

PATHKINEX UPDATE



***Salmonella* 101: What Is the Problem and What Tools are Livestock Producers Using to Manage It?**



The *Salmonella* Problem

Salmonella is a top concern for poultry producers, but it poses health and downstream food safety concerns for all sectors of livestock production. In pigs and cattle, mitigation efforts primarily focus on reducing colonization, intestinal inflammation and necrosis associated with Salmonellosis. In poultry operations reducing *Salmonella* in both pre and post-harvest periods are important to decrease the contamination in meat and eggs. Regardless of industry segments, producers face universal pressure to implement technologies to lower the *Salmonella* burden starting in the live production phase. Why is *Salmonella* so challenging to control?

In the environment they are hardy, surviving for months to years in cool, damp conditions, making them difficult to eliminate. Once ingested, *Salmonella* species can invade host cells and evade detection by the host's defense system. Treatments become less effective once *Salmonella* is intracellular, and some strains are increasingly resistant to antibiotics¹. Additionally, recent PathKinex™ meta-analysis has indicated that an increased risk of disease is present when *Salmonella* is found in coinfection with other pathogens. PathKinex™ findings across swine, dairy cattle, and poultry, also show that *E. coli* gene quantities are significantly higher when *Salmonella* is detected. These results suggest that complex microbial interactions contribute to establishment of *Salmonella* in the animal; therefore, a holistic approach to control may be necessary.



Current *Salmonella* Pre-harvest Solutions and Gaps

Controlling *Salmonella* often involves a multifaceted approach which can include sanitation and disinfection protocols, pest management programs, vaccination, and use of feed additives. These tools can reduce *Salmonella* in livestock and poultry; however, each solution has unique advantages and disadvantages. Continued research, innovation, and collaboration play a crucial role in the future of mitigating the risks associated with *Salmonella*.

Pre-harvest Solution	Description	Advantages	Disadvantages
Sanitizers and Disinfectants	Substances used to clean equipment, housing, and processing areas to reduce overall bioburden, including <i>Salmonella</i> , in the production environment.	Reduce pathogen load, prevent cross-contamination between different animal groups and facilities, improve animal health due to improved cleanliness and reduced animal stress/disease.	Relies on consistent, thorough standard operating procedures. Overuse can lead to resistant strains of <i>Salmonella</i> . Disinfectants can leave chemical residues. Can disrupt beneficial microflora.
Pest Control	Management of unwanted pests such as rodents, wild birds, and insects that can carry and transmit <i>Salmonella</i> .	Reduce vectors that can carry and spread <i>Salmonella</i> into the production environment.	Minimal disadvantages besides added cost and potential for worker exposure to harmful chemicals.
Vaccines	Preparation administered to stimulate the immunity to a specific pathogen, such as a <i>Salmonella</i> serotype.	Elicit protective immune responses in the host to protect against infection of specific <i>Salmonella</i> strains or serotypes.	May provide incomplete protection, often strain-specific. Can take multiple doses or boosters, increasing labor needs. Vaccinated animals can sometimes still become carriers of <i>Salmonella</i> and can shed and spread.
Probiotics	Live microorganisms that confer health benefits on the host.	Some strains can produce antimicrobial substances that inhibit growth of <i>Salmonella</i> and other undesirable microorganisms, prevent <i>Salmonella</i> colonization by competing for nutrients and binding sites in the gut, enhance the host's immune response, improve gut integrity and nutrient absorption.	Not all strains can confer benefit or may be inconsistent. Some strains have a limited shelf life or are unable to survive feed pelleting. May provide a slower response since growth of the live microorganism is needed. Often continuously included in feed which can introduce an ongoing cost. Determining the right dosage may require testing and adjustments.
Prebiotics	Non-digestible substances (often fibers or carbohydrates) that promote the growth of beneficial gut bacteria and/or bind <i>Salmonella</i> .	Selectively stimulate beneficial bacteria in the gut helping to create a robust gut microflora. Improve gut integrity and barrier function, reducing ability of <i>Salmonella</i> to colonize or invade. Some have the capability to bind <i>Salmonella</i> surface proteins further reducing colonization potential.	Variable efficacy, based on type of prebiotic, animal species and diet. May provide a slower response since they have an indirect mode of action. Determining the right dosage may require testing and adjustments.
Essential oils	Aromatic natural compounds extracted from different plant parts.	Antimicrobial properties that inhibit growth of <i>Salmonella</i> . Provide immune boosting, anti-inflammatory, and antioxidant activities.	Palatability issues due to smell and or taste. Potential for bacterial resistance development. May interact with other feed additives. Can be volatile and stability may be a concern when exposed to air, light, or heat.
Bacteriophages	Type of virus that specifically targets a certain bacterial strain.	Highly specific towards the target bacteria and does not disrupt beneficial bacteria.	May provide incomplete protection due to high specificity toward target <i>Salmonella</i> strains. Potential for bacterial resistance development. Stability may be a concern depending on sensitivity to environmental factors like temperature and pH.
Organic Acids and Acidifiers	Naturally occurring or synthetically produced weak acids, such as butyric acid, formic acid, acetic acid, propionic acid and citric acid.	Lower the pH in the GI tract to create an environment that inhibits growth of harmful bacteria while promoting beneficial gut microbiota.	Palatability issues due to smell and/or taste. Corrosive to equipment and delivery systems, increasing maintenance costs or requiring special equipment. Potential for gut irritation and damage to the intestinal lining. Potential for acid-tolerance development in <i>Salmonella</i> . Can interact with other feed components. Often continuously included in feed which can introduce an ongoing cost.
Medium-chain fatty acids (MCFAs)	Type of fatty acid with chains of 6-12 carbon atoms such as caproic acid, caprylic acid, capric acid, and lauric acid.	Effective at disrupting bacterial cell membranes including those of <i>Salmonella</i> . Enhance the host's immune response.	Palatability issues due to smell and/or taste. Specific dose needed. Can disrupt beneficial microflora. Potential for <i>Salmonella</i> to develop resistance or tolerance. Often continuously included in feed which can introduce an ongoing cost.



