

**Transforming  
the Swine  
Value Chain:**

**Health,  
Efficiency,  
Impact**

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*United Animal health*

# Components of the swine value chain

## Production stage

- genetic improvement
- health management
- sustainable feed practices
- environmental impact reduction

## Processing & slaughter

- meat quality enhancement
- waste minimization

## Distribution & marketing

- cold chain optimization
- market diversification
- consumer engagement
- policy & regulatory frameworks
- education & training
- technology integration

# Topical Issues in the Swine Value Chain



## Animal Health and Disease Management

### ASF

**Biosecurity:** inconsistency between smallholder and large farms increases vulnerability to disease outbreaks

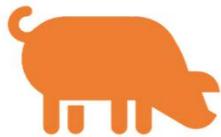


## Environmental and Sustainability Issues

### Manure management

**Greenhouse gas emissions:** land and water use (soybean, corn)

# Topical Issues in the Swine Value Chain



## Animal Welfare

Confinement

Slaughter practices (*variability in humane standards and enforcement*)



## Economic Inequities and Market Volatility

Price fluctuations (*disease, feed costs, trade restrictions*)

Smallholder challenges (*access to markets, veterinary care, financing*)

Vertical integration (*the big gets bigger dominating the market*)

# Topical Issues in the Swine Value Chain



## Consumer Preferences and Transparency

Demand shifts (*organic, higher welfare, plant-based alternatives*)

Traceability



## Labor and Social Issues

Finding labor

Working standards

Future of rural livelihoods

# What can we do to support?

## **For this presentation:**

- Focus on health
- How can we better understand what is in front of us?
- How do we choose the most effective solution with this knowledge?



# Platform for Pathogen Surveillance

1 **Detect** markers and virulence genes unique to bacterial, viral, and fungal pathogens of interest.



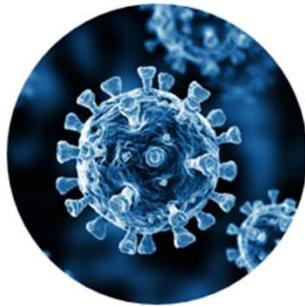
2 **Quantify** differences in various virulence genes between pigs of differing health status.



3 **Correlate:** Find relationships between factors associated with sick and healthy populations. →



# Diverse Microbial Taxa are Involved in Coinfections



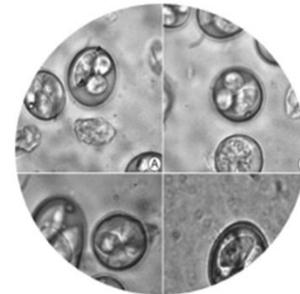
**Viruses**



**Bacteria**



**Fungi**



**Parasites**

**\$200B in global losses over the last decade due to infectious diseases in livestock**

- morbidity, mortality, reduced performance, and, loss of future productivity<sup>1</sup>

<sup>1</sup>FAO. *The Economic Losses Caused by Animal Disease* Food and Agriculture Organization of the United Nations, Available online at: <http://www.fao.org/3/a-i5512e.pdf>.

A row of black dominoes with white dots, receding into the distance. The dominoes are arranged in a line, with the first one in the foreground being the most prominent. The background is a plain, light-colored surface.

**86% of the time, there's more than one pathogen involved!**

Pigs exhibiting enteric disease have more than one pathogenic *E. coli*, *Clostridium perfringens* or *Clostridium difficile* detected through the Platform for Pathogen Surveillance.

# Sow Inoculation of Offspring

adhesin/  
toxin genes

→ F18 K88 stx stx2 sta cpa cpb cpb2



**farrowing  
sows**

Microbial profile of the sow is similar to its offspring.

