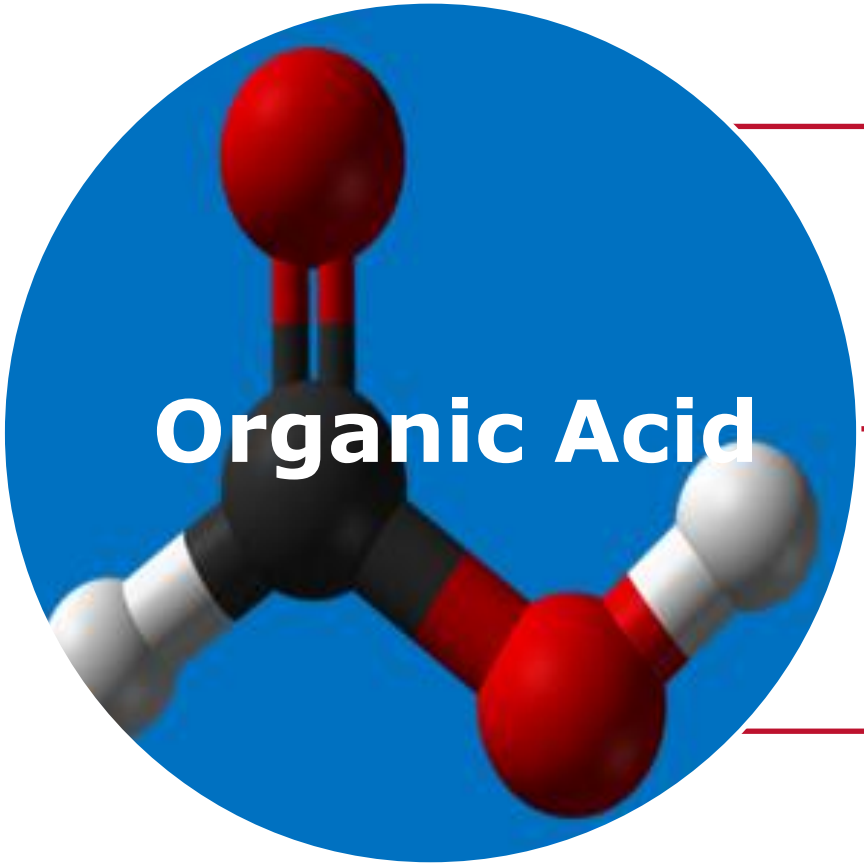
Application



- Oil & Gas
- Food industry
- Nutrition & Animal feed

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Antibiotics

EU, Banned Prophylactic use of AGP in January 2006

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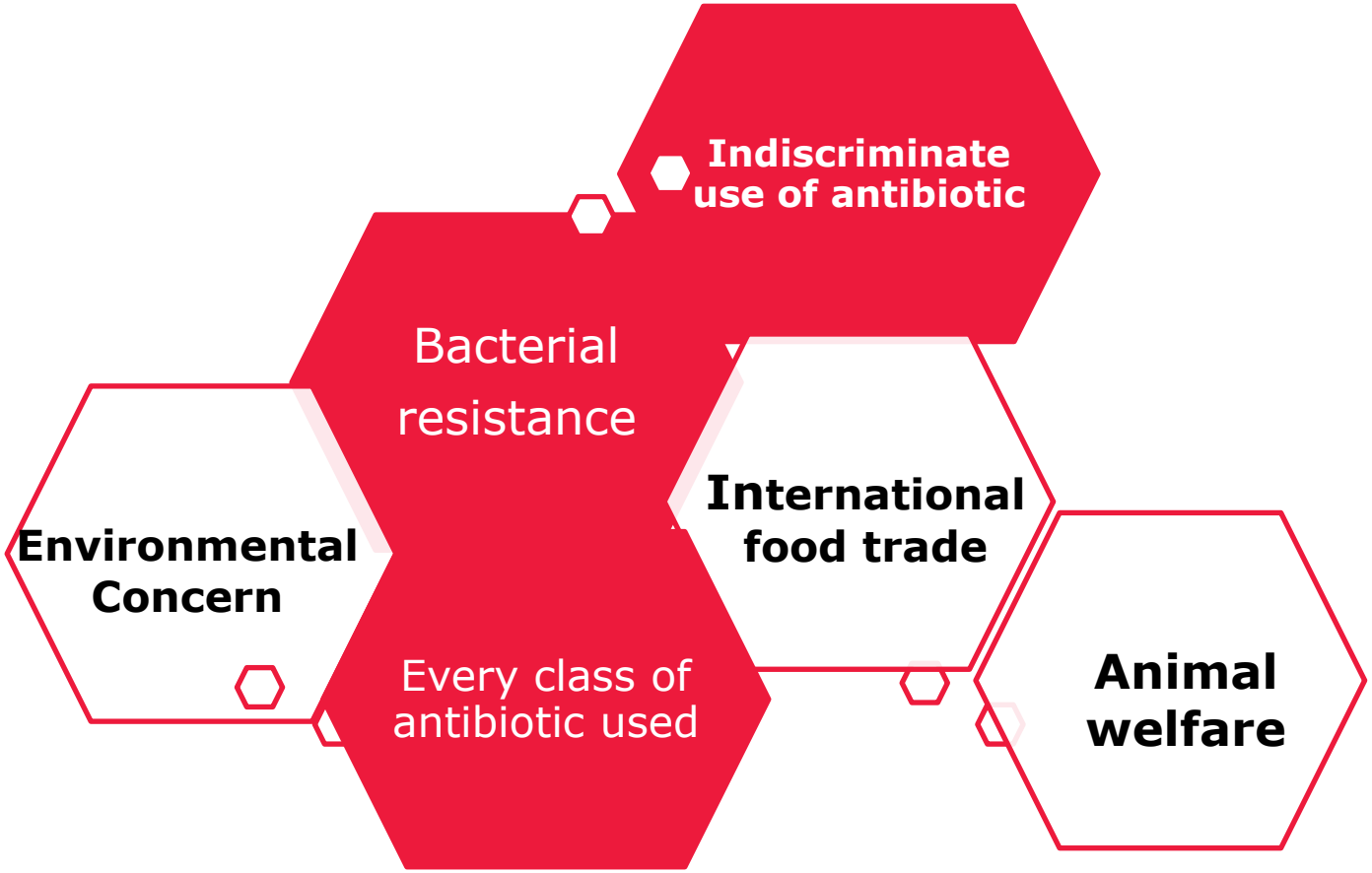
Reason behind ban of antibiotic in Animal Feed



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Antibiotic Usage History in Animal Nutrition

- **In Germany 1,734 Mt.of Antibiotic used for animals in 2011 compare to 800 MT in humans**
- **In Netherlands- Antibiotic usage to treat disease has significantly increased after the ban.**
- **USA- in 2011, 80% of the antibiotic went to livestock production.**
- **China- China Producers consumes the most antibiotic**
- **India- in 2012, India manufactured about a third of the total antibiotics in the world.**

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Effect of growth-promoting antibiotics

Physiological

Nutrient absorption.

