PRRS Update

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PRRS

- Historically
- Type 1: European Strains
- Less pathogenic
- Type 2: North American and Asian strain
- More pathogenic
- More impact on reproductive performance
- Impact on the performance of growing pigs
- Limited to the nursery phase
- Limited to the acute phase of illness in maternity wards
- Unfortunately everything has changed

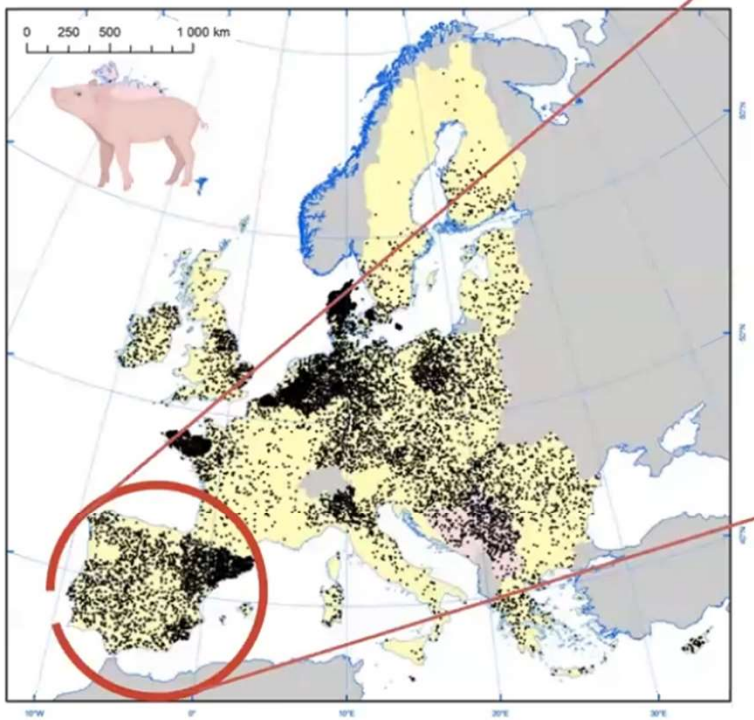
Souche SRRP Rosalia in Spain

Highly pathogenic type 1 strain

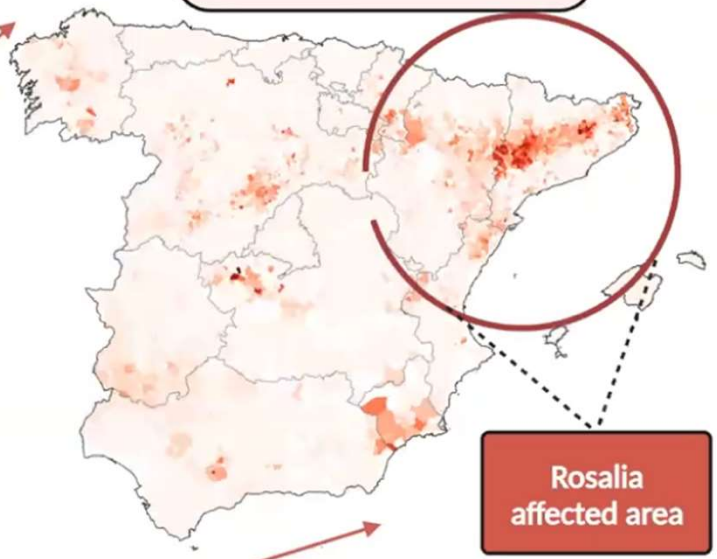
Presentation by Dr. Eric Matau, University of Barcelona

THE CONTEXT

EU pig census (2022) - 146 million pigs



Spanish pig census (2022) - 34 million pigs (23% EU)

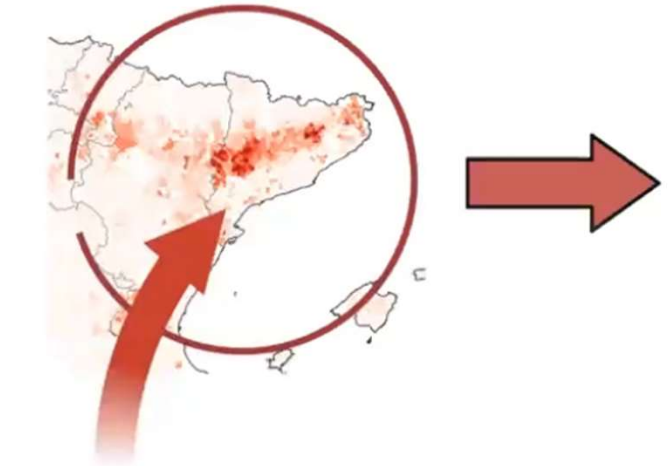


Rosalia affected area

Approx. 31,000 sq miles
(Minnesota is 87,000 sq mile

Approx. 18 million pigs

THE CONTEXT



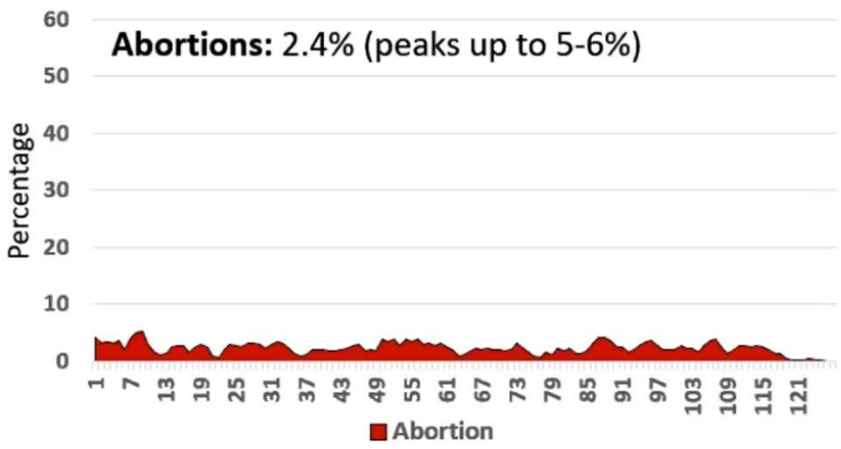
4 million of fattening pigs are imported yearly from several EU countries