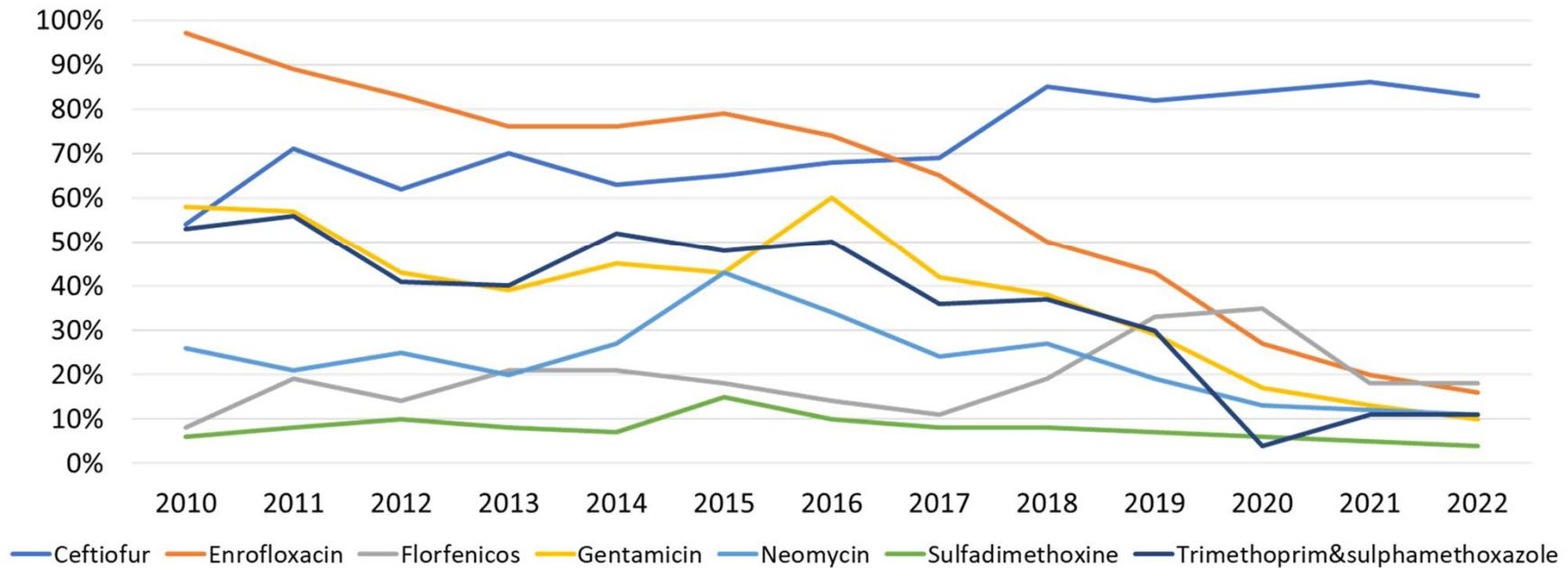
**piglets 0-7  
days old**

Influencing the sow with direct-fed microbials (DFMs) provides benefit to piglets.

**piglets  
8-20 days  
old**

Feeding sow with DFMs is a proactive approach; drives sow performance and set pig up for down-stream success.

# Antimicrobial Susceptibility Trends: F18 *E. coli*

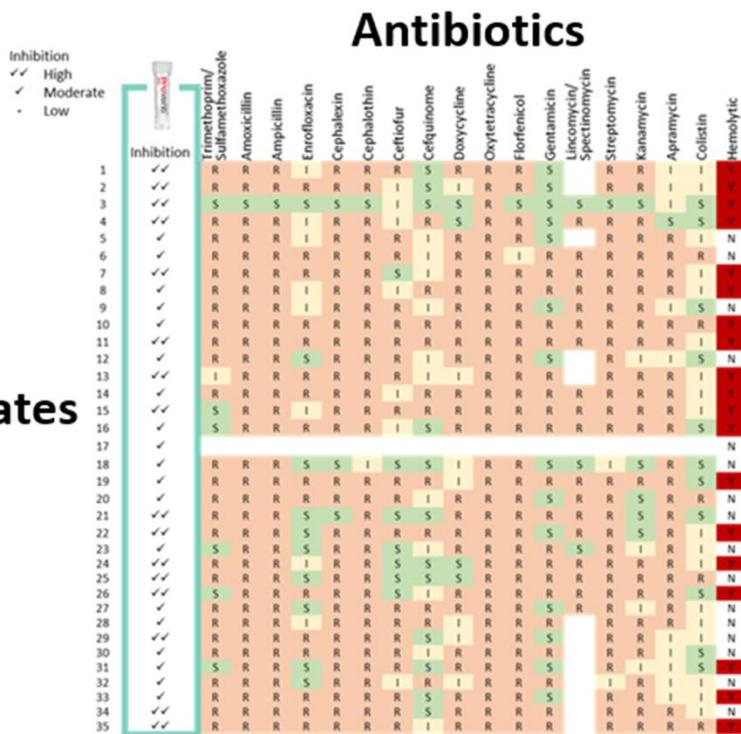


Carthage Veterinary Conference, IL USA. Marcelo Almeida, DVM, MS, PhD, August 2023. "Post-weaning *E. coli* Trends at the Diagnostic Laboratory", Iowa State University Veterinary Diagnostic & Production Animal Medicine

# Platform for Pathogen Surveillance (*Taiwan*): *E.coli* SURVEILLANCE 2024

31 out of the 35 total *E. coli* isolates tested were resistant to  $\geq 10$  common antibiotics.