Feed intake.

Nutritional

Energy retention.

Nitrogen retention.

Metabolic

Liver Protein synthesis.

Others

Immunity.

Physiological

Feed transit time.

Gut Wall diameter.

Gut wall length.

Nutritional

Gut energy Loss.

Vitamin Synthesis

Metabolic

Ammonia production.

Toxic amine production

Fatty acid oxidation

Others

Secondary disease by E coli

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Reason behind Organic Acid introduction in Animal Feed

- **Europe- 1980 first reported bacterial resistance to Vancomycin.**
- **CC398- Methicllin-resistant Staphylococcus aureus was produced by the use of antibiotic in livestock.**
- **The appearance of Carbapenem resistant enterobacteriaceae.**
- **Appearance of resistant E Coli causing blood stream infection.**
- **Study released by CSE India found antibiotic residue in chicken.**
- **Antibiotic resistant bacteria have been found in Brazillian Cattle.**

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Feed Acidifiers

Usage

Application

Classification

Mode of Action & efficacy

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Commonly used Acidifiers

	g/mol	*form*	*pK_a*	*solubility*
Formic	46	liquid	3.75	+++
Acetic	60	liquid	4.76	+++
Propionic	74	liquid	4.88	+++
Butyric	88	liquid	4.82	+++
Lactic	90	liquid	3.83	++
Sorbic	112	solid	4.76	-
Benzoic	121	solid	4,17	-
Fumaric	116	solid	3.02 4.38	-
Malic	134	solid	3.40 5.10	++
Tartaric	150	solid	2.93 4.23	++
Citric	192	solid	3.13 4.76 6.40	++
Phosphoric acid	98	solid	2.15 7.10 12.32	+++

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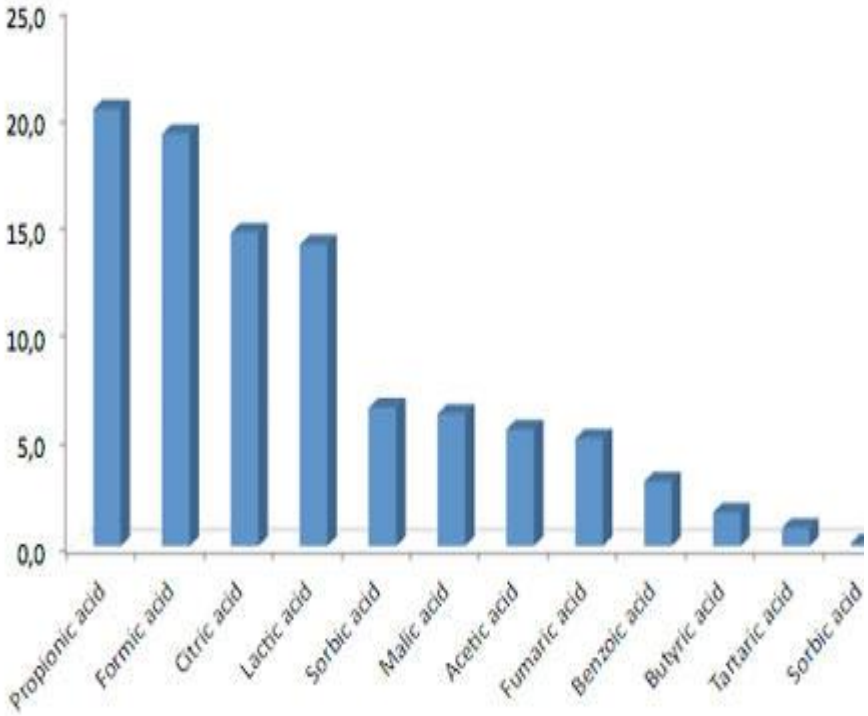
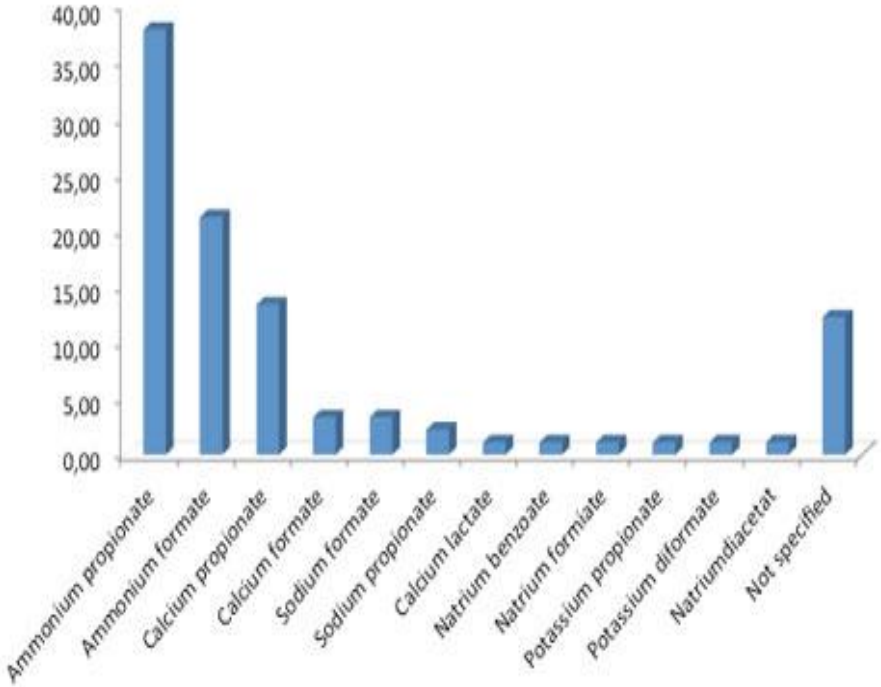
Usage of various Acid & Salts





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Application in Poultry

Application

- Sprayed as a liquid directly in to feedstuff & compound feed
- Powder form are added directly or via premix
- Liquid form via drinking water

