

Salmonella Field Research Technical Report

Reduce *Salmonella* with AviPro® Megan® Vac 1 and Megan® Egg.

Salmonella is the most prevalent cause of bacterial foodborne illness in the United States, with nearly one-third of reported cases each year attributed to eggs and poultry, according to the Meat Science Association.¹ The responsibility of reducing the risk cannot be placed solely on the processing plant. A single outbreak doesn't just impact one segment of your operation; it affects everyone, along with the brand equity and trust you've worked so hard to build.

In 2017, Elanco initiated a multi-year study with a poultry producer and processor that aimed to discover the effect AviPro Megan Vac 1 and AviPro Megan Egg had on reducing the prevalence of *Salmonella* in poultry products. The study also looked at the impact of replacing an existing *Salmonella* vaccination program that included a competitive live *Salmonella* vaccine with Megan Vac 1 and Megan Egg.

The study required extensive sampling and is ongoing. Between February 2017 and August 2019, approximately 3,875 samples were collected: 1,494 hot-rehang samples and 2,381 part rinse samples.

¹ American Meat Science Association. *Salmonella* Fact Sheet. 2015. Accessed on 1/23/2020. https://meatscience.org/docs/default-source/publications-resources/fact-sheets/salmonella-fact-sheet-2015.pdf?sfvrsn=87518eb3_0





Research Setup and Design

Two complexes (each containing breeders, grow-out and feedmill) participated in the study (Complex A and Complex B).

Complex A had no ongoing *Salmonella* vaccination program in place. Complex A began vaccinating the breeders and the progeny from those breeders on the day of hatch with Megan Vac 1, Megan Egg and commercial inactivated and autogenous *Salmonella* vaccines. Complex B had a *Salmonella* vaccination program in place using a competitive commercial inactivated and autogenous *Salmonella* vaccines in the breeders, but no program in place for the progeny. Complex B started by administering Megan Vac 1 to the progeny at hatch.

At both complexes, sampling took place at two key points. The first was at the point of a hot-rehang prior to evisceration when there were minimal interventions of any kind. The second point was after the birds had gone through the chiller and were being parted; a sample was taken prior to the final rinse.

The study began by sampling unvaccinated birds entering the processing facility followed by vaccinated birds entering the processing plant. Sampling continued to indicate the differences in the prevalence of *Salmonella* between the vaccinated birds and the unvaccinated birds.



Results: Reduced Prevalence of *Salmonella*

A serogrouping analysis was completed on each of the isolates of *Salmonella* that the processing facility recovered (serogroups B, D and C). The Megan platform targets primarily B and D serogroups based on the similarity of the O antigen, and helps reduce invasive serogroups that the in-plant interventions may be less effective in controlling.

The study revealed that in Complex A, where the breeders received Megan Egg and progeny received Megan Vac 1, Megan Egg and Megan Vac 1 reduced the prevalence of serogroups B and D precipitously. Administering Megan Egg to breeders and Megan Vac 1 to the progeny from those breeders reduced the prevalence of serogroup B by 26% and the prevalence of serogroup D by 0.4%. Overall, this totaled a combined reduction of 26.3% for serogroups B and D together. *Salmonella* Infantis was also reduced by 8.8%.

Complex A <i>Salmonella</i> Serogroups B, D and C1, Infantis, Pre-Vaccinates and Vaccinates			
	Rinse Samples Only		
Serogroup	Pre-Vax n=256	VAX n=1225	% Change
Negative	1.4%	1.3%	-0.1%
B ¹	40.8%	14.8%	-26.0%
D ²	0.8%	0.4%	-0.4%
B & D	41.6%	15.2%	-26.3%
C1, Infantis*	23.3%	14.6%	-8.8%
All Other ³	33.7%	68.9%	35.2%

¹Group B: Heidelberg,* Schwarzengrund, Typhimurium,* Untypeable

²Group D: Berta,* Ouakam

³All Other: A-I-Untypeable, C1 Mbandka, C1 Montevideo, C1 Ohio, C1 Tennessee, C1 Thompson, C1 Untypeable, C2 Hadar, C2 Kentucky, C2 Untypeable, E1 Anatum,* E4 Liverpool, E4 Senftenberg, E4 Taskony, G Cubana, G Untypeable, G Worthington, Rough (R) Untypeable

*Top 20 Serogroups from CDC, National Enteric Disease Surveillance: *Salmonella* Annual Report, 2018

In Complex B, where the breeders received a competitive *Salmonella* vaccine and the progeny received Megan Vac 1, there was a minor reduction in the prevalence of serogroups B and D. Serogroup B was only reduced by 7.2% and serogroup D was reduced by 1.3%.