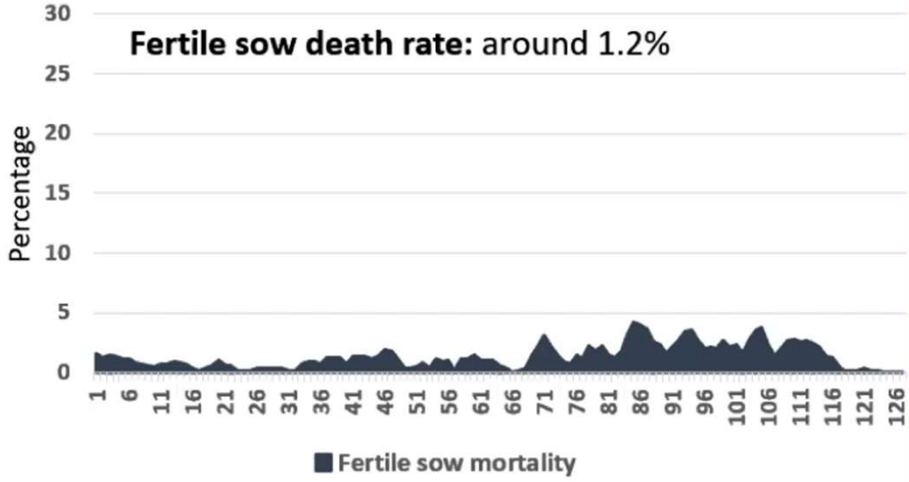
Breeders	Nurseries	Fattening
		
1,000 farms	490 farms	8,000 farms
Average size 1,400 sows		

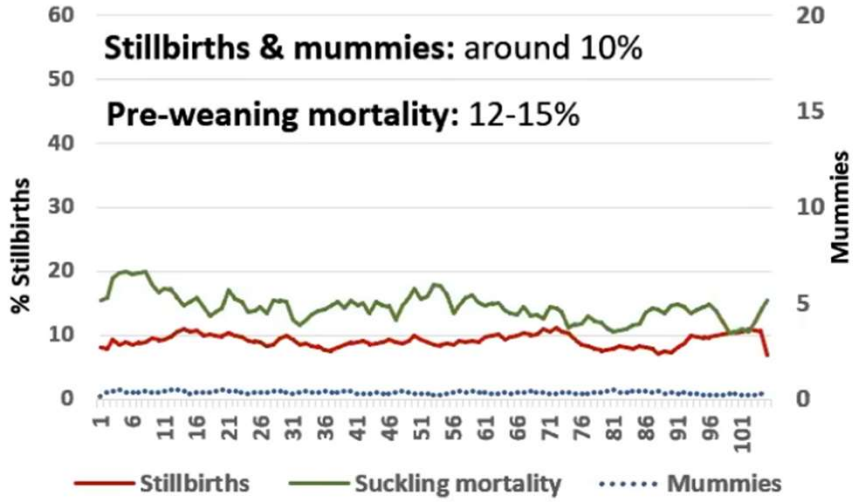
PRRSV PREVALENCE≥70%
PRRSV-1

Vaccination ≥70%	Vaccination ≤20%	Vaccination ≤5%

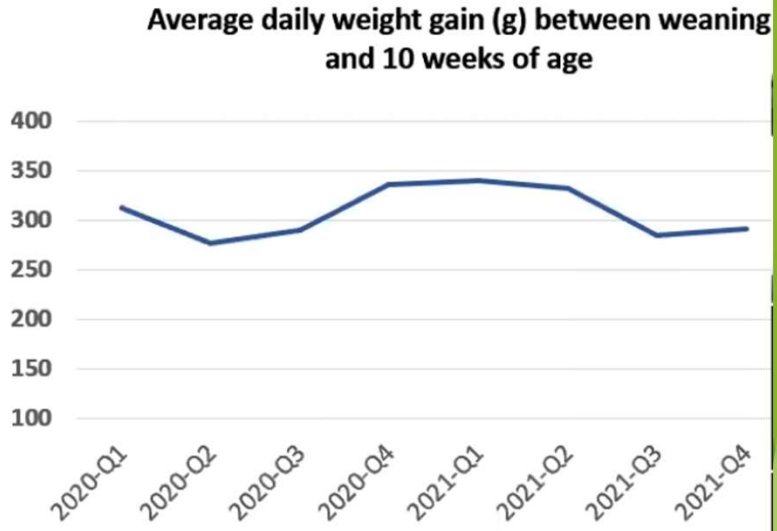
A) Average PRRSV-1 endemic farm in Spain (Breeders)

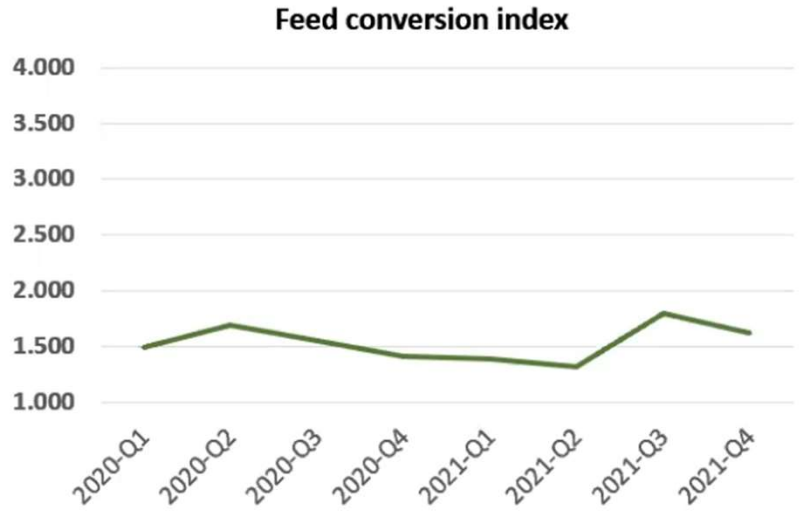




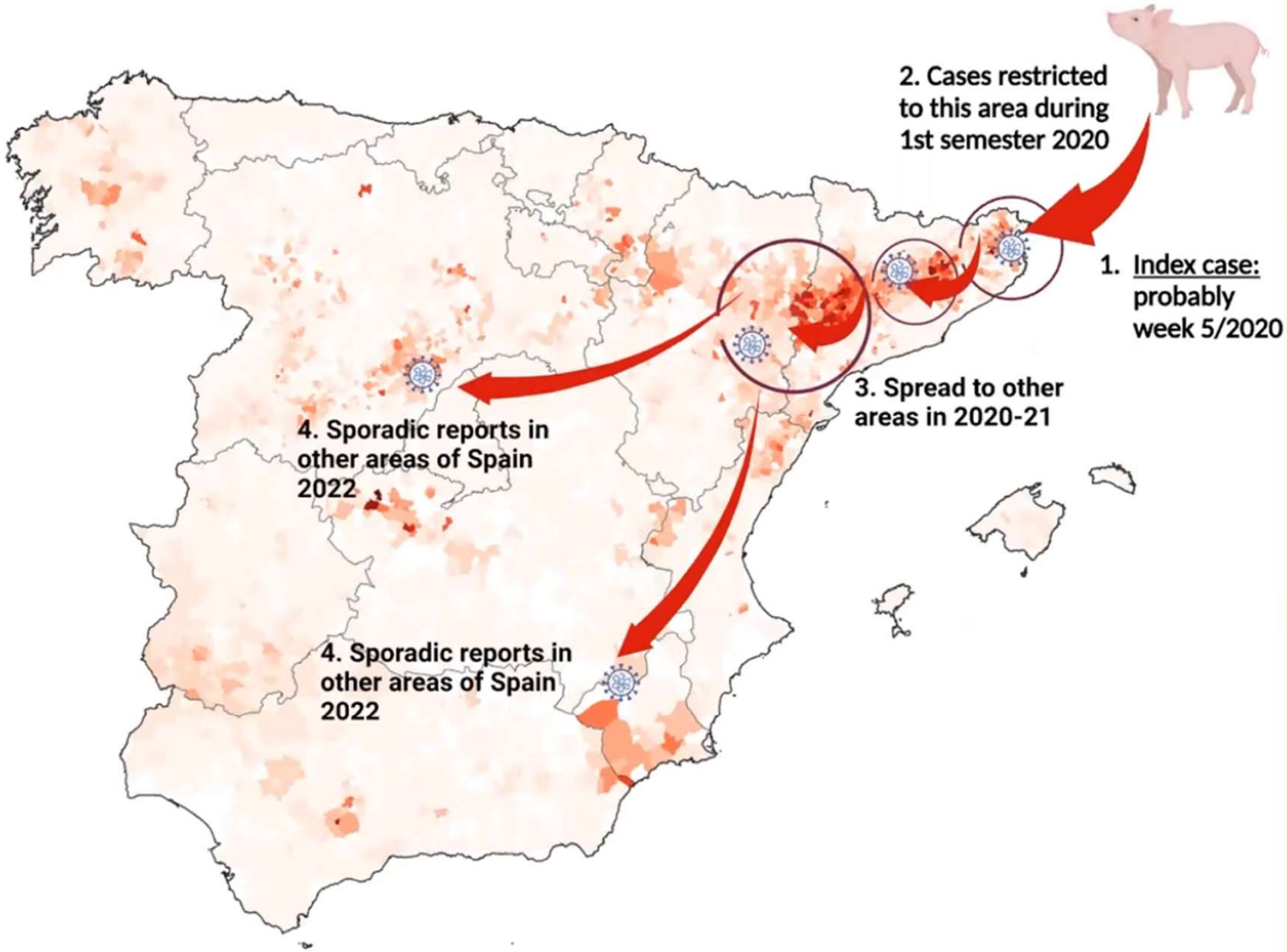


A) Average PRRSV-1 endemic farm in Spain (nurseries)

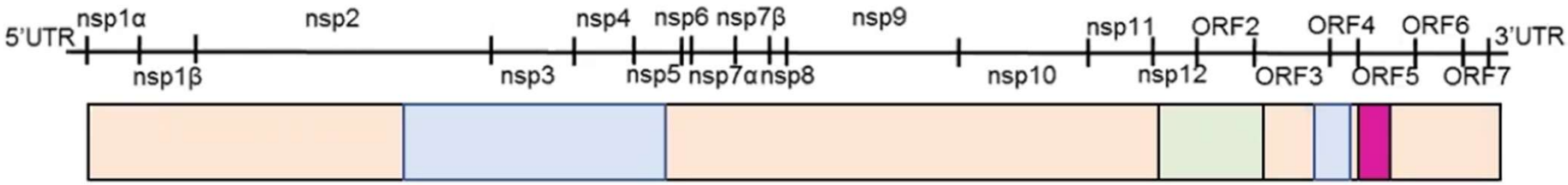




CHRONOLOGY


2. Cases restricted to this area during 1st semester 2020
1. Index case: probably week 5/2020
3. Spread to other areas in 2020-21
4. Sporadic reports in other areas of Spain 2022
4. Sporadic reports in other areas of Spain 2022