35 isolates



Color Code

**Resistant**

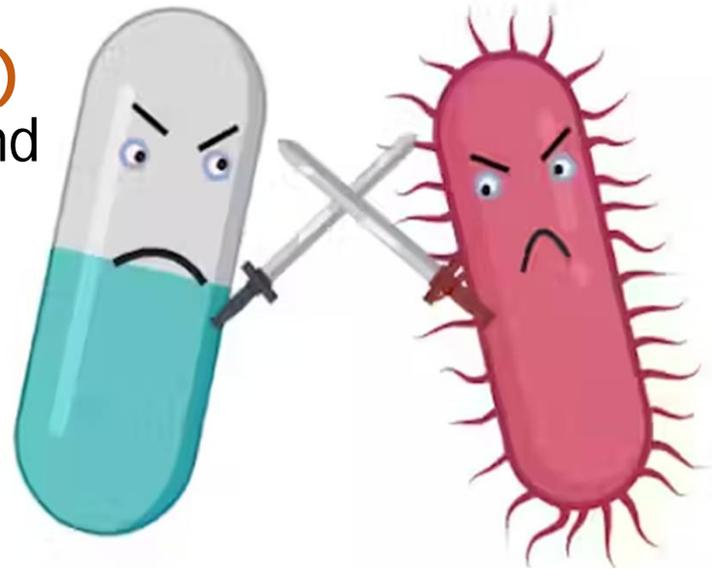
**Intermediate**

**Sensitive**

# Global Duty: Antimicrobial Resistance (AMR)

**Antimicrobial resistance (AMR)** is one of the top global public health and development threats.

The ***misuse and overuse of antimicrobials*** in humans, animals and plants are the ***main drivers in the development of drug-resistant pathogens.***



# Global Duty: Antimicrobial Resistance (AMR)

CAUSE	DIRECT DEATHS	DIRECT AND INDIRECT DEATHS
COVID-19 (Year 2020)	1.80M	3.00M
ANTIMICROBIAL RESISTANCE (Year 2019)	1.27M	4.95M

