Delacon™
performing nature

Phytogenic feed additives on the rise as natural performance enhancers

Known for broad-spectrum efficacy, plant-based feed additives are a promising solution for both conventional and antibiotic-free livestock production systems.

Since the ban on antibiotic growth promoters in the EU in 2006, phytogenic feed additives have been on the rise in global animal production. In the United States, sub-therapeutic use of medically important antibiotics for growth performance will no longer be allowed by 2017. As antibiotic-free feeding programs receive increased attention among scientists, nutritionists, feed manufacturers and farmers, phytogenic feed additives are moving further into the spotlight due to their holistic and broad-spectrum efficacy.

In particular, phytogenic feed additives show enormous potential for their proven impact on performance, sustainability, feed and food safety.

What do U.S. livestock and poultry producers need to know about phytogenic feed additives? What is the proven impact on animal health and performance? And, where do you start?

MODES OF ACTION POWERED BY PLANTS

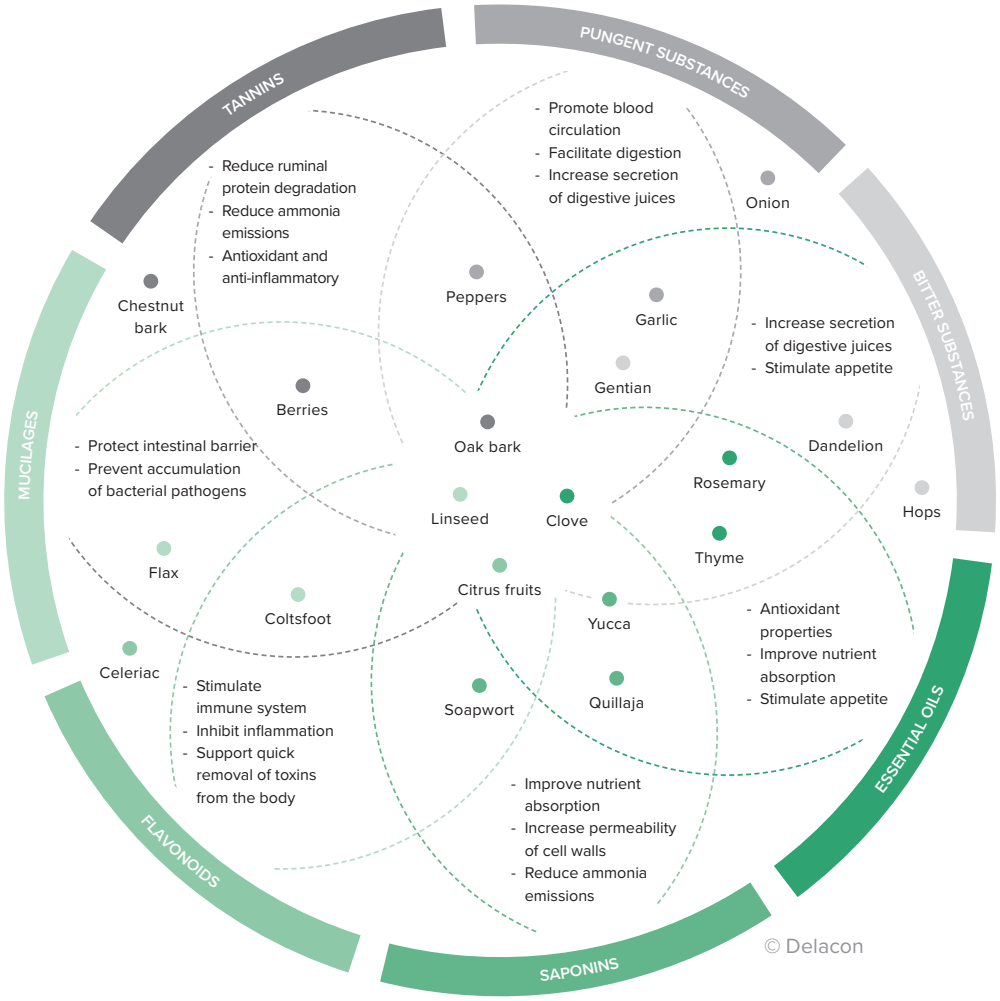
Phytogenic feed additives, commonly defined as plant-based feed additives or botanicals, represent a group of natural substances used in animal nutrition. These substances are derived from herbs, spices, other plants and their extracts, like essential oils. The term phytogenic feed additives (PFAs) was coined nearly three decades ago by Delacon, which even then recognized the potential of plants to meet challenges in animal nutrition.

