K-STATE Research and Extension

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Summary of feed additives with scientific evidence evaluating efficacy against viral pathogens in swine feed

Multiple feed additives are on the market to provide nutritional support to pigs through a wide range of production stages using numerous types of active ingredients and mechanisms of action. Through scientific evaluation, many of these products have demonstrated evidence of reducing the detection and infectivity of viruses when inoculated in an experimental setting. Additionally, products have been developed with specific label claims to maintain *Salmonella*-negative status of feeds or feed ingredients.

However, claims of efficacy for reduction of viral contamination have not been reviewed and approved by the United States Food and Drug Administration for many of the products described in this document. Therefore, within this document there are no claims directed (whether stated or implied) beyond what is provided on the manufacturer label.

The goal of this document is to provide a brief summary of publically available information for products which have been evaluated within experimental viral inoculation settings. For additional information on feed safety related topics, please see:

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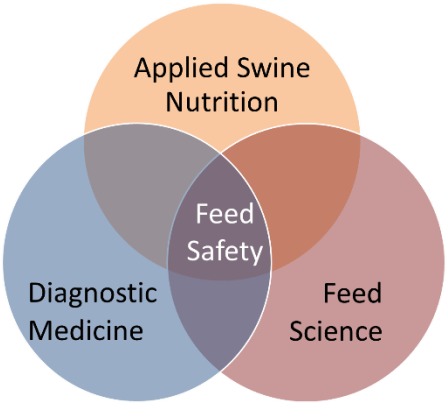
Kansas State University applied swine nutrition



Kansas State University
Animal Sciences and Industry

Diagnostic Medicine/Pathobiology
Kansas State University

Kansas State University
GRAIN SCIENCE & INDUSTRY

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer. No claims are intended (whether direct or implied) beyond the approved manufacturer label claims.

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Summary of available information:

Company	Product name	Active ingredient(s)	Inclusion, lb/ton	Pricing[1]	# of published studies documenting efficacy[2]	Total # of published studies
ADM	DaaFit & DaaFit S	Lauric and myristic acids and glycerol monolaurate	10 (Daafit S) 6 (Daafit)	$$	1	1
ADM	DaaFit PLUS	Lauric Acid, GML-90, formic acid, short chain fatty acids	10	---	1	1
Alltech	Guardian	Lactic acid, propionic acid, essential oils	8 (dry) 5.3 (liquid)	$$$ (dry) $$ (liquid)	3	3
Anitox	Termin8	Formaldehyde, propionic acid (liquid or powder form)	6	---	0	0
Anpario	pHorce	Formic acid, propionic acid, ammonium formate	6	$$	1	1
DSM Nutritional Products	VVC Premix	Blend of essential oil compounds and benzoic acid	7	$	2	3
Feed Energy	R2	Short, medium, long chain fatty acids and essential oils	60 (R2 active ingredients along with added fats/oils)	$ (active ingredient)	1	1
Form A Feed	Prohibio-R	Medium chain fatty acid and monoglyceride, organic acids	4-5	$$$	0	0
Furst McNess	Furst Protect	Monoglycerides, Essential oil, natural extracts	8	$$$	1	1
Kemin	FeedSURE MG	Monoglyceride blend, organic acids	3.3 to 7.7	$$	1	1
Kemin	Sal CURB	Formaldehyde, propionic acid	6.5	$	8	8
Novus	Activate DA	Organic acids, 2-Hydroxy-4-Methylthio Butanoic acid	10	$$$	2	3
PMI	Vitacy FeedLock	Blend of activated medium chain fatty acids	4	$	0	0
Provimi	Vigilex	Fatty acids	8	$	1	1
Ralco	Dual Defender	Phytonutrients	2	$$ to $$$	1	1

[1] Pricing at recommended inclusion. $ = < $10/treated ton; $$ = $10-15/treated ton; $$$ = > $15/treated ton. --- indicates that pricing estimate not available.

[2] Efficacy defined as a reduction in the infectivity of viral samples (PEDV, PRRSV, SVA, ASFV, FMDV) using either a cell culture based assay or swine bioassay. Other non-peer reviewed data may be available to support the products such as meeting abstracts and proceedings, but not considered in this summary.