Specific Target of Organic acid usage in Poultry

Disease Control

- E Coli,Salmonella,Clostredia,Entrococcus

Growth

- High growth,Low FCR,High Egg production,Homogenesity

Improved Metabolism

- Can be used for various metabolic pathways for energy generation

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Effect of Acid

	Acid effect on various functions				
	Antimicrobial gram-	Nutritive	pH lowering	taste	corrosivity
Formic Acid (C1)	+++	++	+++	----	---
Acetic acid (C2)	+++	++	++	++	--
Propionic acid	++++(Y+M)	+	+	±	-
Lactic acid	++	+++	++++	++	+
Fumaric acid (C7)	--	++	++	±	±
Sorbic acid	+++++				
Benzoic acid	+++++				

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Effect of organic acids

	Yeasts	Fungi	Gram– Bacteria	Gram+ Bacteria	Stafylo- / Streptococ
Formic acid	+++	0	++++	0	0
Acetic acid	+	-	+++	0	0
Propionic acid	++	++++	0	0	0
Sorbic acid	++++	+++	+++++	0	0
Benzoic acid	+++	+++	+++++	0	0
Lactic acid	-	-	++?	0	0
Caprylic- and caprinic acid	++	++	+++	+++++	++++
Lauric acid – GML90	+++	++	++	++++	++++++

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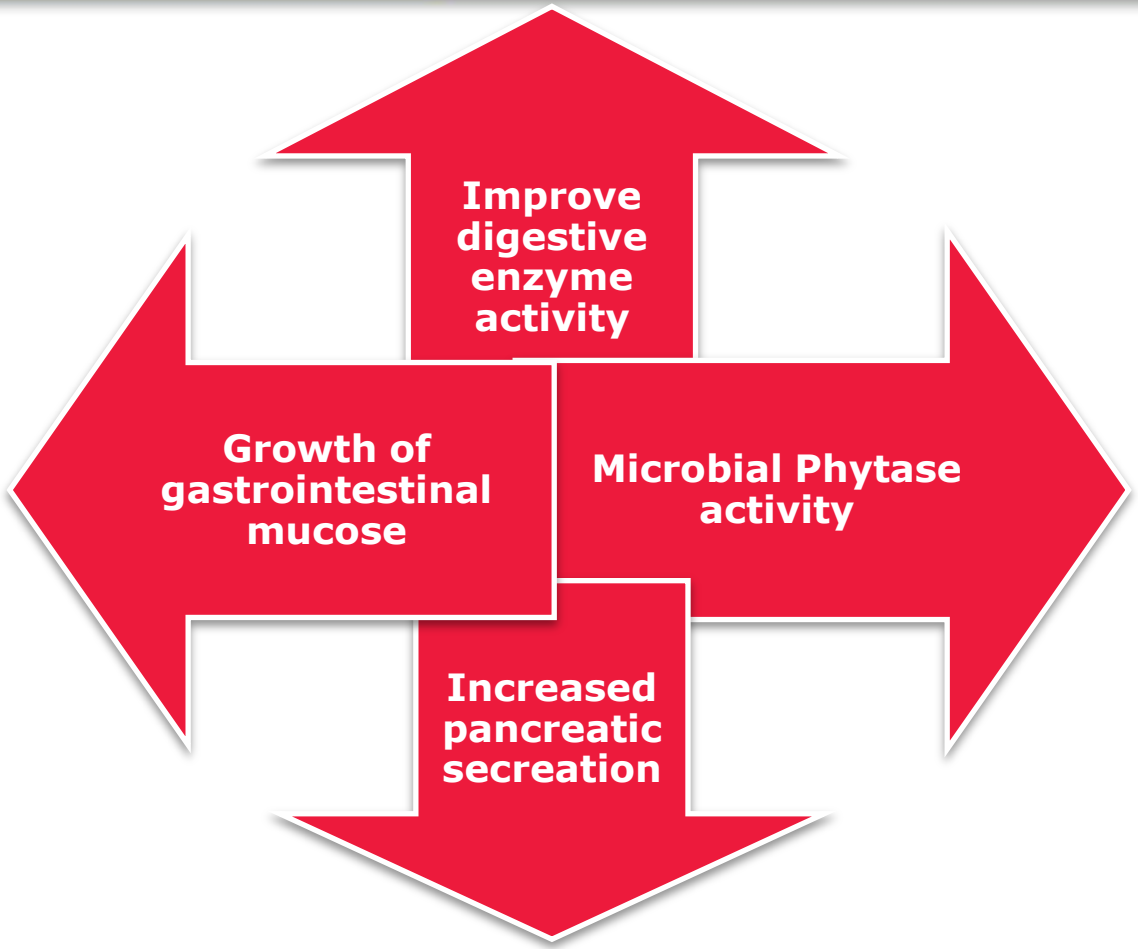
Effects beyond



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Purpose of adding acidifiers in poultry

To Lower the pH below 5

Inhibit the growth of harmful bacteria

directly & indirectly

To reduce the buffering capacity of feed

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Role of Acidifiers in Animal production

Role in Feed Hygiene

- Reducing pH
- Inhibit Microbial growth
- Reduction in BC

Role in Intestinal Tract

- pH reduction
- Antimicrobial Action
- Improves pepsin activity

Role in Metabolism

- Improve nutrient digestibility
- Improve Enzyme secretion

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Which Acid to be used

Short Chain Fatty acid

- **Formic,Acetic,Propionic**. Reduces pH & affect directly gram- bacteria
- **Fumeric,Citric,Malic,Lactic**
- Indirect effect on the b. population by pH reduction, acting mainly on stomach.

MCFA

- **Capric, Caprylic, Lauric acid**
- Direct & strong antimicrobial effect on Gram+ and Gram- bacteria.

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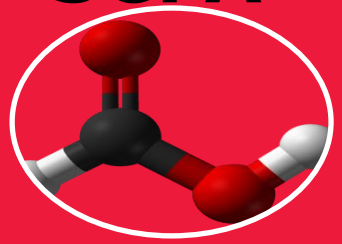
Or the Combination

SCFA



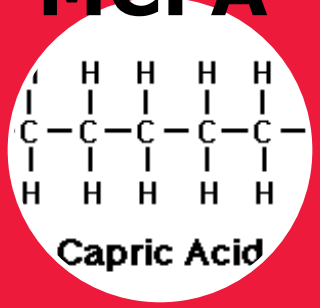
1-Formic Acid

2-Acetic Acid

3-Propionic Acid

+

MCFA



1-Capric Acid

2-Caprylic acid

3- Lauric Acid

+

ESSENTIAL OIL

1-Oregano

2-Cinamon

3-Thymol

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Daavision unique approach

Unique approach of combining SCFA & MCFA to control both Gram+ & Gram- bacteria

Two year scientific study of literature

Hoffman KL, Han IY, Dawson PL (2001).

Ouattar B, Simard RE, Piett G, Bégin A, Holley RA (2000).