PFAs aim to deliver optimized performance by supporting nutrient utilization, as well as gut health and integrity.

They can consist of many different active ingredient groups, such as pungent substances, bitter substances, essential oils, saponins, flavonoids, mucilages and tannins. Owing to this wide range, PFAs offer much more than flavoring properties. The effects are many, while mostly targeting the enhancement of livestock performance.

The impacts can include sensorial stimulation and palatability, increased enzymatic activity in the intestinal tract, improved nutrient utilization, antioxidant effects, enhanced quorum sensing inhibition leading to reduced bacterial pathogenicity, improved gut integrity and improved reproductive performance.

THE PHYTOGENIC UNIVERSE



Throughout history, herbs, spices, other plants and their extracts, like essential oils, have been used for human health and veterinary applications. Today, powerful plant-derived active substances are selected for their modes of action, then precisely combined and formulated in feed additives for the ration.

Notably, PFAs using plant extracts show wider modes of action in animal nutrition compared to chemical nature-identical substances. This advantage is based on the synergistic effects of all agents within a plant, which have not been reduced to the effects of a single lead substance [1,2,3]. This natural synergy, combined with sustainability and safety, makes PFAs a top solution platform in multispecies animal nutrition.

GREEN LIGHT FOR FOOD SAFETY, SUSTAINABILITY AND PROFITABILITY

PFAs are a natural alternative for livestock producers and companies developing antibiotic-free feeding programs. Additives applied in livestock production should not only contribute to profitability and superior quality of animal-derived products but also satisfy food safety and environmental regulations.

PFAs used as natural growth promoters in animal nutrition have been proven to provide a return on investment. They also have been proven to reduce ammonia, methane and other greenhouse gas emissions. The botanical compounds are proven safe for consumers, and can help improve profitability and sustainability in animal production.

Improved performance in broiler chickens

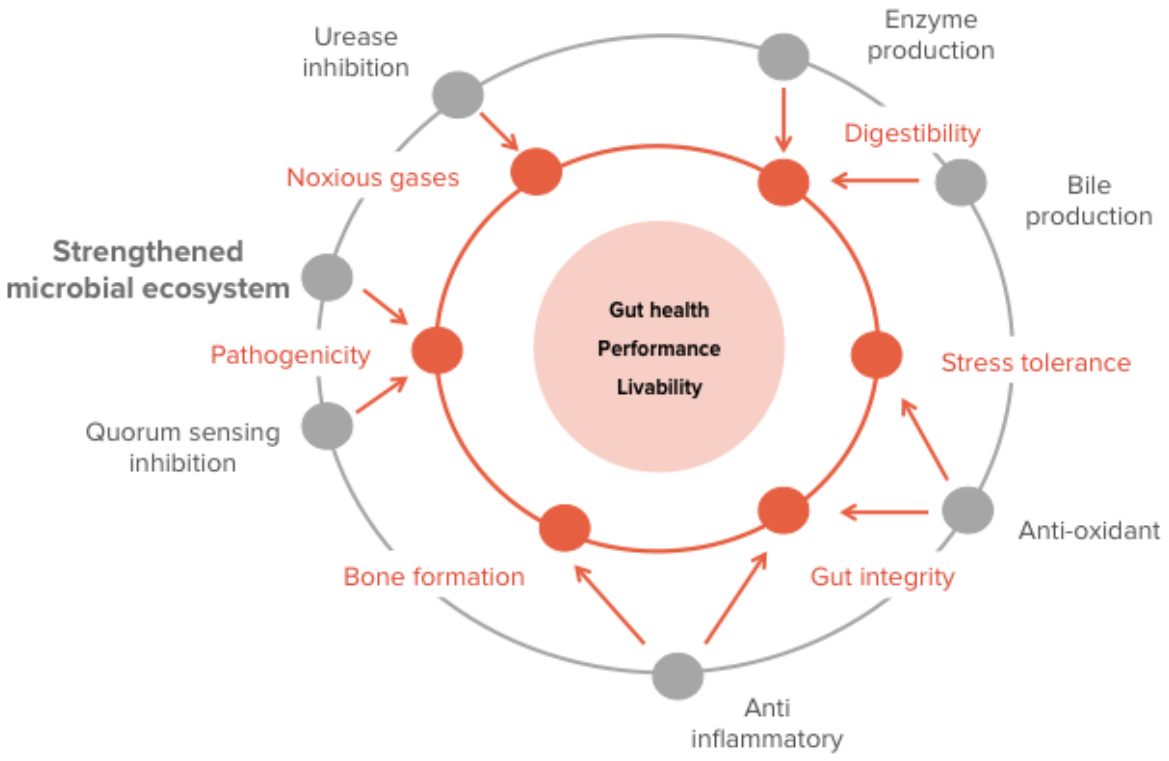
Feeding PFAs nets a 3:1 return on investment with the use of Delacon's Biostrong® 510 formula.