Company	ADM
Product name	**DaaFit and DaaFit S**
Description	A source of medium chain fatty acids.
Active ingredients	A source of fatty acids, including lauric and myristic acids and glycerol monolaurate.
Application form	Dry flowable product delivered in either a summer (DaaFit S) or a winter (DaaFit) formula. Winter formula used approximately 55% less inclusion rate per ton.
Additional equipment necessary?	N/A
Recommended inclusion, lb/ton	DaaFit: 3-6 lb/ton DaaFit S: 4-10 lb/ton
Cost estimate	$10-15/treated ton ($$)
Regulatory/safety considerations	Proper PPE (eye protection N95, etc).
Distribution channel	Provided by ADM/Pancosma
Peer-reviewed publications	Dee et al., 2020
Website	Link
Contact information	animalnutrition@adm.com

Company	ADM
Product name	**DaaFit PLUS**
Description	Feed acidification and a source of medium chain fatty acids.
Active ingredients	MCFA's (Lauric Acid, GML-90) and SCFA's (Formic Acid, Ammonium Formate, Benzoic Acid, Lactic Acid, Acetic Acid, Citric Acid)
Application form	Dry flowable product
Additional equipment necessary?	N/A
Recommended inclusion, lb/ton	10 lb/treated ton
Cost estimate	---
Regulatory/safety considerations	Proper PPE (eye protection N95, etc).
Distribution channel	Provided by ADM/Pancosma
Peer-reviewed publications	Dee et al., 2020
Website	Link
Contact information	animalnutrition@adm.com

Company	Alltech
Product name	**Guardian**
Description	Acidifier for all classes of swine feed
Active ingredients	Lactic acid, propionic acid, essential oils
Application form	Dry or liquid
Additional equipment necessary?	Additional equipment would be required for liquid product. No additional equipment needed for dry product.
Recommended inclusion, lb/ton	8 for dry product, 5.3 for liquid product
Cost estimate	Dry: > $15/treated ton ($$$) Liquid: $10-15/treated ton ($$)
Regulatory/safety considerations	None reported
Distribution channel	Direct through Alltech or through feed companies
Peer-reviewed publications	Dee et al., 2020 - PEDV, PRRSV, SVA Dee et al., 2020 - PEDV Stenfeldt et al., 2021
Website	Website Link
Contact information	Russell Gilliam, 515-708-1968; rgilliam@alltech.com

Company	Anitox
Product name	**Termin-8 Liquid/Termin-8 Powder**
Description	Formaldehyde and organic acid combination for feed application
Active ingredients	Premixture of Aqueous Formaldehyde (37%) used to maintain complete animal feeds or feed ingredients salmonella negative for up to 21 days and Propionic Acid (a preservative) used as a chemical preservative for control of mold in feed or feed ingredients.
Application form	Liquid or dry
Additional equipment necessary?	Yes, Anitox provides equipment for application of liquid product.
Recommended inclusion, lb/ton	6 lb/ton for liquid form; Finished feeds or feed ingredients must prominently display the statement: "Treated with formaldehyde to maintain feed Salmonella negative. Use within 21 days."
Cost estimate	Contact Melissa Schlabs; mschlabs@anitox.com or 1-470-457-5438
Regulatory/safety considerations	May require EPA air permitting. OSHA Formaldehyde standard compliance required. Anitox regulatory team can provide guidance and support to help you meet these requirements.
Distribution channel	Direct through Anitox.
Peer-reviewed publications	---
Website	Website Link
Contact information	anitox@anitox.com or 1-678-376-1055 ask for NA Sales or Customer Experience

Company	Anpario
Product name	**pHorce (pronounced force)**
Description	Feed additive for the acidification of feed
Active ingredients	Silicon Dioxide, Formic Acid (acidifying agent), Propionic Acid (a preservative), Ammonium Formate (acidifying agents).
Application form	Dry
Additional equipment necessary?	No
Recommended inclusion, lb/ton	6 (see note 1)
Cost estimate	$10-15/treated ton ($$)
Regulatory/safety considerations	Acid based product, classified as hazardous for shipping. MSDS provided to all customers to describe safe handling and product usage.
Distribution channel	Direct through Anpario
Peer-reviewed publications	Dee et al., 2020
Website	Website Link
Contact information	Phil Burke, National Accounts Manager Swine and Turkey, 507-509-3881, phil.burke@anpario.com

[1] Ongoing work evaluating 5, 4, and 3 lb/ton inclusions. Data not yet available