Le virus Rosalia est le résultat de la recombinaison de 4 virus différents



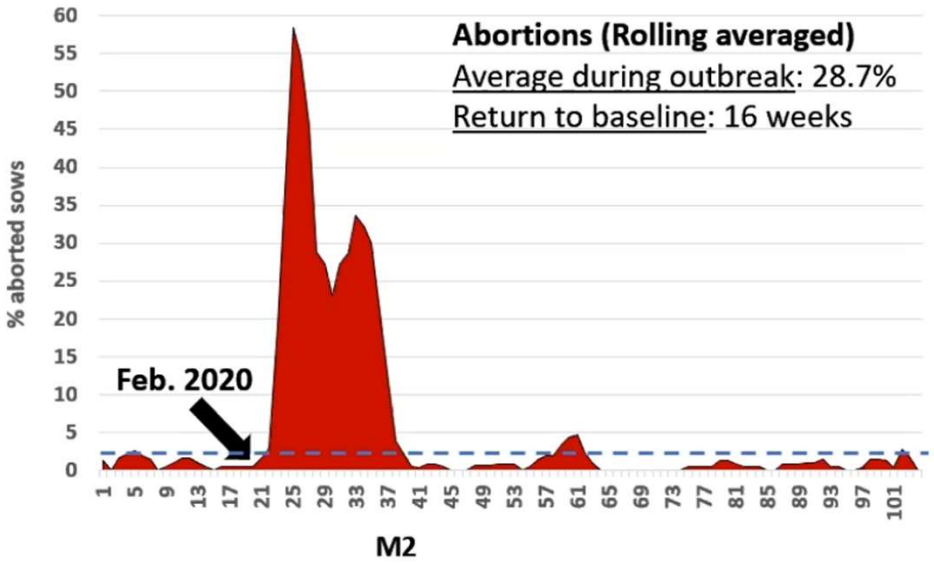
Derived from PRRSV-1 MF346695 (Italian strain PR40/2014 reported by Canelli et al., 2018)

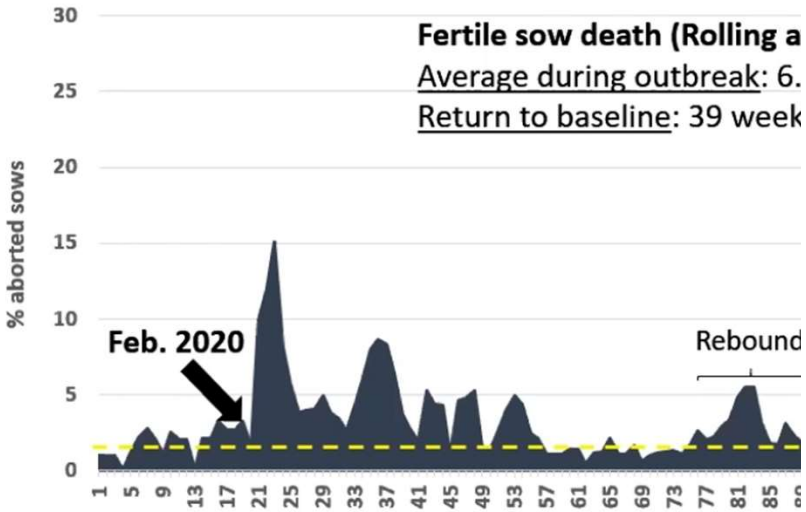
Derived from PRRSV-1 local Spanish isolates clustering with KC862570

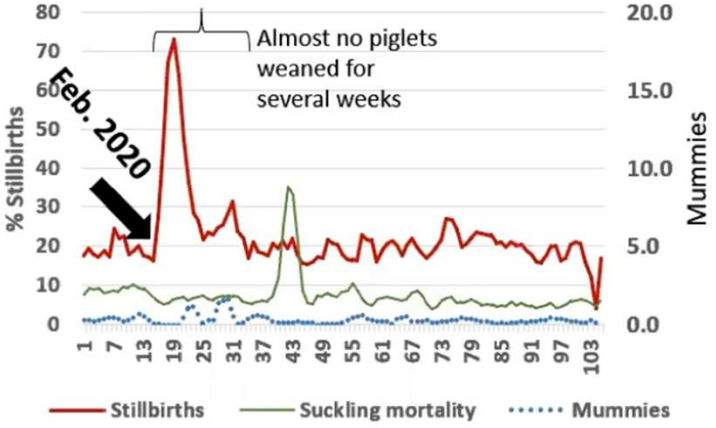
Derived from PRRSV-1 isolates clustering with KY434184

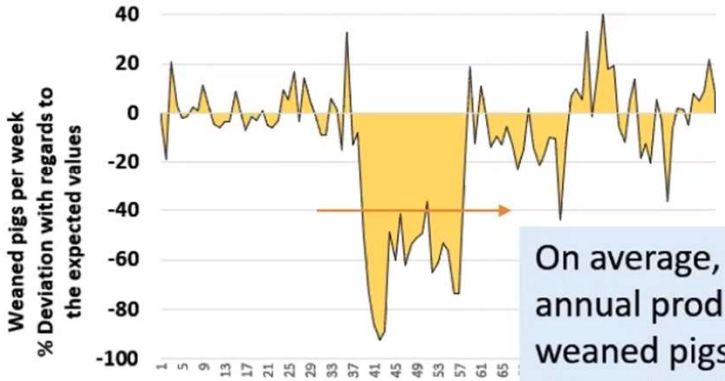
Segment of PRRSV-1 of unknown origin

B) Early outbreaks (Winter-spring 2020). Exmaple: PRRSV-1 stable farm, vaccinated sows

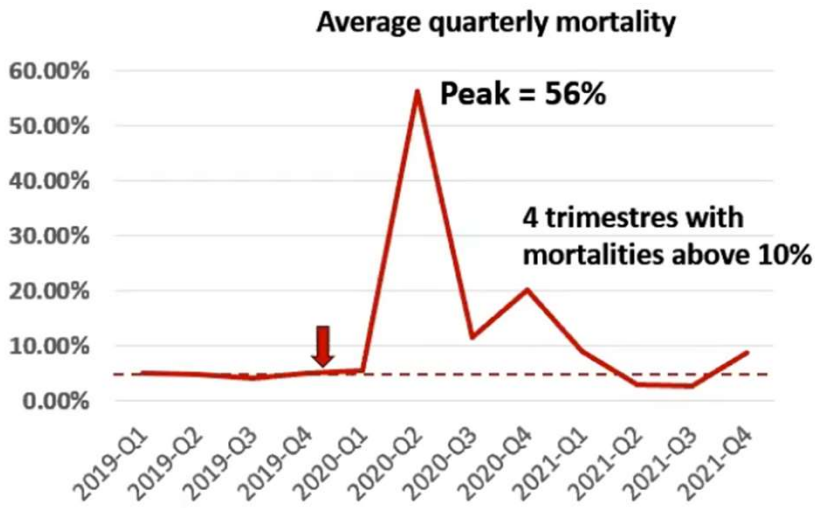


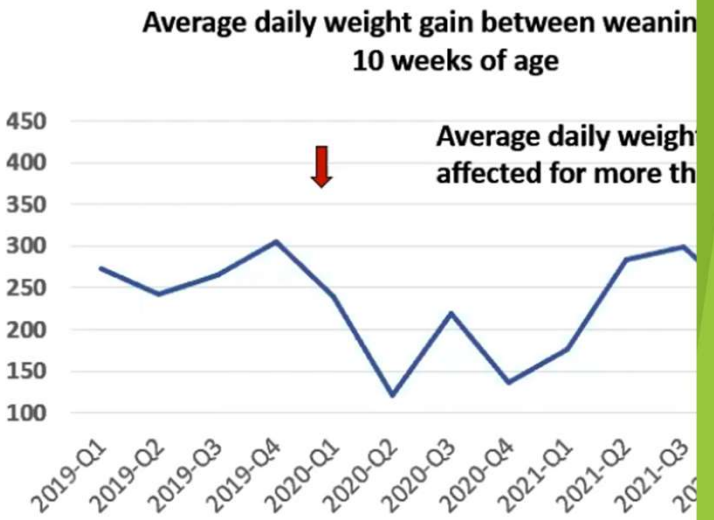


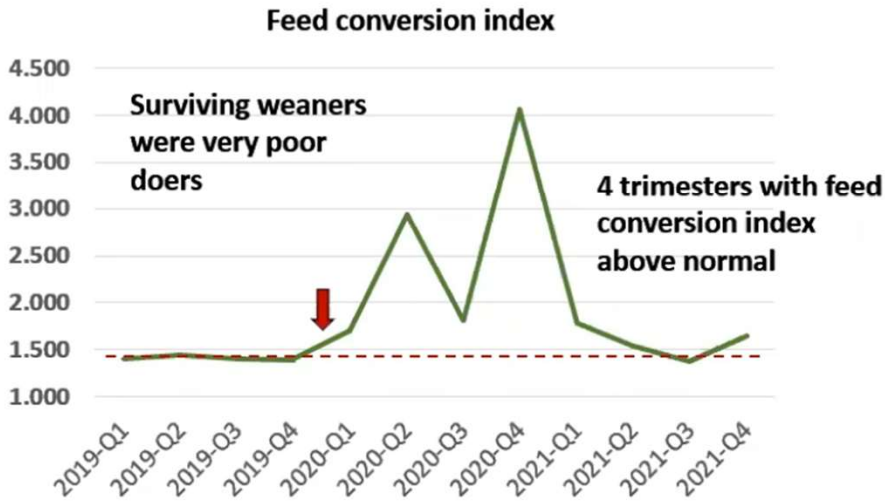




On average, -18% of the annual production of weaned pigs lost during the outbreak