- Enhances nutrient digestibility and retention [4,5,6]
- Improves feed conversion ratio by at least 2% [4,7]
- Enhances body weight gain by at least 1% [4,7]
- Significantly reduces ammonia and greenhouse gas emissions [8]
- Supports intestinal health and improves bone strength [9]

Biostrong® Forte combines full Biostrong® 510 effects with strengthening gastro-intestinal tract properties. In addition, Biostrong® Forte:

- Enhances foot pad quality [10]
- Improves feed efficiency, body weight gain and intestinal integrity under challenging conditions [4,7]
- Enhances livability [4,5,6]

Power of nature released in Biostrong® product line

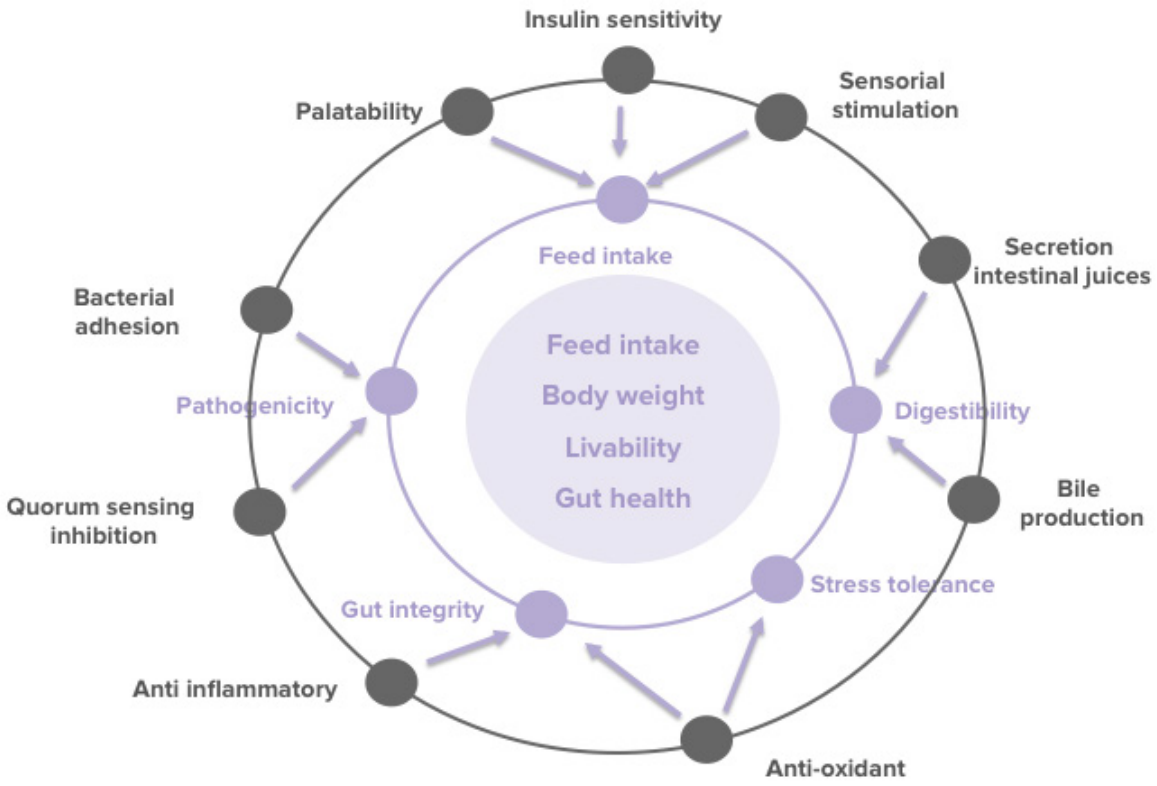


Healthy pigs increase profit potential

Delacon's Fresta® F formulas can completely replace antibiotic growth promoters, while enhancing pig performance. In the U.S., Fresta® F is a key ingredient in Purina's NEWtraStart™ feed for nursery, grow-finish pigs and sows.