PL Dawson, GD Carl, JC Acton, and IY Han (1 May 2002).

Study of 2 years in Vivo,In Vitro study

Equivalence of Lauric Acid and Glycerol Monolaurate as Inhibitors

Clostridial Enteric infections in pigs. J. Vet. Diagn. Invest. 17 (528-536)

Accenture Nomination

Nominated for 2 category (2013),

1- Green Sustainability.

2-Consumer goods & services.

Combination effect of scfa & GML 90 against Gram- & Gram+ bacteria.

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Mode of Action

- At low pH un-dissociated acid are lipophilic and can diffuse across cell membranes including bacteria & molds.
- Once in the bacterial cell,The higher pH of cytoplasm cause dissociation of the acids, and the resulting reduction in pH due to the release of H+ disrupt the enzymatic reactions & nutrient transport system.
- Molecule of organic acid also attacks the DNA of bacteria resulting it to death.

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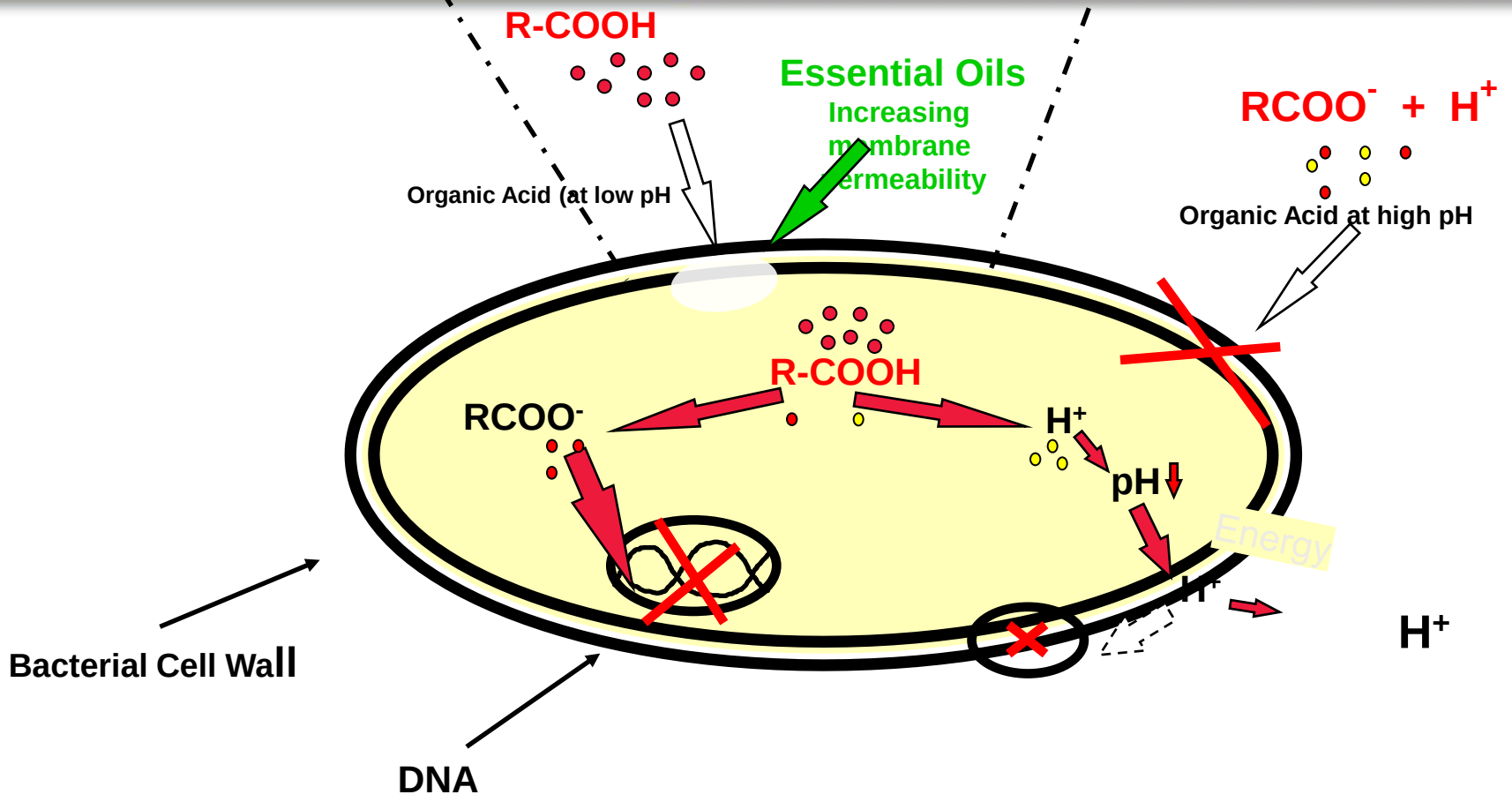
Mode of action



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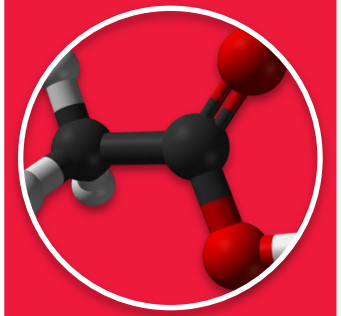
Antibacterial activity & growth promoting effect of acid in poultry

Inhibit growth of pathogenic microbes

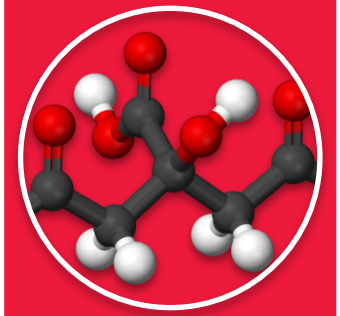


Improving gut health by the promoting beneficial bacterial growth

Growth promoting effect Of Acidifiers

Reduction of the buffering capacity of the feed

Improving pancreatic secretion, increases digestibility, absorption & retention of protein & amino acid