source: World Health Organization

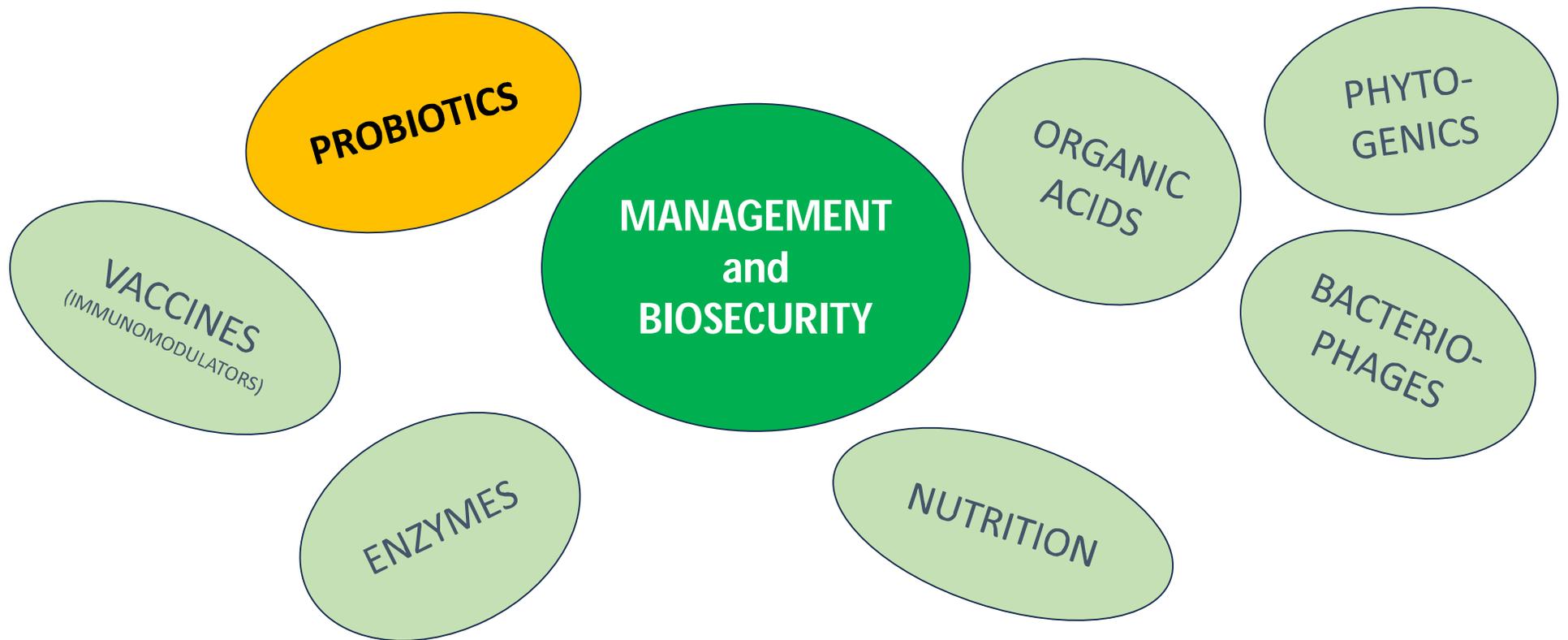
**By 2050, it is estimated that there will be up to 10M deaths per year due to AMR**