- Enhances feed intake in lactating sows (+6%) [11,12] and piglets (+4.7%) [13,14], and high acceptance of feed after weaning
- Optimizes piglets feed efficiency and growth performance [13,15]
- Supports intestinal health [16,17]
- Improves vitality and decreases piglet mortality (-36%) [13]
- Enhances nutrient utilization in piglets [15] and sows [14]
- Improves nutritional quality of milk in lactating sows [14]
- Improves piglet uniformity at birth and weaning [18]
- Reduces body weight loss of sows at weaning (-25%) [14]
- Increases litter size and weight [12]
- Enhances stress tolerance in sows and piglets [12,17]
- Improves sows' fertility and shortens reproduction cycle [14]

Power of nature released in Fresta® F



Celebrating the power of nature

PFAs are celebrated for their unique ability to connect the power of nature from farm to fork. PFAs are natural ingredients, many as common as those found on a kitchen spice rack, and they offer maximum safety to consumers, as tested by authorities. That means no harmful residues and a **feed-to-food chain consumers can trust.**

The use of PFAs supports livestock producers in acting sustainably, and minimizes the carbon footprint of animal production. In fact, feeding phytogenic feed additives in poultry and pigs has been shown to reduce ammonia emissions by up to 50% compared to rations without phytogenic feed additives [8]. All benefits that resonate positively with mainstream audiences.

More detailed information on phytogenic feed additives for pigs and poultry is summarized in review articles [19, 20, 21, 22].

A NATURAL CHOICE FOR YOUR FEEDING PROGRAM

Livestock producers need feed additive solutions that work – solutions that improve gut health, thereby enhancing animal performance and health without the use of antibiotic growth promoters. PFAs are a natural choice, and offer promising benefits to the animal, producer, consumer and environment.

Delacon works with U.S. livestock producers to integrate PFAs in animal feeding strategies for profitable outcomes. Learn about our custom solutions and feeding trial opportunities by contacting **Sonny Pusey, Delacon's regional manager for North America, at sonny.pusey@delacon.com or 1-574-361-3106.**

DELACON U.S.

Sonny Pusey
Phone +1 574 361 3106 | sonny.pusey@delacon.com

GLOBAL HEADQUARTERS, AUSTRIA

Delacon Biotechnik GmbH, Weissenwolffstr. 14, 4221 Steyregg
Phone +43 732 640 531-0 | office@delacon.com

WHEN SELECTING QUALITY PFA PRODUCTS:

- **Experience matters.** Be cautious of companies that have shallow expertise in developing and testing PFA products. Delacon's experience spans three decades.
- **Confirm the research and efficacy.** Ask for and understand the research behind the product. Delacon operates the Performing Nature Research Center, and partners with PMI Nutritional Additives to conduct fundamental joint research and field trials in the United States.
- **Choose true phytogenic products.** Look for PFAs that contain natural, plant-derived extracts with several active substances, rather than single substances produced synthetically. Delacon uses true PFAs for their greater synergistic effects between different active substances.
- **Ensure viability of active substances.** PFAs should unfold their maximum efficacy where it is needed: in the gastro-intestinal tract of the animal. Delacon's patented, heat-resistant microencapsulation process protects active substances from processing and storage conditions.
- **Work with your expert team.** Your veterinarian and nutritionist are key to making sound decisions in your operation. Delacon works with you and your team to create customized solutions that meet specific animal nutrition goals.

REFERENCES

[1] Elaissi, A., Rouis, Z., Salem, N. A. Ben, Mabrouk, S., ben Salem, Y., Salah, K. B. H., … Agboola, S. (2012). Chemical composition of 8 eucalyptus species' essential oils and the evaluation of their antibacterial, antifungal and antiviral activities. *BMC Complementary and Alternative Medicine,* 12(1), 81.

[2] Bakkali, F., Averbeck, S., Averbeck, D., & Idaomar, M. (2008). Biological effects of essential oils - A review. *Food and Chemical Toxicology,* 46(2), 446–475.