Company	DSM Nutritional Products
Product name	**VVC Premix**
Description	Flavoring product and acidifier approved for swine diets
Active ingredients	Blend of essential oil compounds and pure benzoic acid
Application form	Dry
Additional equipment necessary?	No
Recommended inclusion, lb/ton	7
Cost estimate	< $10/treated ton ($)
Regulatory/safety considerations	N/A
Distribution channel	Direct through DSM
Peer-reviewed publications	Gebhardt et al., 2018 Dee et al., 2020 Zhai et al., 2021
Website	Website Link
Contact information	Dr. Jon Bergstrom (jon.bergstrom@dsm.com); Dr. Sara Hough (sara.hough@dsm.com)

[1]Can be added as two separate products (CRINA Piglets AF at 0.24 lb/ton and VevoVitall 6 lb/ton), or in a single premix called VVC Premix at 7 lb/ton inclusion.

Company	Feed Energy
Product name	**R2**
Description	Lipid-based anti-pathogenic product along with gut health benefits to animals.
Active ingredients	Low pKa lipid based ingredients with proprietary combination of short, medium and long chain fatty acids and essential oils.
Application form	Liquid; delivered through fats/oils.
Additional equipment necessary?	May not require any separate dosing system if the feed mill is already equipped with fat application system. Equipment must be able to handle lower pH. Feed Energy can assist in proper equipment setup as needed.
Recommended inclusion, lb/ton	60 lb/treated ton dose (per desired fat/oil inclusion) evaluated by Dee et al. (2020)
Cost estimate	< 10/ton ($); Active ingredients without added fats/oils; Specific pricing available by request: 515-263-0408
Regulatory/safety considerations	None reported
Distribution channel	Direct through Feed Energy
Peer-reviewed publications	Dee et al., 2020
Website	Website Link
Contact information	Feed Energy Company Sales and Marketing, 515-263-0408

Company	Form A Feed
Product name	**Prohibio-R**
Description	Nutritional support product for swine to address challenges that impact pig gut health.
Active ingredients	Medium chain fatty acid and medium chain monoglyceride, organic acids.
Application form	Dry flowable product
Additional equipment necessary?	N/A
Recommended inclusion, lb/ton	4-5
Cost estimate	> $15/treated ton ($$$)
Regulatory/safety considerations	Proper PPE (eye protection N95, etc).
Distribution channel	Direct through Form-A-Feed company and its affiliated dealerships.
Peer-reviewed publications	N/A
Website	Website Link
Contact information	Dr. Mark Whitney (507-380-2644, markwhitney@formafeed.com) or FAF (1-800-422-3649).

Company	Furst McNess
Product name	**Furst Protect**
Description	A source of emulsifying agents and natural flavor
Active ingredients	Monoglycerides, Essential oil, natural extracts
Application form	Dry
Additional equipment necessary?	No
Recommended inclusion, lb/ton	8
Cost estimate	> $15/treated ton ($$$)
Regulatory/safety considerations	N/A
Distribution channel	Direct through Furst McNess
Peer-reviewed publications	Dee et al., 2020
Website	Website Link
Contact information	Contact Link
Product is also available as Furst Protect Direct, which is provided through drinking water via stock solution at 1:128 dilution.	

Company	Kemin
Product name	**FeedSURE MG**
Description	Monoglyceride blend and organic acids to be used as a liquid energy source for animal feed and feed ingredients.
Active ingredients	Proprietary blend of monoglycerides and organic acids (preservative).
Application form	Liquid
Additional equipment necessary?	A liquid application system is needed for accurate and efficient application to feeds and feed ingredients. Site-specific application system is designed, fabricated, installed, commissioned, and serviced by the Kemin Application Solutions team. Cost of system varies depending on application needs. Supply agreement is available to support system implementation.
Recommended inclusion, lb/ton	3.3 to 7.7 lb/ton
Cost estimate	$10-15/treated ton ($$)
Regulatory/safety considerations	N/A
Distribution channel	Direct through Kemin Pathogen Control Team
Peer-reviewed publications	Phillips et al., 2021
Website	Website Link
Contact information	Mark Bienhoff, DVM; Pathogen Control Team Leader mark.bienhoff@kemin.com