*(1.91M direct + up to 8.22M contributing)*

Source: *The Lancet*, September 2024

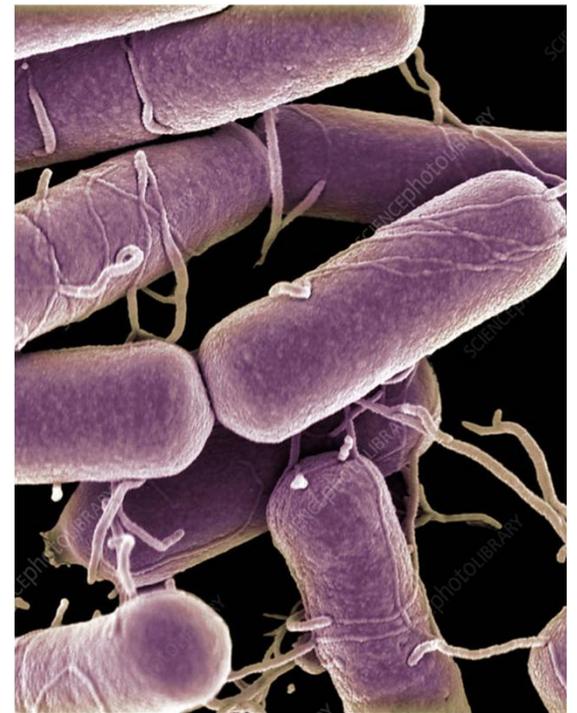


# WHAT ARE THE ALTERNATIVES TO ANTIBIOTICS?

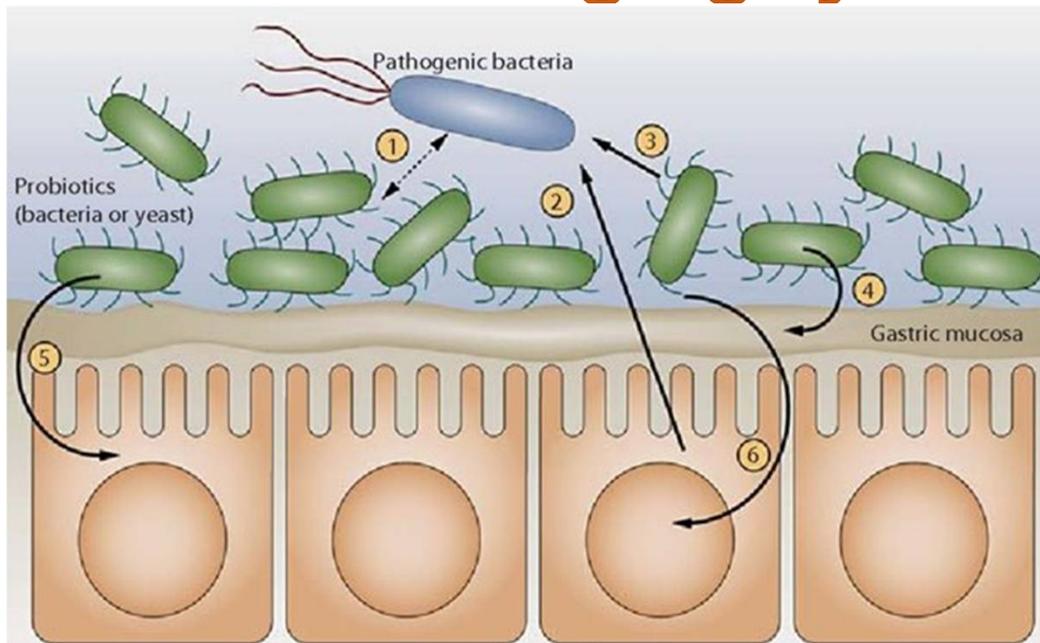


# What is a Probiotic (Direct-Fed Microbial)?

- Live microorganisms (mainly bacteria and yeast)
- When taken in the right amount, they provide health benefits
- Often called "good" or "friendly" bacteria
- *Bacillus* bacteria often used (6 species recognized by AAFCO to be used as direct-fed microbials)



# Can gut microbiome play a role in managing systemic disease?



Digestive Diseases 2011  
Indications for the Use of Probiotics in Gastrointestinal Diseases  
Marc Girardin, Ernest G. Seidman

## Roles of the gut microbiome:

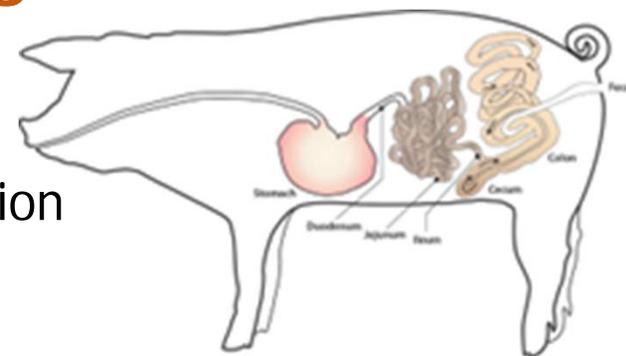
- Absorption, metabolism and storage of calories
- Protective barrier function
- Development and regulation of immunity

## Diversity and composition of gut microbiome impacts:

- Disease susceptibility
- Response to pathogens

## ***Bacillus* spp can be a tool to manage disease and improve production.**

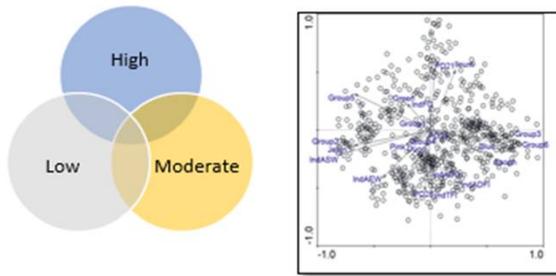
- Common *Bacillus* spp benefits:
  - Some strains can improve growth rate and feed conversion
  - Some strains can produce antimicrobial metabolites
  - Some can help with immune regulation
  - Some promote beneficial microbial growth to improve gut health
  - Spore-forming
  - Tolerant to heat and GI tract conditions



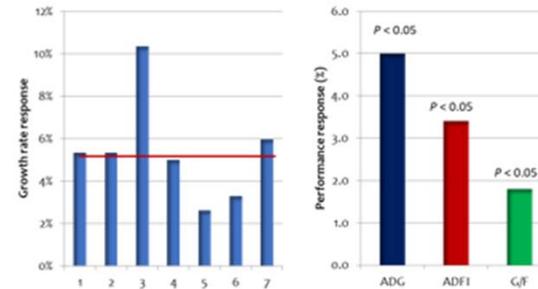
**Remember.....VAST differences exist in *Bacillus* spp capabilities!**