Reduce the formation of Biogenic Amines

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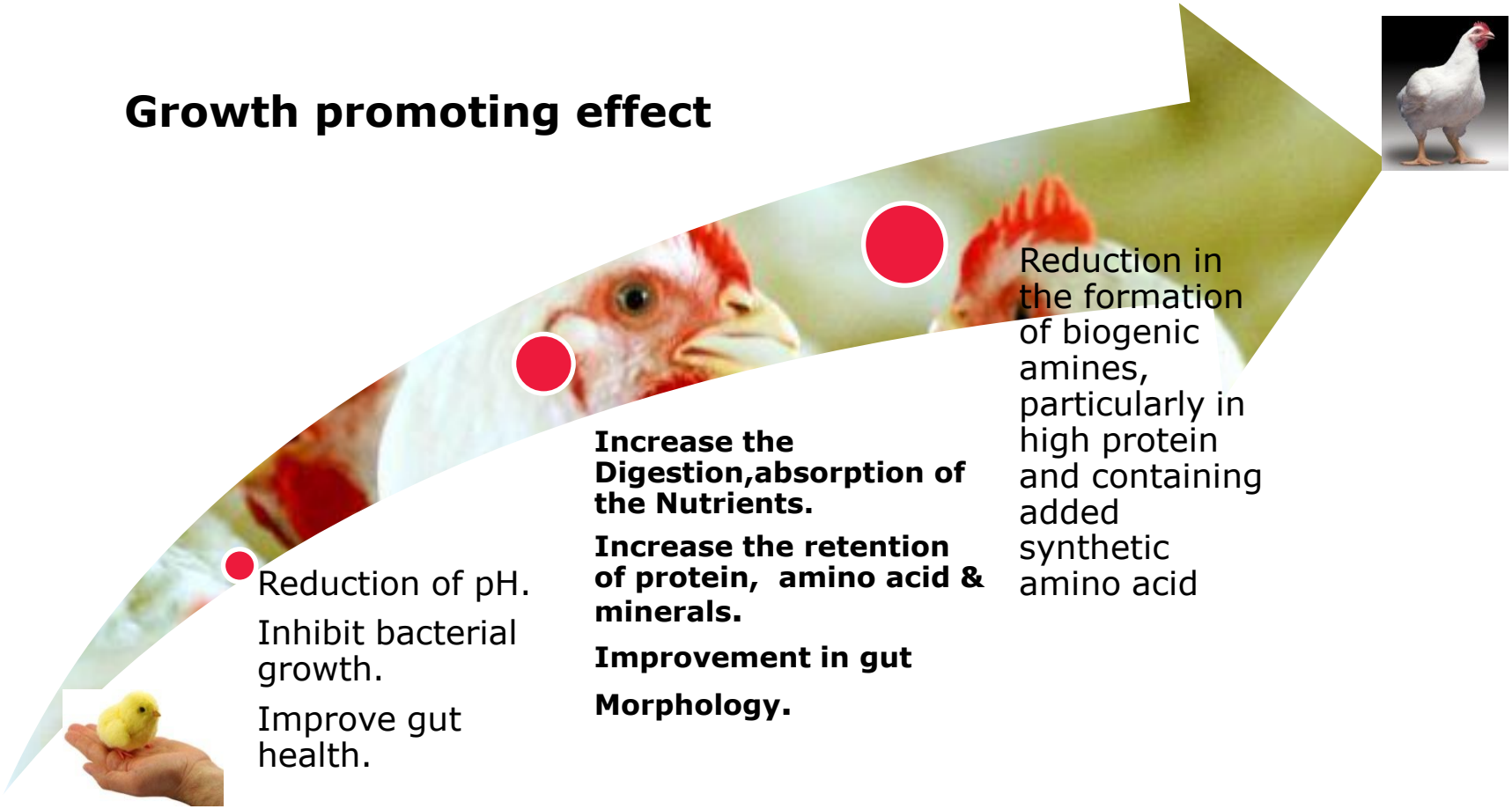
Acid Effect on growth

Growth promoting effect



Reduction of pH.

Inhibit bacterial growth.

Improve gut health.

Increase the Digestion,absorption of the Nutrients.

Increase the retention of protein, amino acid & minerals.

Improvement in gut Morphology.

Reduction in the formation of biogenic amines, particularly in high protein and containing added synthetic amino acid

Experimental Trial

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Practical trial with Daacid

- Daacid is a special mixture of acidifiers to ensure a broad anti-microbial spectrum in the gut of poultry

