# **Respiratory disease control**



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# Respiratory disease in pigs Viruses

#### Bacteria Others



# A different way of thinking





# Mycoplasma hyopneumoniae infection



fects animal welfare a production

# The cost of respiratory disease in pigs

**Table 1:** Productivity and economic impact of SIV, PRRS, and M hyopneumoniae

Pathogen/combination	Difference from baseline in %MCT	Difference from baseline in ADG	Difference from baseline in loss per head placed
M hyo	2.15%	0.04	\$0.63
PRRS	1.68%	-0.11	\$5.57
SIV	1.87%	-0.04	\$3.23
PRRS and M hyo	5.43%**M**P	-0.14*M*P	\$9.69
PRRS and SIV	4.34%**S**P	-0.16**S	\$10.41
SIV and M hyo	3.46%**M*S	-0.18**S	\$10.12

\*\* M,P,S = combinations vs. M/P/S; P < 0.05

\* M,P,S = combinations vs. M/P/S; P < 0.1



# The cost of *M. hyopneumoniae* in pigs

Production parameter	Value in <i>M.</i> <i>hyopneumoniae</i> positive pigs	Value in <i>M.</i> <i>hyopneumoniae</i> negative pigs	Difference
Average daily gain (kg)	0.818	0.854	0.036
Feed conversion ratio (feed:gain)	2.840nce-driven soluti	2.820	-0.018
Mortality (%)	5.37	4.11	-1.26



# Improving disease control by understanding epidemiology



# M. hyopneumoniae epidemiology





### Mycoplasma hyopneumoniae persistence in the field

			Ex	posu	re at th	ne off-si	ite GD	U						Ex	posure	e at th	e on-si	te GDU	l and :	sow fa	ırm		
	Da	ys of He	rd Closu	ire			Da	ys of He	rd Closu	ıre		Days of Herd Closure Days of Herd Closure				ure							
Parity	30	60	120	180	240	Parity	30	60	120	180	240	Parity	30	60	120	180	240	Parity	30	60	120	180	240
Gilt	18.99	25.6	32.29			Gilt	NC	32.27	36.56			РО	32.32	35.9				P 2- 3			33	NC	NC
Gilt						Gilt	30.57	25.42	26.13			PO						P 2- 3				NC	NC
Gilt	19.82	NC	NC	NC	NC	Gilt	30.52	19.8	25.39	34.05		PO				34.08		P 2- 3					
Gilt						Gilt	20.96	36.4	38.67			PO						P 2- 3					
Gilt	25.63	30.26	31.68	38.26		Gilt	22.97	34.21	33.75			PO	38.33			38.96		P 2- 3	1				
Gilt	38		38.02			Gilt	23.16	29.11	34.69			PO	37.23			-		P 2- 3	ų.		_		NC
Gilt	33.35		36.85			Gilt	25.46	28.28	39.95			PO						P 2- 3			NC	NC	NC
Gilt	24.28	24.05	28.36	37.9	33.87	Gilt	22.17	22.37	25.74			PO			-			P 2- 3	1		50.C		
Gilt	29.24	33.02	38.12	37.95		Gilt	20.86	34.27	37.19			PO	28.32	33.5	32.57			P 2- 3					
Gilt	28.49		39.96			Gilt	28.22	19.35	24.08			PO						P 2- 3			NC	NC	NC
Gilt	30.58	31.13				Gilt	23.28	32.13	36.34			PO	36.81	6	39.85		8	P 2- 3	5	-			-
Gilt	26.27	29.17	35.31	35.25		Gilt	26.97	21.11	21.87	37.94		PO			-			P 2- 3			39.15		
Gilt	23.94	32.23	36.02			Gilt	26.18	27.06	35.14	NC	NC	PO	29.17	0000000	37.94	38.95		P 2- 3				Address Control of Mart	
Gilt	25.33	32.28	28.77			Gilt	21.17	24.19	39.71			PO	29.5	39.7			6	P 2- 3				37.37	
Gilt	27.17	25.47				Gilt		20.15	26.07			PO	22.81		1		-	P 2- 3				39.29	-
Gilt	20.43	30.83	35.62	28.15	<u></u>	Gilt	22.38	18.71	29.26	30.65		PO		36.24			2	P2-3	22				2
Gilt	20.41	22.93	34.54	36.99		Gilt	37.1	27.5	27.03		38.59	PO	25.15	31.39	33.84			P2-3	1		39.16		
Gilt	15.78	21.43	27.99			Gilt	25.17	30.42		39.89		P1	-	-			4	P4+	2	-			
Gilt	20.44	29.18	20.75			Gilt	25.17	25.04	27.74	36.11		P1					7	P4+	2		NC	NC	NC
Gilt	20.08	25.88	38.75	NC		GIIE	38.55	25.97	34.39		1	PI	-			-	-1	P4+	4				1
Gilt	33	35.86	27.20			Gilt	20.0	21.72	28.24	07.00		P1	;	8			2	P4+	2				2
Gilt	21.39 N/C	24.22	27.38	26.00	-	Gilt	38.80	22.43	25.0	37.33		P1 					1	P4+	27.07	-			-
Gilt	22.14	25.02	20.51	30.33		Gilt	30.54	21.02	24.7	27.50	NC	P1	5	<i></i>				P4+	57.07				
Gilt	20.42	22.74	20.07	20		Gilt	23.57	21.10	21.07	1	A INC	Sil		×			NC	P4+	4	3		10	-
Gilt	27.14	32.84	35.37	30		Gilt	31.46	20.50	24.94			P1					INC	P4+	-		36.55		
Gilt	22.37	26.93	32.92			Gilt	21.77	27.17	39.81	35.04	<b>.</b>	P1	-	8				P4+			00.00	39.36	
Gilt	23.11	34.67	33.93			Gilt	25.44	37.7	NC	NC	NC	P1		j.				P4+	T.			05100	
Gilt	28.63	32.53	30.28			Gilt	33.3	27.84	30.63	NC	NC	P1						P4+					
Gilt	22.13	20.52	29.68	36.34		Gilt	35.48	38.18	37.12	NC	NC	P1		39.5				P4+					
Gilt	21.06	34.06	26.91			Gilt	32.21	39.52		39.06		P1					-	P4+	38.52				
Gilt	21.85	27.17	29.24		NC	Gilt	27.87	26.26	33.95	NC	NC	P1	33.21		39.25			P4+					
Gilt	32.12	24.04	36.51			Gilt	27.61	37.45	33.01			P1						P4+	38.34				
Gilt	20.91	30.76	34.33			Gilt	36.3	1997 (A. 1997)	(55155		23 (A	P1	28.15	23.57	35.91		1	P4+	-				1
Gilt	21.53	21.13	37.38			Gilt	21.9	23.46	35.53	37.51		P2-3						P4+			35.36		
Gilt	30.74	21.37	30.24					CALCULATION OF															