# Advanced Probiotic Development Process

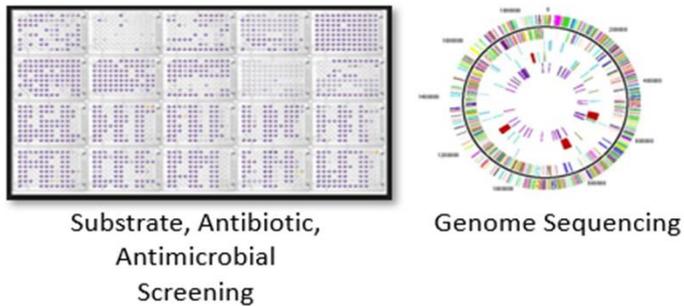
## 1. performance-based strains from the source



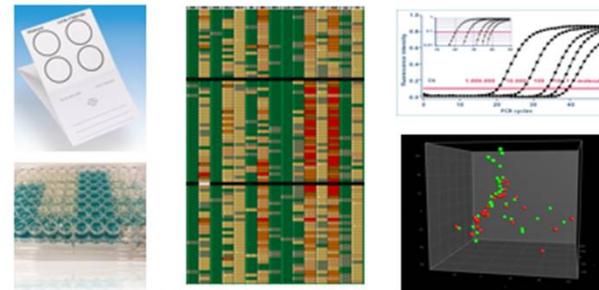
## 2. validation through animal trials



## 3. mechanism screening



## 4. continued discovery & innovation



**100+**

**Animal trials conducted each year at the research facilities.**

**70,000+**

**Animals on test each year at the research facilities.**

**21,000+**

**Bacterial isolates tested & inhibited with probiotics since 2014.**



## Results from a 6-strain *Bacillus* spp product

	# Farms	# Isolates	Inhibited	Not Inhibited
<i>E. coli</i>	144	5,965	93%	7%
<i>C. perfringens</i>	107	3,461	99%	1%
<i>C. difficile</i>	73	2,667	97%	3%
<i>Salmonella</i>	33	812	91%	9%

\*Results of testing via liquid and agar AST, isolates collected 2016-2024

- Pathogen profiles are different at each farm.
- 86% of the time, more than one pathogen is detected in pigs exhibiting clinical disease.
- A six-strain formulation is needed to provide coverage against current swine industry pathogens.

# U.S. top 25 pig producers:

More than **50% of US Top 25 Producers** are given probiotics in 2024.

2023 USA World Mega Producers		Headquarters	# Sows 2022
1	Smithfield/WH Group	Smithfield VA	1,113,500
2	Pipestone System	Pipestone, MN	461,000
3	Triumph Foods**	St. Joseph, MO	435,000
<small>Five companies that make up Triumph Foods are listed throughout</small>			
4	Seaboard Foods	Shawnee Mission, KS	365,000
5	Iowa Select Farms	Iowa Falls, IA	242,000
6	JBS USA	Greeley, CO	240,000
7	Carthage System	Carthage, IL	180,400
8	Prestage Farms	Clinton, NC	178,000
9	The Maschhoffs	Carlyle, IL	156,000
10	AMVC Management Services	Audubon, IA	150,000
11	Christensen Farms**	Sleepy Eye, MN	143,000
12	Clemens Country View Family Farms	Hatfield, PA	111,000
2023 USA Major Pork Producers		Headquarters	# Sows 2022
13	Tyson Foods	Springdale, AR	90,000
14	Allied Producers' Cooperative**	Westside, IA	87,500
15	The Hanor Company**	Enid, OK	85,000
16	Pillen Family Farms	Columbus, NE	77,500
17	Holden Farms	Northfield, MN	72,000
18	Eichelberger Farms**	Wayland, IA	62,500
19	Schwartz Farms	Sleepy Eye, MN	62,000*
20	New Fashion Pork**	Jackson, MN	57,000
21	Wakefield Pork	Gaylord, MN	54,800*
22	Reicks View Farms	Lawler, MN	50,000*
23	Protein Sources	Mapleton, MN	43,000*
24	Standard Nutrition Services	Emmetsburg, IA	42,000
25	Tosh Farms	Henry, TN	38,000
26	Sietsma Farms	Allendale, MI	36,500
27	TDM Farms	Newton Grove, NC	35,000
28	Cooper Farms	Fort Recovery, OH	34,300
29	Livingston Enterprise	Fairbury, NE	34,000
30	Suidae Health & Production	Algona, IA	33,700
31	Brenneman Pork	Washington, IA	33,000*
tie	Cactus Feeders	Amarillo, TX	33,000
	Fine Swine	Dublin, OH	33,000
34	Hord Livestock	Bucyrus, OH	30,000
35	Kalmbach Feeds	Upper Sandusky, OH	27,500
tie	VMC Management	Williamsburg, IA	27,500*
<b>Total of 36 companies in 2022</b>			<b>4,953,700</b>