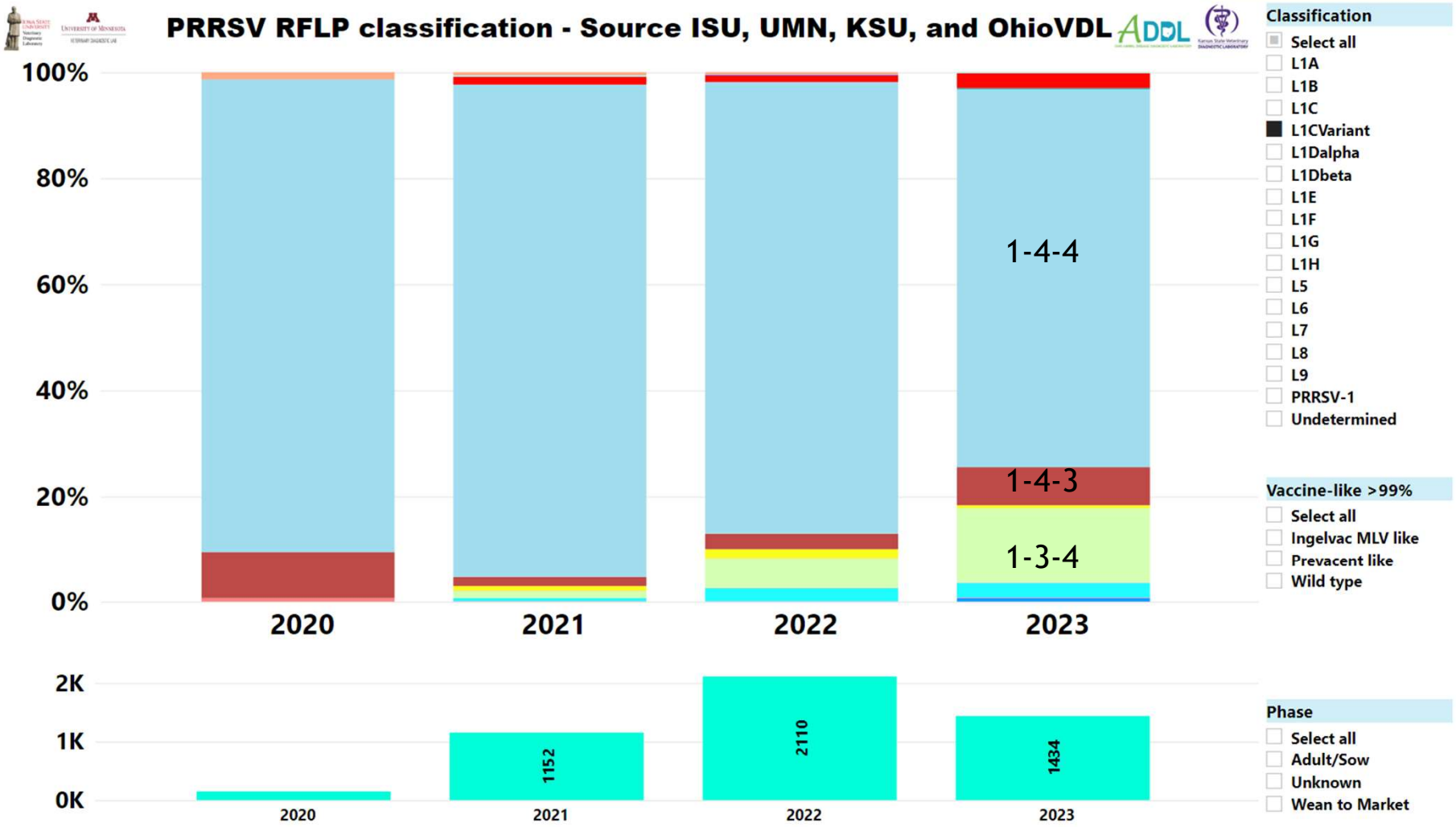

Average quarterly mortality
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Peak = 56%
4 trimestres with mortalities above 10%
2019-Q1
2019-Q2
2019-Q3
2019-Q4
2020-Q1
2020-Q2
2020-Q3
2020-Q4
2021-Q1
2021-Q2
2021-Q3
2021-Q4


Average daily weight gain between weanin
10 weeks of age
450
400
350
300
250
200
150
100
Average daily weigh
affected for more th
2019-Q1
2019-Q2
2019-Q3
2019-Q4
2020-Q1
2020-Q2
2020-Q3
2020-Q4
2021-Q1
2021-Q2
2021-Q3