#### Mycoplasma hyopneumoniae PCR positive

on a continuum (Ct<40)

Low

High Ct

#### PCR negative for Mycoplasma hyopneumoniae





### **Mycoplasma detection in minimum prevalence**



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### **Mycoplasma detection by PCR**

#### **Deep tracheal catheters**





### **Mycoplasma detection by PCR**

#### Serum

0	1	2 Science-driv	en solutions™	6	8 wpe





## **Mycoplasma detection by PCR**

#### **Oral fluids**







### Detection of *M. hyopneumoniae* in processing fluids



Table 1 Summary of Mycoplasma hyopneumoniae rt-PCR results by litter and sample type

Litter	Sample type									
identification (dam parity)	Testicle fluid	Tail fluid	Tissue swab	Laryngeal swab						
1 (2)	-	-	2	-						
2 (1)	36.62	120	100							
3 (2)	1	100		-						
4 (0)		-	-	-						
5 (2)	39.4	-	-	-						
6(2)	-	-	35.10	-						
7 (2)	-	120	12							
8 (2)		12.1	10. 	-						
9 (0)	36.42	-	-	-						
10 (0)	35.73		=	-						
11(0)	35.00	-	35.78	-						
12(4)		-	<u></u>	5 <u>-</u>						
13 (3)	34.02	37.00	10	-						
14(5)	39.12	1000	NC	-						
15(2) en s	d <del>lu</del> tions"		NC	-						
16(1)	38.25		NC	-						
17 (0)	-	-	NC	NC						
18(0)		8 FF	NC	NC						
19 (0)	35.59	-	NC	NC						
20 (2)	34.81	-	NC	NC						
21 (2)	33.58		NC	NC						

Positive (Ct value  $\leq$  37; shaded in grey) and suspect (Ct >37 and Ct <40) Ct values are shown. Negative (Ct value  $\geq$ 40) results are shown as '-'.

Ct, cycle threshold; NC, not collected; rt-PCR, real time-PCR.



Environmental detection of *Mycoplasma hyopneumoniae* genetic material from bacterin origin

Bacterial DNA detected up to 28 days post-spray in farrowing facilities

Potential for sample cross-contamination?



(Weidmayer et al., 2020)



# **Total control**



### Disease eradication



# What is the justification for *M. hyopneumoniae* elimination?

- Predictable results in well implemented programs
- Relatively low implementation cost
- Negative pig value capture (Schwartz, 2015)





## Example

### How to approach eradication?



# How to confirm success of the eradication method?



### How to confirm the success of the eradication method?

Number of individual pigs to sample and cost of sampling option based on experimentally infected pigs when using deep tracheal catheters late during *Mycoplasma hyopneumoniae* infection.

	Submission type	Number of individuals to sample Cost of sampling option (USD) Prevalence estimate (% positive)								
Sensitivity		0.5	1	2	3	4	5			
	Individual	672	336	167	111	83	66			
	individual	\$24,192	\$12,096	\$6,012	\$3,996	\$2,988	\$2,376			
Lower limit of Sensitivity	Pool of 3	846	423	213	141	108	87			
95 % CI		\$12,972	\$6,486	\$3,266	\$2,162	\$1,656	\$1,334			
	Pool of 5	870	440	220	150	110	90			
		\$9,744	\$4,928	\$2,464	\$1,680	\$1,232	\$1,008			
	Individual	Scien610_drive	n 305 tions	152	101	75	61			
		\$21,960	\$10,980	\$5,472	\$3,636	\$2,700	\$2,196			
Maan Consitivity	Beel of O	714	357	180	120	90	72			
Mean Sensitivity	P001 01 3	\$10,948	\$5,474	\$2,760	\$1,840	\$1,380	\$1,104			
	Pool of 5	735	370	185	125	95	75			
	P001 01 5	\$8,232	\$4,144	\$2,072	\$1,400	\$1,064	\$840			

\* USD rounded to the nearest dollar.



## **Eradication methods cost comparison**

	Herd closure and medication (per sow)	Whole-herd meedication (per sow)
Investment	\$22.14	\$37.14
Net benefit per year	\$124.71 Science-driven solutions <sup>™</sup>	\$124.71
Success rate	86%	58%
Months to pay cost	3.12	11.36

Yeske et al., 2019

# **North American initiatives**

- "Mycoplasma Elimination Initiative"
- Veterinarians / Produces
- No geographical lamitation
- Support from large organizations
  - Swine Disease Eradication Center
  - Morrison Swine Health Monitoring Program

## **Strategic control**