The decision was then made to go back and vaccinate the breeders with Megan Egg. After an 8-week transition period, and as more and more of the vaccinated progeny from vaccinated breeders entered the facility, more significant reductions in the prevalence of serogroup B and D were recorded. Serogroup B was reduced by 26% while serogroup D was eliminated entirely. *Salmonella* Infantis was reduced by 10.8%.

Sampling continued through 2019 and the results revealed a 43% reduction in the prevalence of *Salmonella* from 2017 to 2019.

Complex B <i>Salmonella</i> Serogroups B, D and C1, Infantis, Pre-Vaccinates and Vaccinates					
	Parts Only				
Serogroup	Pre-Vax n=306	VAX n=870	Transition [†] n=582	Total VAX n=374	Change Pre-Vax to Total VAX
Negative	16.0%	11.3%	51.1%	77.6%	61.6%
B ¹	31.6%	24.4%	10.5%	5.6%	-26.0%
D ²	1.4%	0.1%	0.5%	0.0%	-1.4%
B & D	32.9%	24.5%	11.0%	5.6%	-27.4%
C1, Infantis*	23.7%	31.7%	23.7%	12.8%	-10.8%
All Other ³	27.4%	32.2%	14.2%	4.0%	-23.4%

¹Group B: Heidelberg,* Schwarzengrund, Typhimurium,* Untypeable

²Group D: Berta,* Ouakam

³All Other: A-I-Untypeable, C1 Mbandka, C1 Montevideo, C1 Ohio, C1 Tennessee, C1 Thompson, C1 Untypeable, C2 Hadar, C2 Kentucky, C2 Untypeable, E1 Anatum,* E4 Liverpool, E4 Senftenberg, E4 Taskony, G Cubana, G Untypeable, G Worthington, Rough (R) Untypeable

*Top 20 Serogroups from CDC, National Enteric Disease Surveillance: *Salmonella* Annual Report, 2018

[†]Transition between programs in breeders



Analysis: Seasonality of *Salmonella*

When the results were broken down by quarter, Elanco observed a seasonal fluctuation in the prevalence of *Salmonella*. In Complex A, for example, the prevalence of serogroups B and D increased from 10.1% in Q3 of 2017 to 21.2% in Q1 of 2018 for breeders vaccinated with Megan Egg and the progeny vaccinated with Megan Vac 1. However, the research still revealed a 20.4% reduction from the pre-vax levels, showing the continued benefit of administering the Megan *Salmonella* vaccine line to breeders and their progeny.

The research also revealed that the Megan *Salmonella* vaccines may not be as effective against *Salmonella* Infantis. By Q3 of 2018, the prevalence of that serogroup had returned almost to pre-vax levels.

Megan Egg and Megan Vac 1 are live Typhimurium vaccines that are most effective on the higher risk *Salmonella* B and D group serogroups. These serogroups include Enteritidis and other highly zoonotic *Salmonella* serogroups that are difficult strains to manage with in-plant interventions due to their presence in the meat and muscle of the bird. While Megan Egg and Megan Vac 1 may not be as effective against *Salmonella* Infantis, this serogroup is more vulnerable to processing plant interventions.