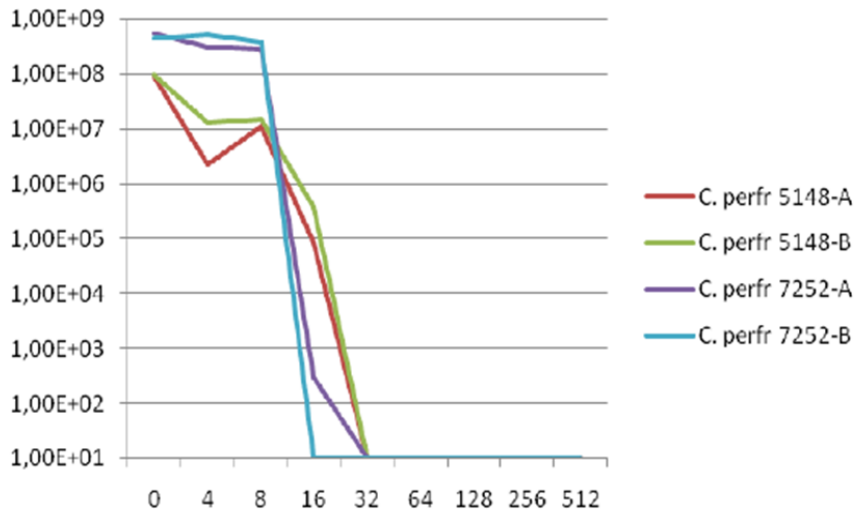

Plate counts of C. Perferenges after 24 hours in Daacid

Conclusions:
Daacid reduces the C. Perferenges effectively in vitro

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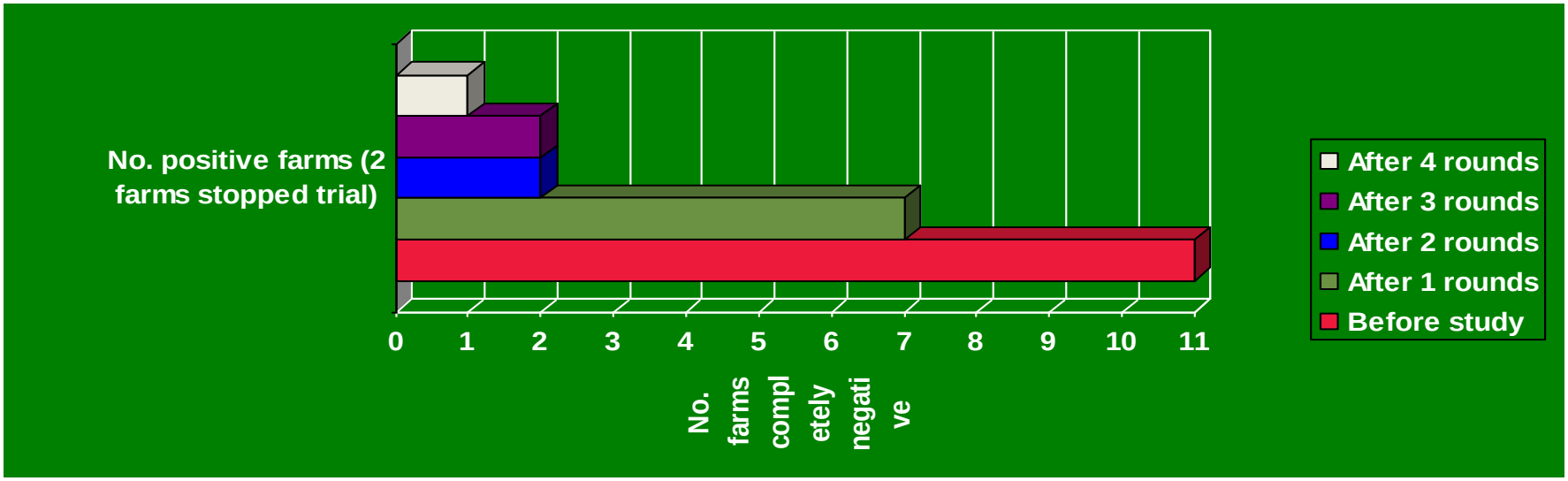
Overview 11 broiler farms with chronic Salmonella problems (1 mil. broiler places) using Daacid



- Total approach, including Daacid® and management measures (HACCP)
- Continuous care leads to success

Daavision 2009 + Veterinair service

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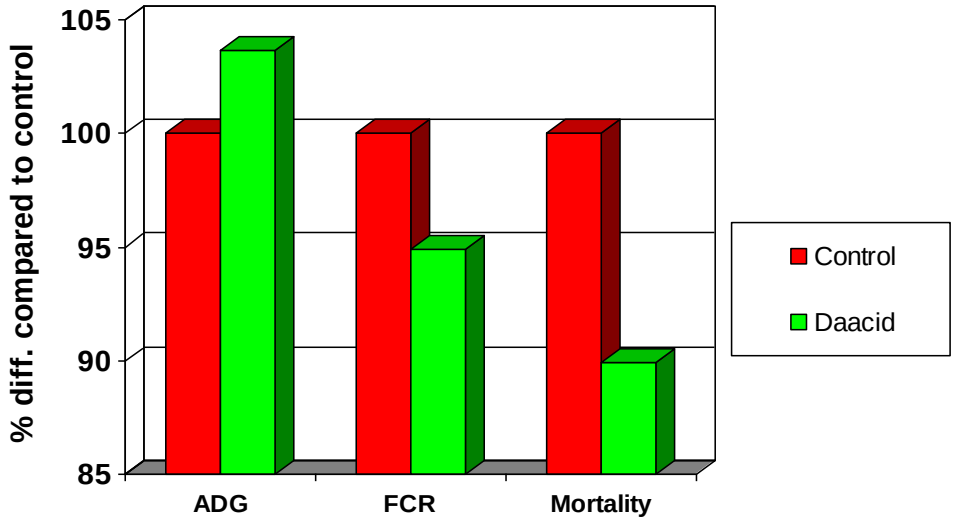
Commercial field trials with Daacid

A total of 200,000 broilers was tested in 4 identical rooms. Birds where on feed with 2kg/ton, 1kg/ ton and 1kg/ton Daacid in starter, grower resp. finisher feed; the other room were on control feed without growth promoter. Data are for period 0–40 days.



Comm. broiler operation, Netherlands,2005

Conclusion:
In field trials proven efficiency

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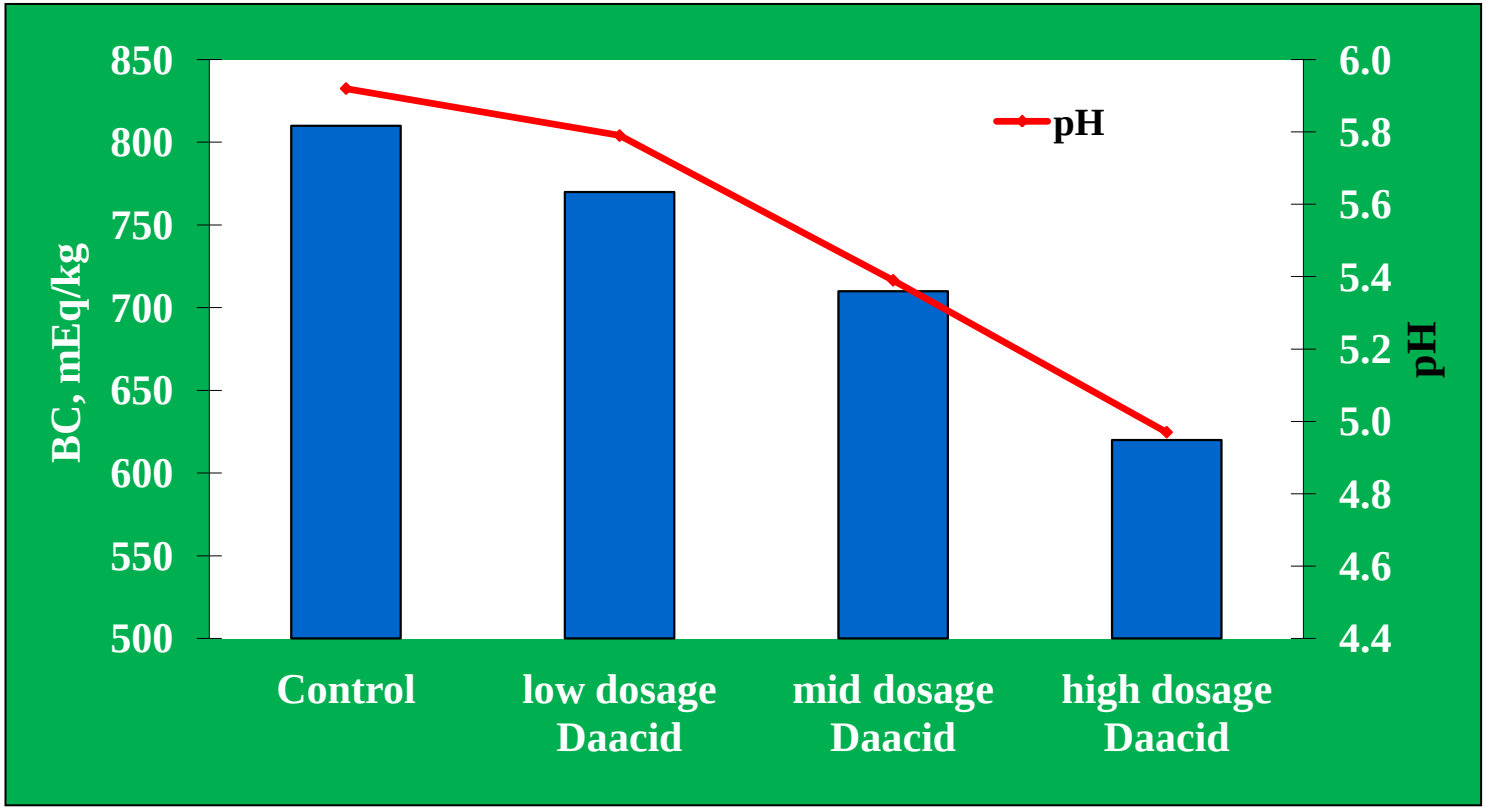
Daacid and pH reduction