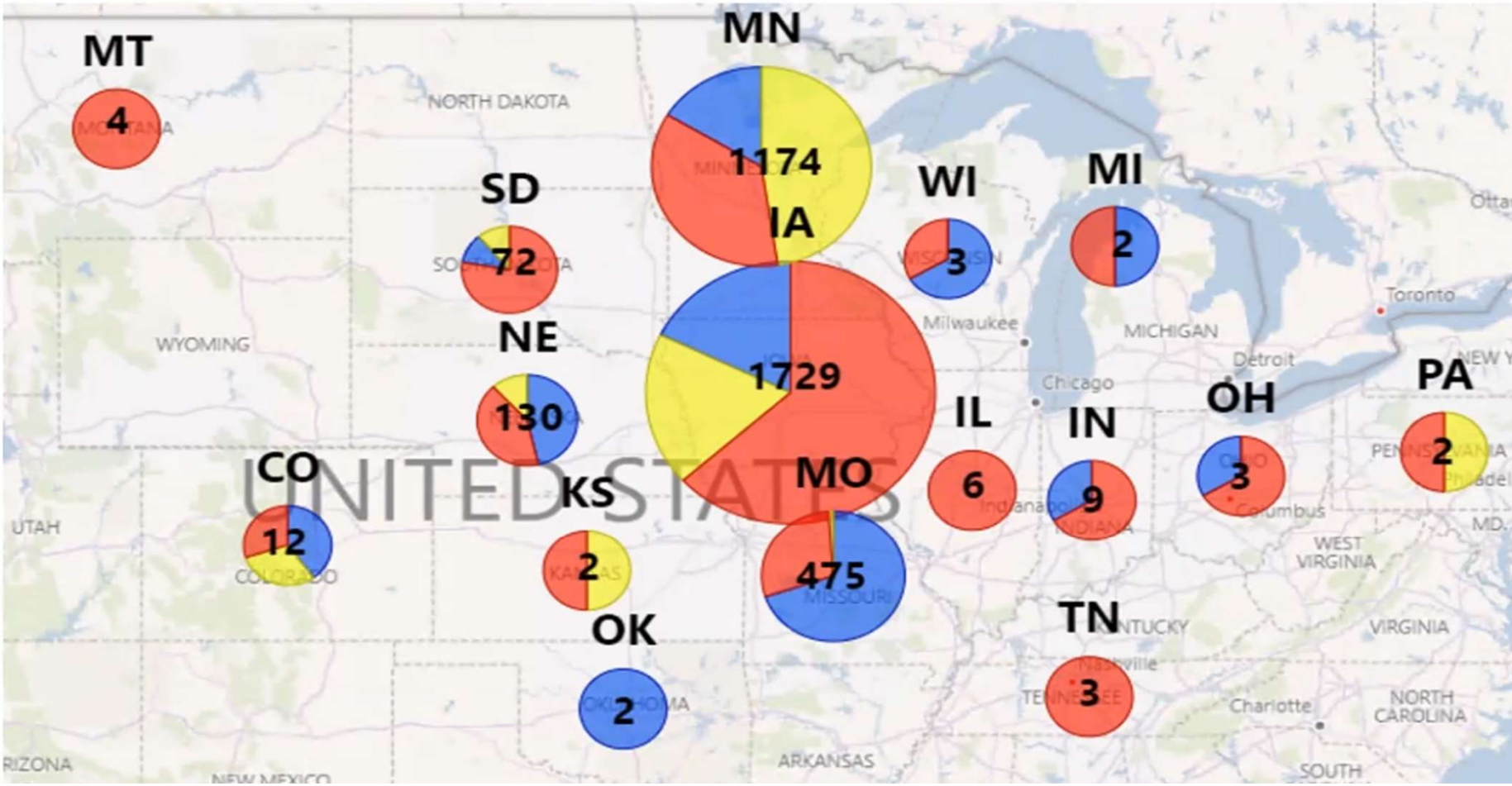

Feed conversion index
4.500
4.000
3.500
3.000
2.500
2.000
1.500
1.000
Surviving weaners were very poor doers
4 trimesters with feed conversion index above normal
2019-Q1
2019-Q2
2019-Q3
2019-Q4
2020-Q1
2020-Q2
2020-Q3
2020-Q4
2021-Q1
2021-Q2
2021-Q3
2021-Q4

PRRS Lineage 1 variant C RFLP144

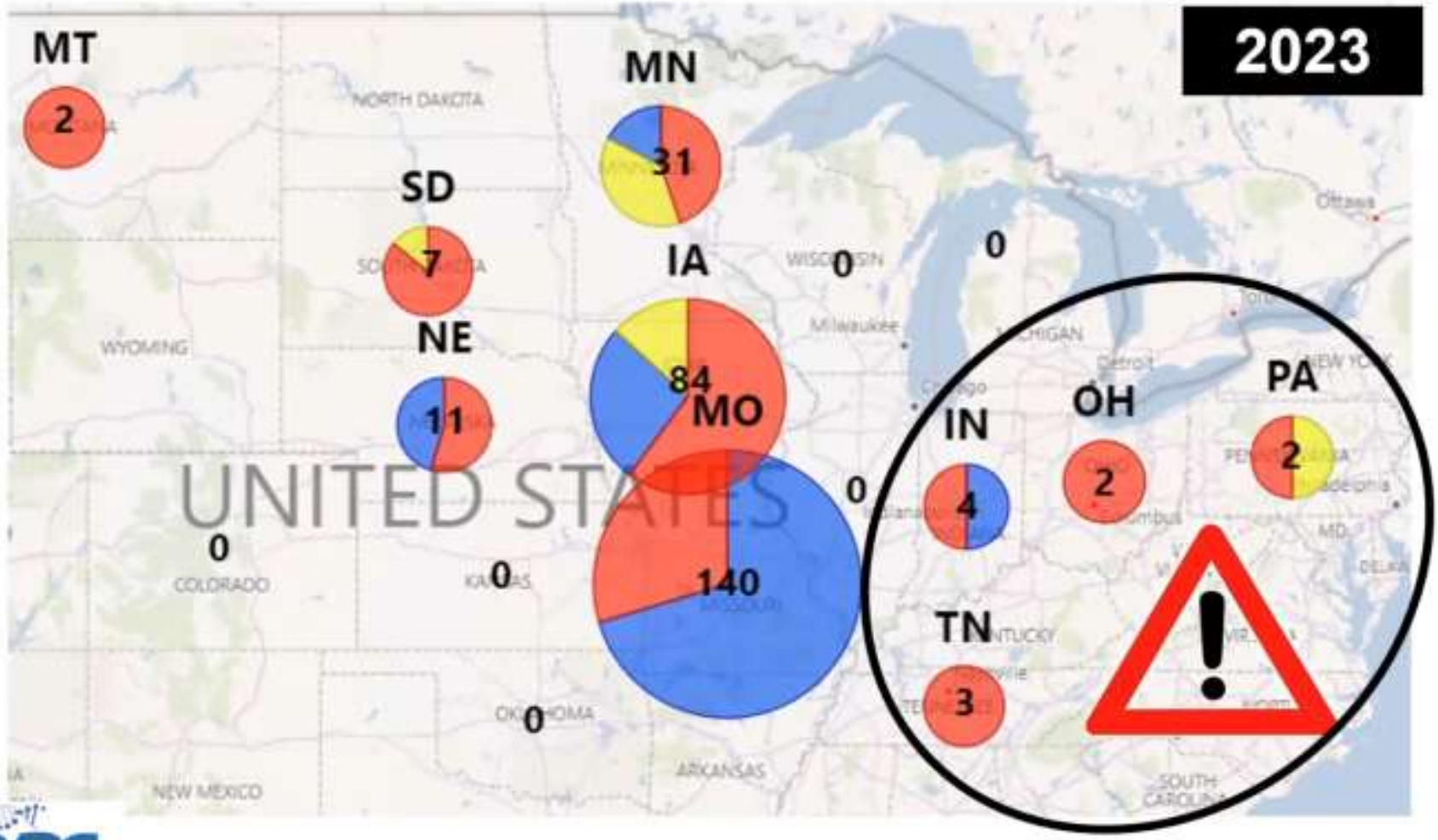
Swine Disease Reporting System Iowa state university


PRRSV RFLP classification - Source ISU, UMN, KSU, and OhioVDL
100%
80%
60%
40%
20%
0%
2020
2021
2022
2023
1-4-4
1-4-3
1-3-4
2K
1K
0K
1152
2110
1434
Classification
Select all
L1A
L1B
L1C
L1CVariant
L1Dalpha
L1Dbeta
L1E
L1F
L1G
L1H
L5
L6
L7
L8
L9
PRRSV-1
Undetermined
Vaccine-like >99%
Select all
Ingelvac MLV like
Prevacent like
Wild type
Phase
Select all
Adult/Sow
Unknown
Wean to Market

L1C variant emerged in MN 2020 spread to IA end of 2020 > South & West 2021/2022 > East i



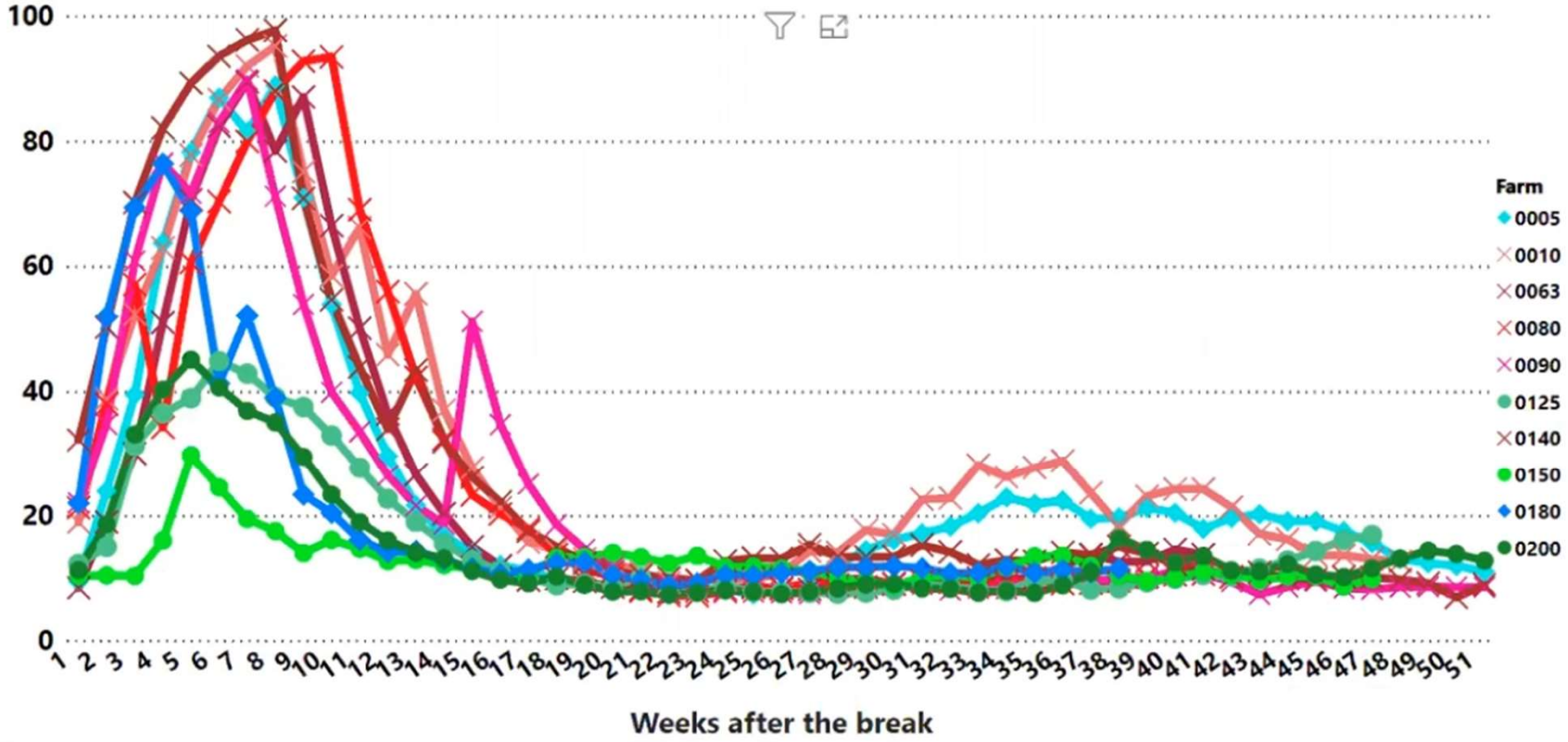
L1C variant is moving east threatening 1.5 + mi