A Combination of Control Measures Creates Multiple "Hurdles" for *Salmonella* and Other Pathogenic Microbes, Improving Outcomes for Producers

A multi-pronged approach is crucial to reduce *Salmonella* in livestock and poultry production. Using combinations of control measures and additive products, producers will create a series of hurdles that reduce *Salmonella* survival and host resilience to a greater extent than any method alone. Choice of technologies will depend on the goals and unique situation of each producer. Producers will have to carefully consider the best approach for their operations weighing the advantages and disadvantages of each technology.

Naturally, as new serotypes and strains of *Salmonella* arise, mitigation programs may need to be adjusted, leaving, as always, plenty of opportunity for continuous innovation.



Question to consider:

How are your customers currently handling challenges with *Salmonella*?

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Helpful Links:

[OUS ProVent-ECL Brochure \(seismic.com\)](#)
[Novela ECL Brochure oUS METRIC March 2023 \(seismic.com\)](#)
[Strateris ECL 10g – Presentation \(seismic.com\)](#)

References

1. El-Saadony, M. T., Salem, H. M., El-Tahan, A. M., Abd El-Mageed, T. A., Soliman, S. M., Khafaga, A. F., Swelum, A. A., Ahmed, A. E., Alshammari, F. A., & Abd El-Hack, M. E. (2022). The control of poultry salmonellosis using organic agents: An updated overview. *Poultry Science*, *101*(4), 101716. <https://doi.org/10.1016/j.psj.2022.101716>
2. Abd-El Wahab, A., Basiouni, S., El-Seedi, H. R., Ahmed, M. F., Bielke, L. R., Hargis, B., Tellez-Isaias, G., Eisenreich, W., Lehnerr, H., Kittler, S., Shehata, A. A., & Visscher, C. (2023). An overview of the use of bacteriophages in the poultry industry: Successes, challenges, and

possibilities for overcoming breakdowns. *Frontiers in Microbiology*, 14.
<https://doi.org/10.3389/fmicb.2023.1136638>



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