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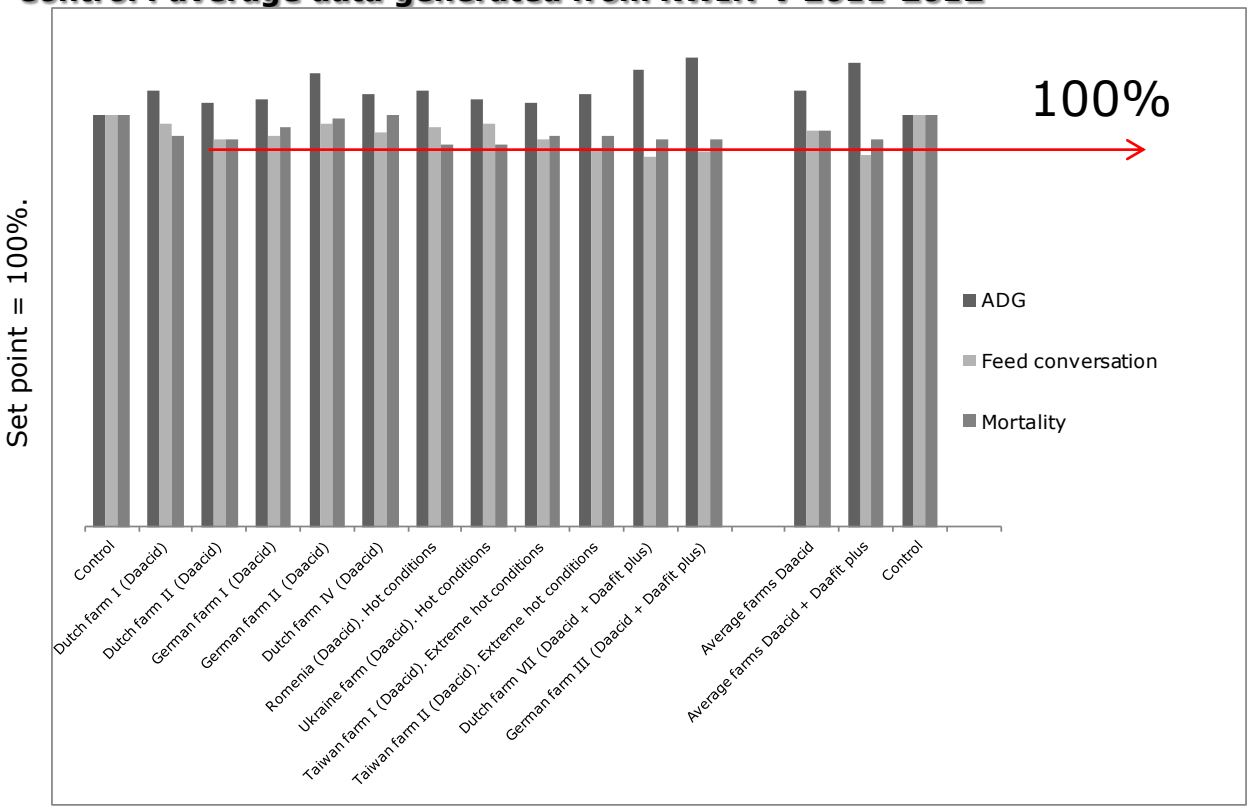
Technical trial data Daacid in poultry

Broiler trials with Daacid ® (and Daacid ® + Daafit ® plus) in different countries
Trial duration: 7- 42 days
Feed : standard commercial feed
Control : average data generated from KWIN-V 2011-2012



Dosage Daacid ® :
Total period D0-D42 : 2 kg/ Mt dry feed (88% DM)

Dosage Daacid ® + Daafit plus®
Starter : Daacid : 2 kg/ Mt dry feed (88% DM)

Grower : Daacid : 1 kg/ Mt dry feed (88% DM)

Finisher : Daafit Plus plus: 0,5 kg/ Mt dry feed (88% DM)

Trial data 2008-2011, data summary overview Daacid trials world wide

Factor affecting consistency in result

Factor's contributes inconsistency

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Factors affecting Acidifiers benefits

Substrates

Buffering capacity

- Composition of diets
- Qty of fermentable carbohydrates
- Presence of toxic metabolites such as biogenic amines

Others

Type/pKa/dose of supplemented acid

- Colonization & activity resulting in acid production
- Receptors for bacterial colonization on the epithelial villi
- Immunity level

Risk factor of using Acidifiers

Risk Factor

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Risk Factor

Diet Palatability

- When added at excessive level

Lower feed intake or feed refusal

- Due to the strong odor & flavor

Corrosive

- Corrosive to cement & steel equipment

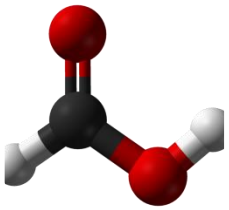
Solution's

Solution's

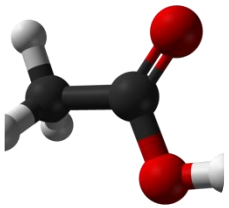
Solution's

- Evaluate the natural BC of feeds to determine the minimum amount of acid required
- Use of slow release form of acid
- Use of organic acid with fatty acid and mono- and diglycerides mixes to form micro granules