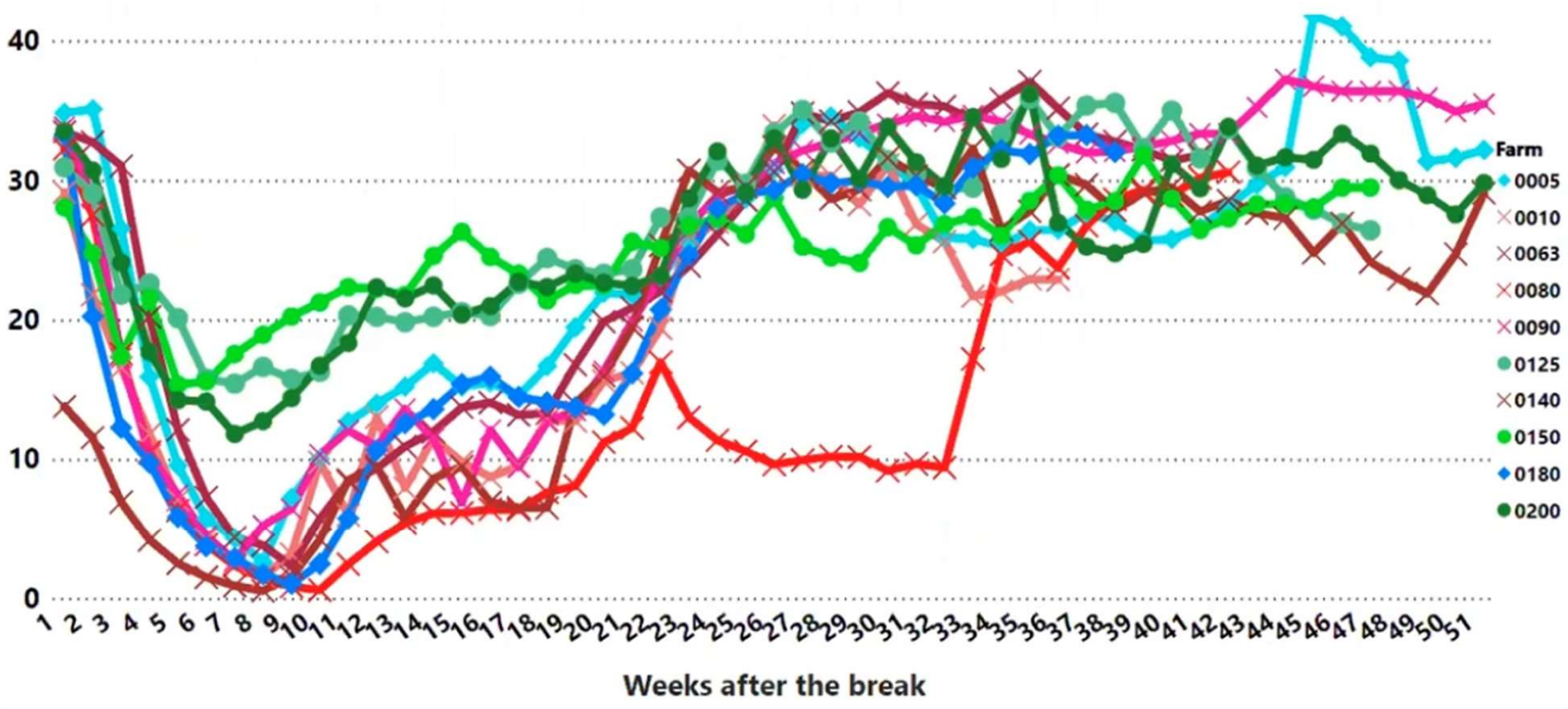
PRRS RFLP 144 L1C variant in Maternity

- Acute Phase Severe Clinical Signs
- Sow mortality
- Abortion
- Pre-weaning mortality
- Prolonged chronic phase
- High mortality and poor zootechnical performance
- 20-40% post-weaning mortality
- Do not respond consistently following herd closure
- Several herds still positive after more than 60 weeks of closure
- Considers depopulation when infected with its new strains

PRRS 1-4-4 V1C
Preweaning Mortality

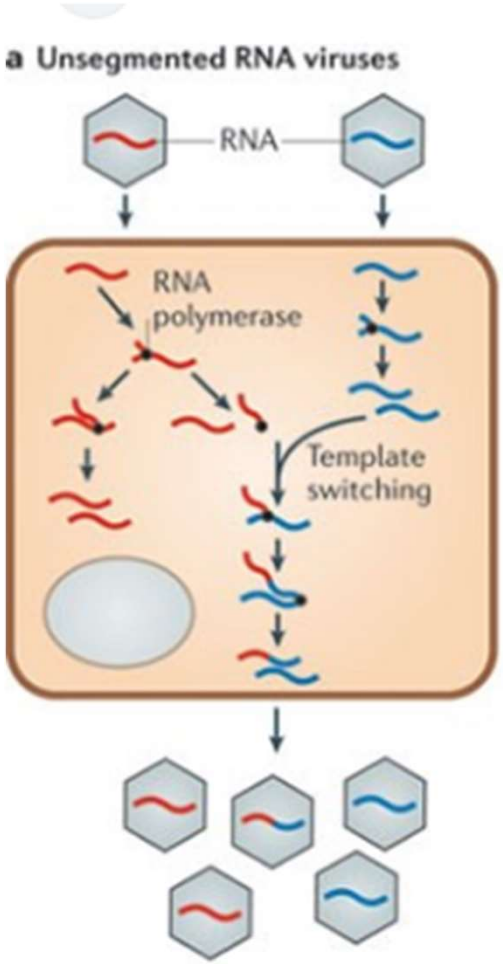


PRRS 1-4-4 V1C
Pigs Weaned/Mated Female/Year



PRRS RFLP144 L1C variant : Growing Pig

- Very high viral replication and shedding
- More Enhanced Aerosol Transmission
- Post-weaning piglet performance is affected for a long time
- Very high transmission rate of growing pigs in the U.S. Midwest
- High pig density
- Few biosecurity measures
- Severe clinical sign and very high mortality in pigs from negative herds
- 20-50% mortality
- Little positive impact of PRRS vaccination
- Evidence of viral recombination



Viral recombination

- A process that allows the genesis of a new variety of virus by mixing the genetic program of two viruses of the same or unrelated family.
- The result of this recombination is referred to as a reassorted virus
- Mostly discussed at the level of influenza

Viral recombination

- Viral recombination can only occur if two different viruses simultaneously infect the same cell
- Viral recombination gives more or less viable, more or less virulent results
- In the vast majority of cases, the result is unsustainable
- However
  - the more genetically close the different virus variants are
  - The greater the number of infected animals
  - And the longer the viral replication phase
- The greater the likelihood of viable recombination occurring

PRRS Viral Recombination

- The characteristics of the SRRP virus combined with some modern production practices used in the United States and Spain
- Multi-site production
- Movement of pigs between regions (countries at the level of Spain)
- Increases the number of pigs simultaneously infected with different strains of PRRS
- Whole-genome sequencing of the PRRS virus shows that this phenomenon is much more frequent than previously estimated
- Several evidences of recombination
  - between wild strains
  - Between wild-type and vaccine strains
  - Between vaccine strains
- Those farming practices are also present in Ontario
- This should be consider in Control/elimination strategies