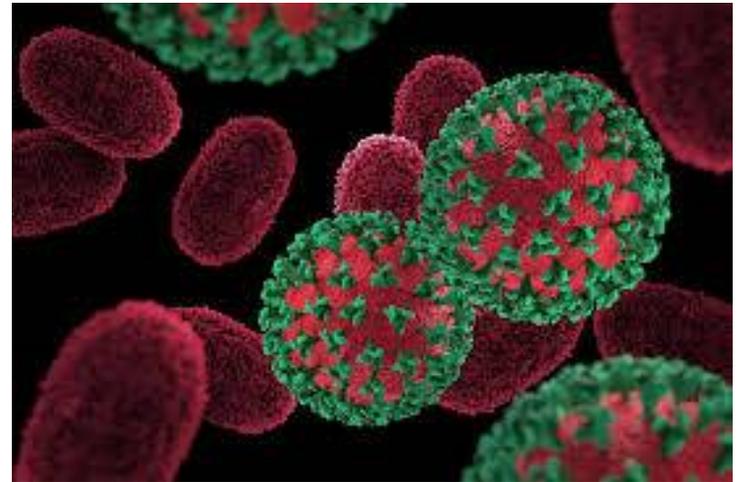
# US Top 10 Producers: Coinfection Field Evaluation

## Situation:

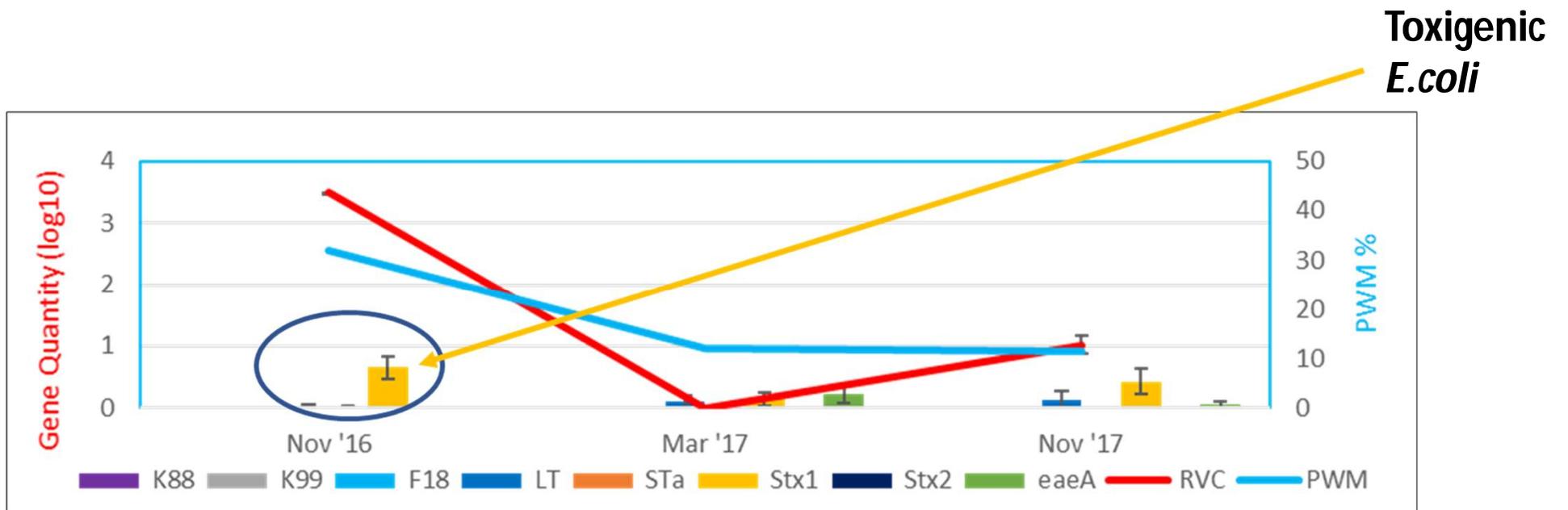
- 5000 head sow unit (Top 10 US Pork Powerhouse)
- Experiencing high PWM
- Traditional diagnostics, presumed *Rotavirus*