Company	Kemin
Product name	**Sal CURB**
Description	Maintains Salmonella-negative status of complete feeds and feed ingredients for up to 21 days and controls mold in feeds or feed ingredients.
Active ingredients	Blend of aqueous formaldehyde 30% solution and propionic acid
Application form	Liquid
Additional equipment necessary?	Yes, additional information available through Kemin.
Recommended inclusion, lb/ton	6.5
Cost estimate	< $10/treated ton ($)
Regulatory/safety considerations	A liquid application system is needed for accurate and efficient application to feeds and feed ingredients. Site-specific application system is designed, fabricated, installed, commissioned, and serviced by the Kemin Application Solutions team. Cost of system varies. Supply agreement is available to support system implementation.
Distribution channel	Direct through Kemin Pathogen Control Team
Supplemental materials	• Sal CURB ASF Liquid Antimicrobial: Internal Research Summary • ASFV Patent
Peer-reviewed publications	• Dee et al., 2014 • Dee et al., 2015 • Dee et al., 2016 • Cochrane et al., 2020 • Dee et al., 2020 • Niederwerder et al., 2020 • Tran et al., 2020 • Stenfeldt et al., 2021
Website	Website Link
Contact information	Mark Bienhoff, DVM; Pathogen Control Team Leader mark.bienhoff@kemin.com

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Company	Novus
Product name	**Activate DA**
Description	Nutritional feed acid
Active ingredients	Granular organic acids, 2-Hydroxy-4-Methylthio Butanoic acid (HMTBa).
Application form	Dry
Additional equipment necessary?	No
Recommended inclusion, lb/ton	10 lb/ton (data evaluating 3 and 10 lb/ton inclusion rates)
Cost estimate	> $15/treated ton ($$$)
Regulatory/safety considerations	Not provided by manufacturer
Distribution channel	Not provided by manufacturer
Supplemental materials	Data Sheet Link
Peer-reviewed publications	Trudeau et al., 2016 Cottingim et al., 2017 Dee et al., 2020
Website	Website Link
Contact information	Web Contact 1-314-576-8886

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Company	**PMI**
Product name	**Vitacy Feedlock**
Description	Source of activated medium-chain fatty acids formulated to help address risk factors in swine feeds.
Active ingredients	Blend of medium chain fatty acids
Application form	Dry (bag or tote) or liquid
Additional equipment necessary?	Additional equipment would be required for liquid product. No additional equipment needed for dry product.
Recommended inclusion, lb/ton	4 for dry product, 2.5 for liquid product
Cost estimate	< $10/treated ton ($)
Regulatory/safety considerations	N/A
Distribution channel	Marketed by PMI, distributed through NutraBlend.
Peer-reviewed publications	---
Website	Website Link
Contact information	Todd Clevenger, tlclevenger@landolakes.com, 260-438-6383

Exact composition of product is not publically available, although it is a medium chain fatty acid (MCFA)-based product. Research documenting the efficacy of similar medium chain fatty acids is available:

- Dee et al., 2016
- Cochrane et al., 2020
- Lerner et al., 2020
- Niederwerder et al., 2020

Exact composition and inclusion rates of MCFA of Vitacy Feedlock is not known and no publications are available with the commercial product.

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Company	Provimi
Product name	**Vigilex**
Description	Feed additive for the acidification of feed
Active ingredients	A proprietary oil blend of fatty acids, bacterial fermentation products, whey products, plant protein and natural flavorings. Concentration of active ingredients are 0.4%.
Application form	Dry
Additional equipment necessary?	No
Recommended inclusion, lb/ton	8
Cost estimate	< $10/treated ton ($)
Regulatory/safety considerations	N/A
Distribution channel	Direct through Cargill/Provimi
Peer-reviewed publications	Dee et al., 2020
Supplemental materials	Saddoris-Clemons and Ebarb (2020) – AASV Proceedings, available from supplier by request. Ebarb and Saddoris-Clemens (2020) – AASV Proceedings, available from supplier by request.
Website	N/A
Contact information	Matt Ritter, PhD; Provimi North American Pork Team, Cargill Animal Nutrition & Health; mritter@provimi-na.com, (515)520-1808.

Company	Ralco
Product name	**Dual Defender**
Description	Natural feed supplement that helps support overall health
Active ingredients	An optimized blend of phytonutrients including Microfused Essential Oils and ActiFibe prebiotic fiber.
Application form	Dry
Additional equipment necessary?	No
Recommended inclusion, lb/ton	2
Cost estimate	$10-15 ($$) to > $15/treated ton ($$$) depending on quantity.
Regulatory/safety considerations	N/A
Distribution channel	Either direct or through network of distribution and dealer partners.
Peer-reviewed publications	Dee et al., 2020
Website	Website Link
Contact information	Ralco Nutrition, Inc. 1-800-533-5306 Link