PRRS OUTBREAK MANAGEMENT PROGRAM (POMP)

- POMP Database Overview
  - 235 farms total for TTS, TTBP, TL covering 2013-2021
  - 67 completed farms with survey information (2018-2021)
  - 29 farms currently enrolled awaiting stabilization

- Some preliminary data analysis

Time to low prevalence (weeks)	Cohort 2011	Cohort 2021
10th percentile	15	26
25th percentile	22	32
median	**27**	**36**
75th percentile	33	50
90th percentile	46	73

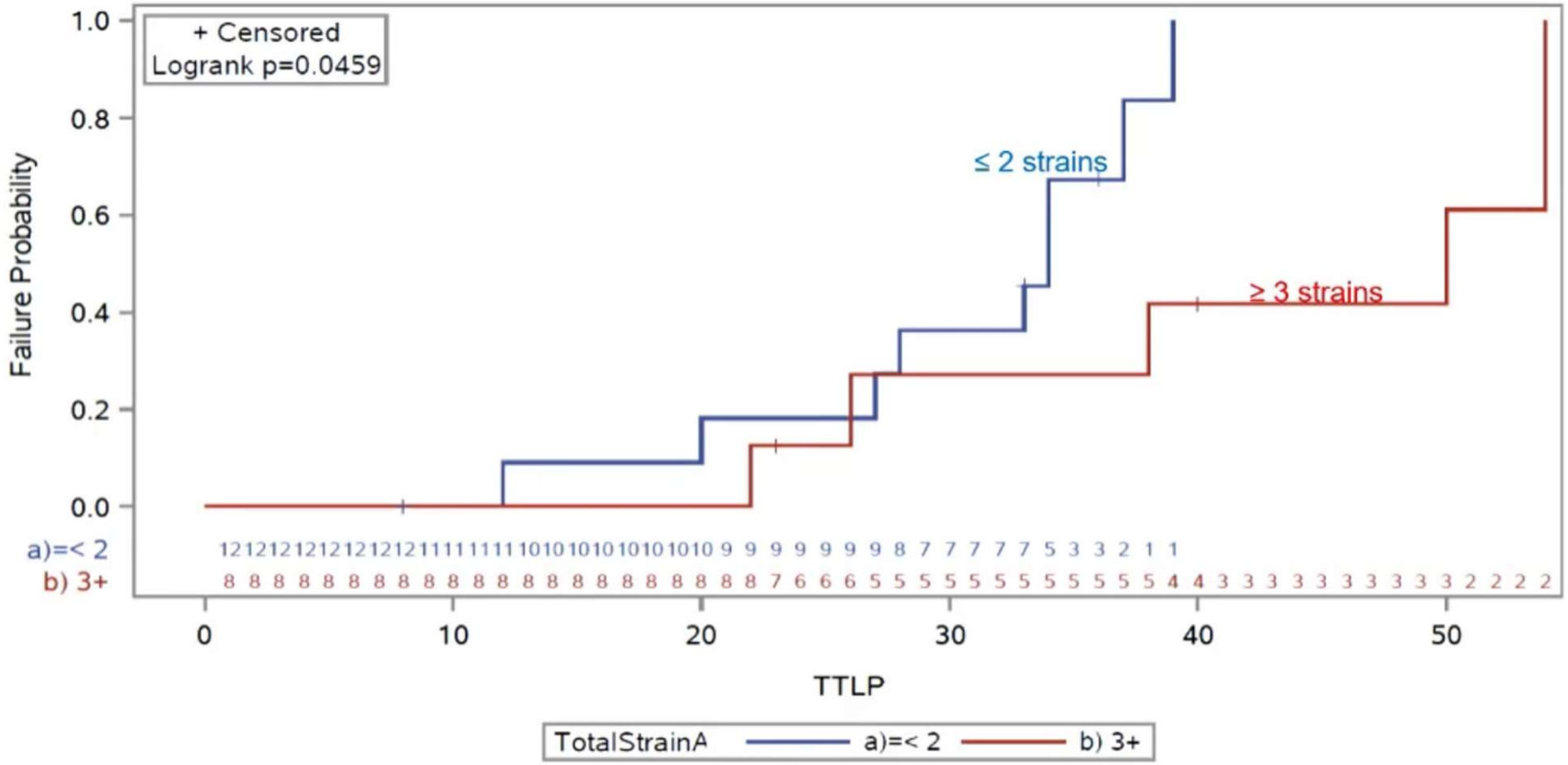
Compared to the 2009-2012 cohort, the 2020-21 POMP herds had:

- Longer TTLP (+9 weeks average)
- Longer TTBP (+6 weeks average)
- More severe losses +1,355 pigs not weaned/1k sows

Time to baseline productivity (weeks)	Cohort 2011	Cohort 2021
10th percentile	0	7
25th percentile	8	16
median	**16**	**22**
75th percentile	18	26
90th percentile	28	31

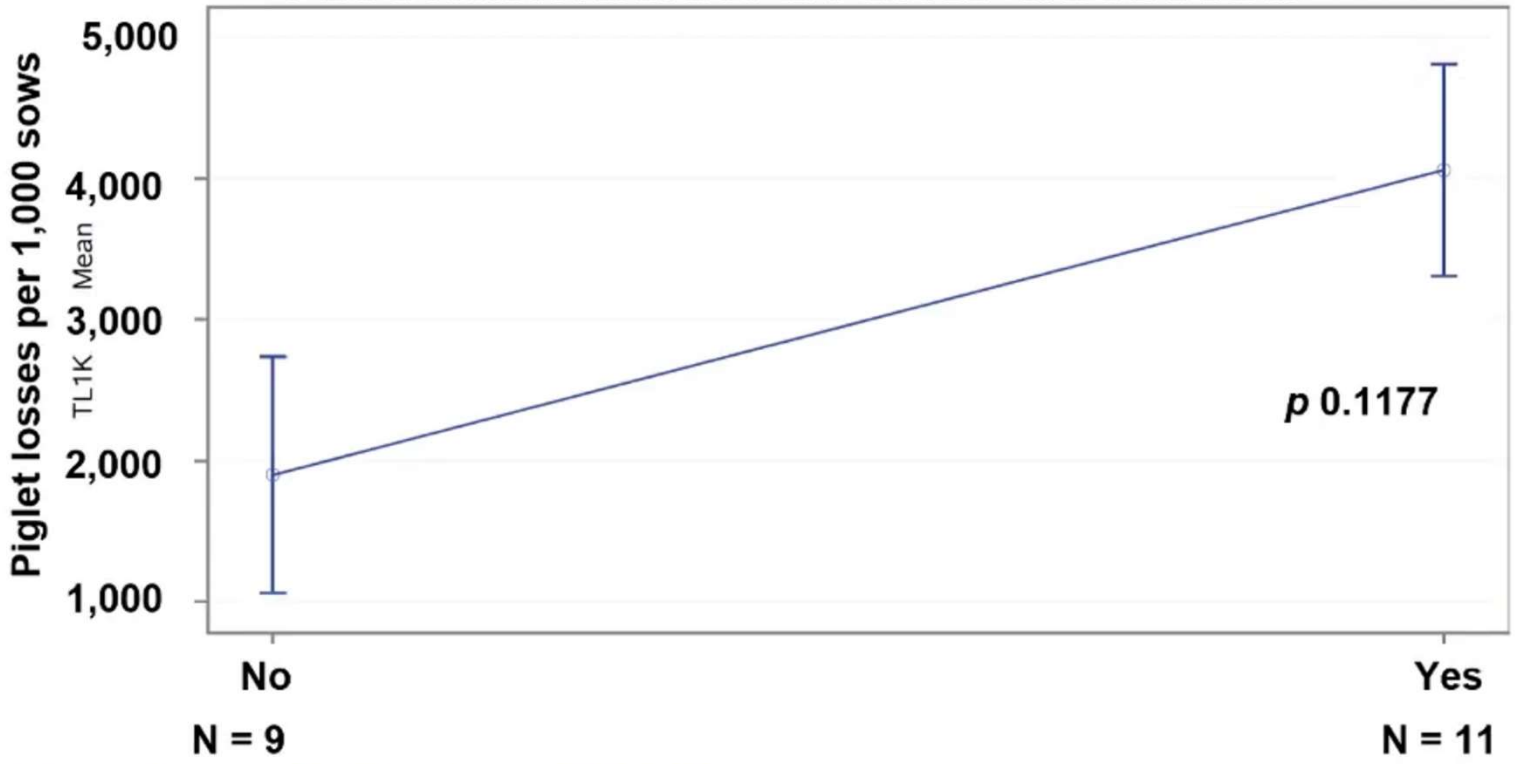
Total loss per thousand sows	Cohort 2011	Cohort 2021
10th percentile	43	1,910
25th percentile	1,174	2,363
median	**2,789**	**4,144**
75th percentile	4,755	5,557
90th percentile	6,087	7,195