[3] Hyldgaard, M., Mygind, T., & Meyer, R. L. (2012). Essential oils in food preservation: Mode of action, synergies, and interactions with food matrix components. *Frontiers in Microbiology,* 3(JAN), 1–24.

[4] Amad, a. a., Manner, K., Wendler, K. R., Neumann, K., & Zentek, J. (2011). Effects of a phytogenic feed additive on growth performance and ileal nutrient digestibility in broiler chickens. *Poultry Science,* 90(12), 2811–2816.

[5] Utterback, P., Spangler, H., Parr, C., Aardsma, M., Pugh, J., Hilgendorf, D., … Parsons, C. (2013). Effects of Biostrong 510 on performance and amino acid digestibility in laying hens. *PSA Annual Meeting 2013,* 129.

[6] Jungbauer, L., & Wendler, K. R. (2012). Effects of a Phytogenic Feed Additive on Nutrient Digestibility in Broilers. *European Symposium on Poultry Nutrition 2012.*

[7] Jungbauer, L., & Wendler, K. R. (2013). Effects of a phytogenic feed additive on performance in broilers fed a corn - soybean meal - wheat based diet. *PSA Annual Meeting 2013.*

[8] Hörtenhuber, S. J., Jungbauer, L., Wendler, K., & Werner, J. (2013). Reduction of ammonia and greenhouse gas emissions from egg production by using a phytogenic feed additive Institute of Organic Agriculture (FiBL) Austria Sustainable Agricultural Systems. BOKU Symposium 2013.

[9] Cypriano, L., Piccini, I., Filho, J. B. P., Pastore, N. S., & Mader, A. (2009). Performance and tibia phytogenic feed additive characteristics of broilers fed a. BOKU Symposium 2009.

[10] Trials by Southern Poultry Research & Delacon R&D.

[11] Delacon R&D, performed in Texas Farm.

[12] Zhong, M., Wu, D., Lin, Y. & Fang, Z., F. (2011). Phytogenic Feed Additive for Sows: Effects on Sow Feed Intake, Serum Metabolite Concentrations, IgG Level, Lysozyme Activity and Milk Quality. *Journal of Agricultural Science and Technology,* 802-810.

[13] EFSA, (2011). Scientific Opinion on the safety and efficacy of FRESTA® F for weaned piglets. *EFSA Journal 2011,* 9(4), 2139.

[14] Delacon R&D, Performed in *Freie Universität Berlin*, Germany.

[15] Lan, X.R., li, T.S., & Kim, I., H. (2016). Effects of essential oils supplementation in different nutrient densities on growth performance, nutrient digestibility, blood characteristics and fecal microbial shedding in weaning pigs. *Animal Feed Science and Technology, 214,* 77–85.

[16] Gaetner, S. (2011). PhD Dissertation, Studies on effects of plant-based feed additives on digestive, microbiological and immunological parameters in weaned piglets. *Freie Universität Berlin,* Germany.

[17] Zentek, J., Gaetner, S., Tedin, L., Maenner, K., Mader, A., & Vahjen, W. (2012). Fenugreek seed affects intestinal microbiota and immunological variables in piglets after weaning. *British Journal of Nutrition, 109,* 859–866.

[18] Vinyeta, E., Goerke, M., & van der Klis J.,D. (2015). 13th *Digestive Physilogy of Pigs,* Kliczków, Poland.

[19] Ayrle, H. Mevissen, M., Kaske, M., Natues, H., Gruetzner, N., Melzig, M. & Walkenhorst, M. (2016). Medicinal plants – prophylactic and therapeutic options for gastrointestinal and respiratory diseases in calves and piglets? A systematic review. *BMC Veterinary Research* 12 (89).

[20] Brenes, A., & Roura, E. (2010). Essential oils in poultry nutrition: Main effects and modes of action. *Animal Feed Science and Technology,* 158(1–2), 1–14.

[21] Windisch, W., Schedle, K., Plitzner, C., & Kroismayr, A. (2008). Use of phytogenic products as feed additives for swine and poultry. *Journal of Animal Science,* 86(14 Suppl).

[22] Franz, C., Baser, K. H. C., & Windisch, W. (2007). Essential oils and aromatic plants in animal feeding – a European perspective. *Flavour and Fragrance Journal,* 22(November), 206–213.