Overview of Global Market



Current Status



Growth Drivers

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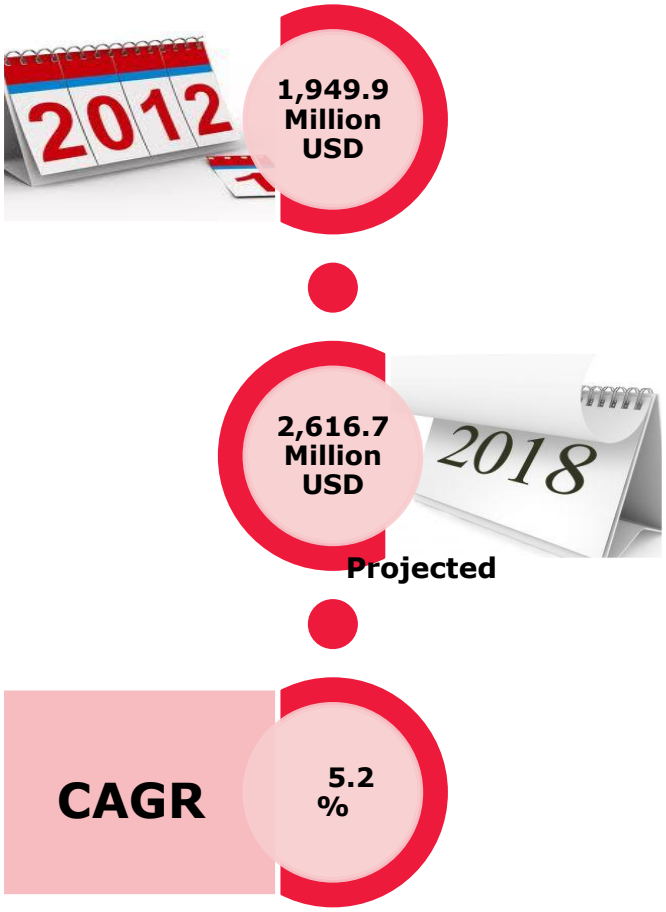
Acid Market



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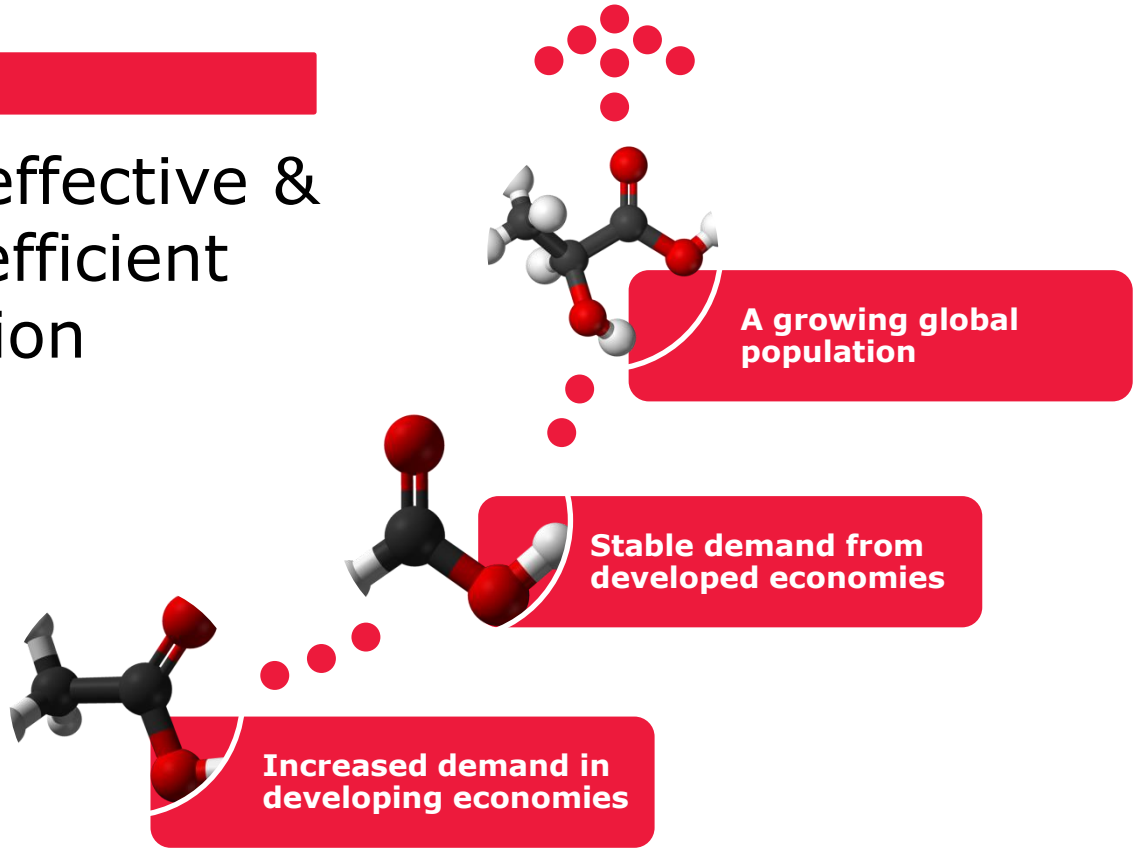
Growth Drivers

Cost effective & eco-efficient solution




Conclusion

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Conclusion

1. Organic Acid are arguably are the most effective & eco-efficient feed additives to date.
2. Short chain & MCFA have specific antimicrobial activity.
3. Antimicrobial activity of the acidifiers is pH dependent, Acidifiers plays definite role in the pH reduction and inhibition of the harmful pathogens.
4. Reduction in the bacterial population are associated with feeding organic acid which are effective against acid in-tolerent species,E coli, Salmonella etc.
5. Organic acid improve protein & energy digestibility by reducing microbial competition with the host.
6. Effect of organic acid go beyond those of antibiotic, includes reduction of BC, increased pancreatic secretion, effect on mucosa.
7. Lack of consistency in the benefits is related to uncontrolled variables, eg BC of the Strata, presence of other antimicrobial compound, cleanliness of the production environment & heterogeneity of the gut microflora.

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Scheme for poultry with recommended **Daavision products**

Functional groups

	Grand parent stock	Parent stock	Broilers (starter)	Broilers (grower)	Broilers (finisher)	Laying hens	Turkeys
E. coli							
Salmonella control							
Streptococci, Staphylococci							
Water quality optimalisation							
Clostridia (NE)							
Campylobacter							
Resistance improvement (immuno modulation)							
Enterococci							
Calcium absorption, Eggshell strength							
Coccidiosis							

Species

Possibilities

- Daa**fit**® **Plus P** (2 kg/1000 kg) through feed (88% DM)
- Daa**fit**® **P** (1 kg/1000 kg) through feed (88% DM)
- Daa**fit**® **Aqua** (0,7 kg-2 kg/1000 litre) through drinking water
- Daa**sal**® (3-5 kg/1000 kg) through feed (88% DM) **Salmonella protocol available**
- Daa**quasafe**® (1-2 kg/1000 litre) through drinking water
- Research projects

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Please visit us again in Oss or at www.daavision.com

Thank You

Feed Milling Technology & Trends Seminar 2014