Farms with ≥ 3 strains reached low prevalence 12 weeks after farms with ≤ 2 PRRSV strains



Trevisan, *et al*. 2022, Transboundary and Emerging Diseases

Farms with recombination events detected had 1,827 higher piglet losses / 1,000 sows than farms with no recombination events detected



https://www.fieldepi.org/POMP

Preliminary Analysis

Factors associated with shorter TTS & Production impact:

- Prior immunity (still) matters
  - Negative herds take longer to recover and have higher losses
- Herd closure: increases the success rate to achieve Stability
- Reporting 'seeking elimination':
  - 80% achieved stability compared to 40%
  - Longer TTBP, higher TL
- Batch farrowing system was associated with quicker TTLP, TTBP (n=4 herds)
- Timing bio-management practices: sooner = better
- PRRSV genotype ("different" or "new" = worse)
- Multiple strains or recombination events = Longer TTS and higher TL

New Diagnostic Technique

Collection des bouts de langues (mort-nés et mortalité préseuvrage)

CONSIDERATIONS:

- Risk-based sample – an additional tool
- Great to assess PRRSV circulation in the gestation herd (stillborn)
- Practical, cheap, time-efficient

SUPPLIES:

- ❑ Scissors and forceps.
- ❑ Disposable plastic bag.
- ❑ Conical tube.
- ❑ Freezer (-20°C).

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www.fieldepi.org

COLLECTION INSTRUCTIONS:

STEP 1.
From dead piglets, collect ~1 inch of tongue tips with the help of scissors and forceps.

STEP 2.
Place 20+ tongue tips in a disposable bag.

STEP 3.
(optional)
Freeze the bag, followed by thawing (freeze-thaw) immediately prior to submission.

STEP 4.
Squeeze the bag of thawed tongue tips and place the fluid in a conical tube.

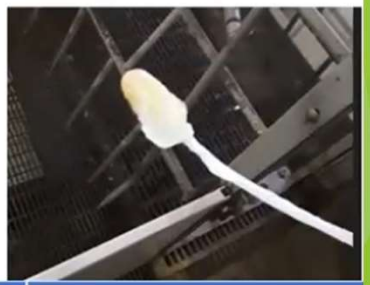
STEP 5.
Ship the fluid to the VDL for PRRSV RNA detection by RT-qPCR. Keep samples refrigerated during shipment.

Tongue tips

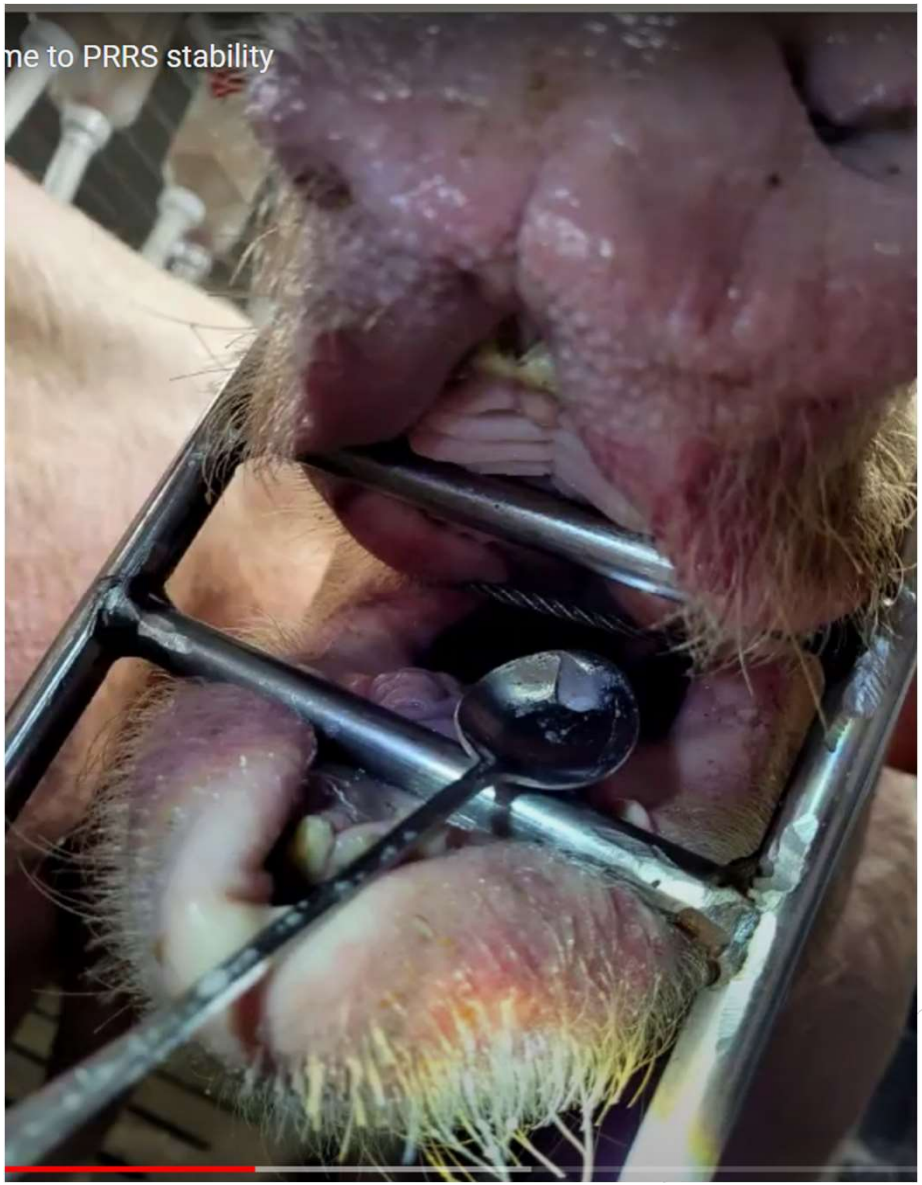
- As sensitive if not better than processing fluid
- Better quality sample than oral fluids
- Can be collected and frozen for an extended period of time
- Minimum equipment needed
  - Scissor
  - Forceps or pliers
  - Freezer bags

New Diagnostic Tools in Process

- Developed to help with PRRS Elimination projects
  - Better understand gestation herd
  - Throat samples



	Serum	Tonsil Scraping	Throat sampling
PCR positivity	5 of 30 (10%)	X of 30 (70%)	30 of 30 (100%)
Need for straining	Yes	Yes	No
Collection time	2 min	3 min	30 sec


me to PRRS stability

Conclusion

- PRRS takes advantage of modern production systems to become
- More pathogenic
- More contagious
- At the clinical level, these new viruses
- Create More Severe Losses
- Easier to transmit
- Harder to get rid of
- More efforts must be put in place to limit the transmission but also the creation of new strains

Concluson

- Can we keep new variant from emerging?
  - Reduce the rate of recombination
  - Reduce at risk behavior
    - Comingled multiple unstable sources
      - Same barn
      - Same region
  - Reduce transmission to contain evolution
    - Movement of highly infectious animal
  - Kept biosecurity up to speed on the main risk of infection and transmission
  - Emphasis on Biocontainment
    - Animal movement
-

PED

- Acute diarrhea in all age groups
- 100% mortality in lactating piglets
- Very strong maternal immunity three weeks after exposure
- Following the devastation of 2013 and 2014, PED became endemic in the U.S. pig herd
- Sporadic hatching on sow farms
- Especially in areas dense with pigs
- Circulation in the grow-finish population is often undetected
- Lack of washing and disinfection on market transport is a significant problem
- The virus can remain infectious for an extended period of time
- In manure (more than 60 weeks)
- In feed ingredients (several weeks in some ingredients)
- Several systems use viral inoculation to reduce the risk of recirculation

PED risks of infection in naïve area

- Movement of highly infectious animal
- Manure handling of infected site
- The port of entry in negative region
  - Cull market
    - If site positive possibility of moving highly infectious animal
    - If site is never depopulating high risk of maintaining infection in clean zone
  - Packing plant
    - If the site receives positive animal
    - Cross contamination of finisher late in phase
    - Movement of highly infectious animal
- It is critical to monitor both Packing plant and cull market to detect and act on early infection
  - Cheap (pool and 1 daily test)

Questions?