## Diagnostics

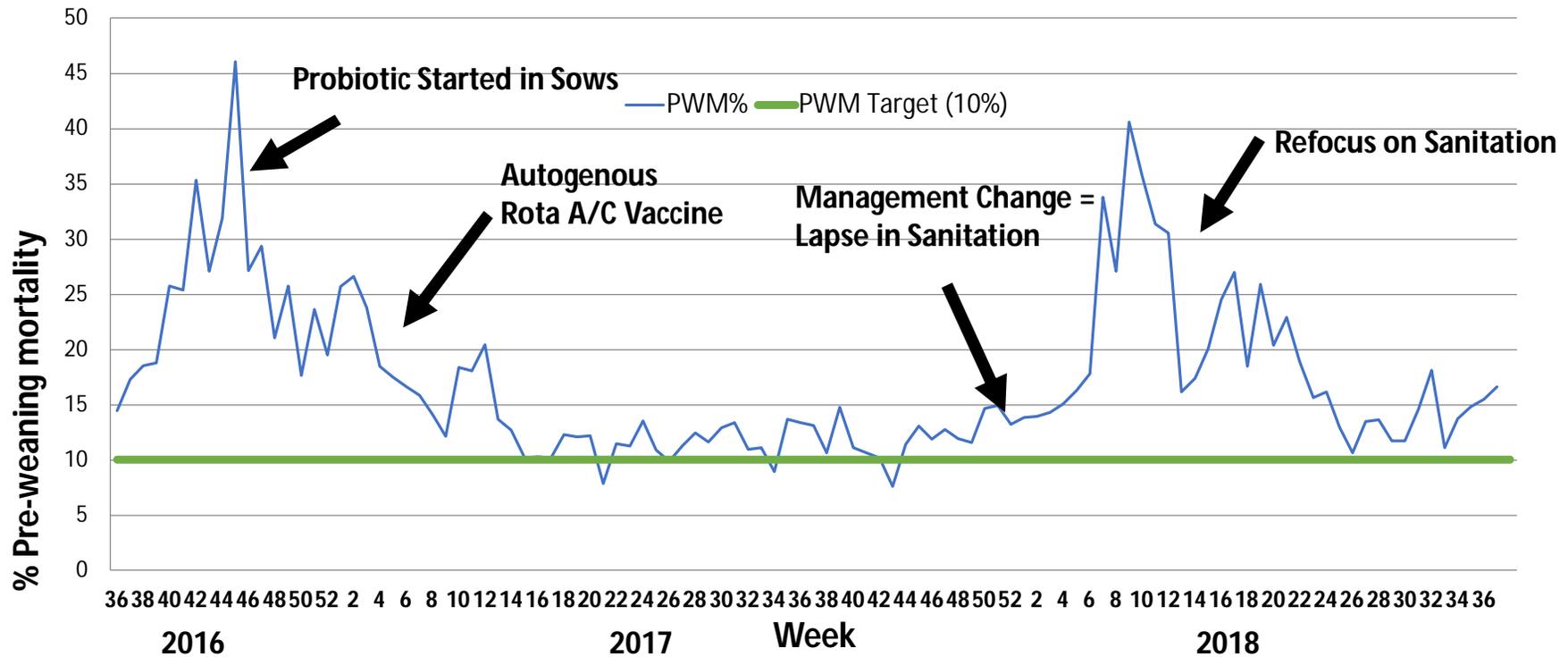
- **Platform for Pathogen Surveillance** was used to determine factors correlated to sick piglets (Detect > Quantify > Correlate)
- **Platform for Pathogen Surveillance** detected and quantified bacterial pathogens further compounding *Rotavirus C*, including **toxigenic *E. coli***.



# US Top 10 Producers: Coinfection Field Evaluation



# US Top 10 Producers: Coinfection Field Evaluation



# SUMMARY

- The Global Swine Value Chain is complex.
- 86% of the time, there is more than one pathogen involved in a disease situation.
- Antimicrobial resistance is not just about swine health.
- Probiotics are a well-proven sustainable health and performance improver.
- There is no silver bullet: multiple intervention approach
- The consumer has high expectations and is watching.