Complex A							
<i>Salmonella</i> Serogroups B, D and C1, Infantis, Pre-Vaccinates and Vaccinates by Quarter							
Serogroup	Pre-Vax		Rinse Samples Only				
			Q3-2017	Q4-2017	Q1-2018	Q2-2018	Q3-2018
Negative	1.4%		3.2%	1.0%	0.0%	0.0%	2.8%
B ¹	40.8%		10.1%	18.3%	21.2%	13.2%	11.7%
D ²	0.8%		0.0%	0.0%	0.0%	0.0%	2.8%
B & D	41.6%		10.1%	18.3%	21.2%	13.2%	14.5%
C1, Infantis*	23.3%		15.9%	14.1%	9.8%	12.5%	22.0%
All Other ³	33.7%		70.9%	66.7%	69.0%	74.3%	60.7%

¹Group B: Heidelberg,* Schwarzengrund, Typhimurium,* Untypeable

²Group D: Berta,* Ouakam

³All Other: A-I-Untypeable, C1 Mbandka, C1 Montevideo, C1 Ohio, C1 Tennessee, C1 Thompson, C1 Untypeable, C2 Hadar, C2 Kentucky, C2 Untypeable, E1 Anatum,* E4 Liverpool, E4 Senftenberg, E4 Taskony, G Cubana, G Untypeable, G Worthington, Rough (R) Untypeable

*Top 20 Serogroups from CDC, National Enteric Disease Surveillance: *Salmonella* Annual Report, 2018

Also, in Complex B, the prevalence of serogroups B and D had risen back to almost pre-vax levels by Q4 of 2017. In Q4 of 2018, however, two months after the transition period from the competitive breeder *Salmonella* vaccine to Megan Egg and the progeny vaccinated with the Megan Vac 1 had entered the processing complex, the prevalence of serogroups B and D was 16.2% lower than pre-vax levels. This further demonstrates the effectiveness of a two-prong approach with Megan Egg in breeders and Megan Vac1 in broilers in managing serogroups B and D.

Complex B

Salmonella Serogroups B, D and C1, Infantis, Pre-Vaccinates and Vaccinates by Quarter†

	Parts Only							
Serogroup	Pre-Vax	Q2-2017	Q3-2017	Q4-2017	Q1-2018	Q2-2018	Q3-2018	Q4-2018
Negative	16.0%	17.8%	10.4%	7.7%	52.6%	88.4%	79.4%	69.4%
B ¹	31.6%	20.7%	23.5%	27.0%	8.4%	0.5%	1.0%	16.7%
D ²	1.4%	0.0%	0.3%	1.0%	0.0%	0.0%	0.0%	0.0%
B & D	32.9%	20.7%	23.8%	28.1%	8.4%	0.5%	1.0%	16.7%
C1, Infantis*	23.7%	27.0%	33.6%	37.8%	23.4%	7.1%	13.9%	13.0%
All Other ³	27.4%	34.4%	31.8%	26.3%	15.7%	4.0%	5.6%	0.9%

¹Group B: Heidelberg,* Schwarzengrund, Typhimurium,* Untypeable

²Group D: Berta,* Ouakam

³All Other: A-I-Untypeable, C1 Mbandaka, C1 Montevideo, C1 Ohio, C1 Tennessee, C1 Thompson, C1 Untypeable, C2 Hadar, C2 Kentucky, C2 Untypeable, E1 Anatum,* E4 Liverpool, E4 Senftenberg, E4 Taskony, G Cubana, G Untypeable, G Worthington, Rough (R) Untypeable

*Top 20 Serogroups from CDC, National Enteric Disease Surveillance: *Salmonella* Annual Report, 2018

†To 11/20/2018



Conclusions

- ◆ Poultry producers need to have a comprehensive *Salmonella* vaccination plan for both broilers and breeders. Administering the vaccines to only some of the birds will result in incremental improvements in the prevalence of *Salmonella*. A comprehensive plan will yield the best results.
- ◆ While seasonality may impact the prevalence of *Salmonella*, AviPro Megan Vac 1 and Megan Egg reduce the prevalence of *Salmonella* serogroups B and D, as well as the overall prevalence, by a significant amount.
- ◆ Megan Egg and Megan Vac 1 are live Typhimurium vaccines that are most effective on the higher risk *Salmonella* B and D group serogroups. These serogroups include Enteritidis and other highly zoonotic *Salmonella* serogroups that are difficult strains to manage with in-plant interventions due to their presence in the meat and muscle of the bird.