非洲猪瘟的重新认识、病毒特征及群体状态下阻断传播的探讨

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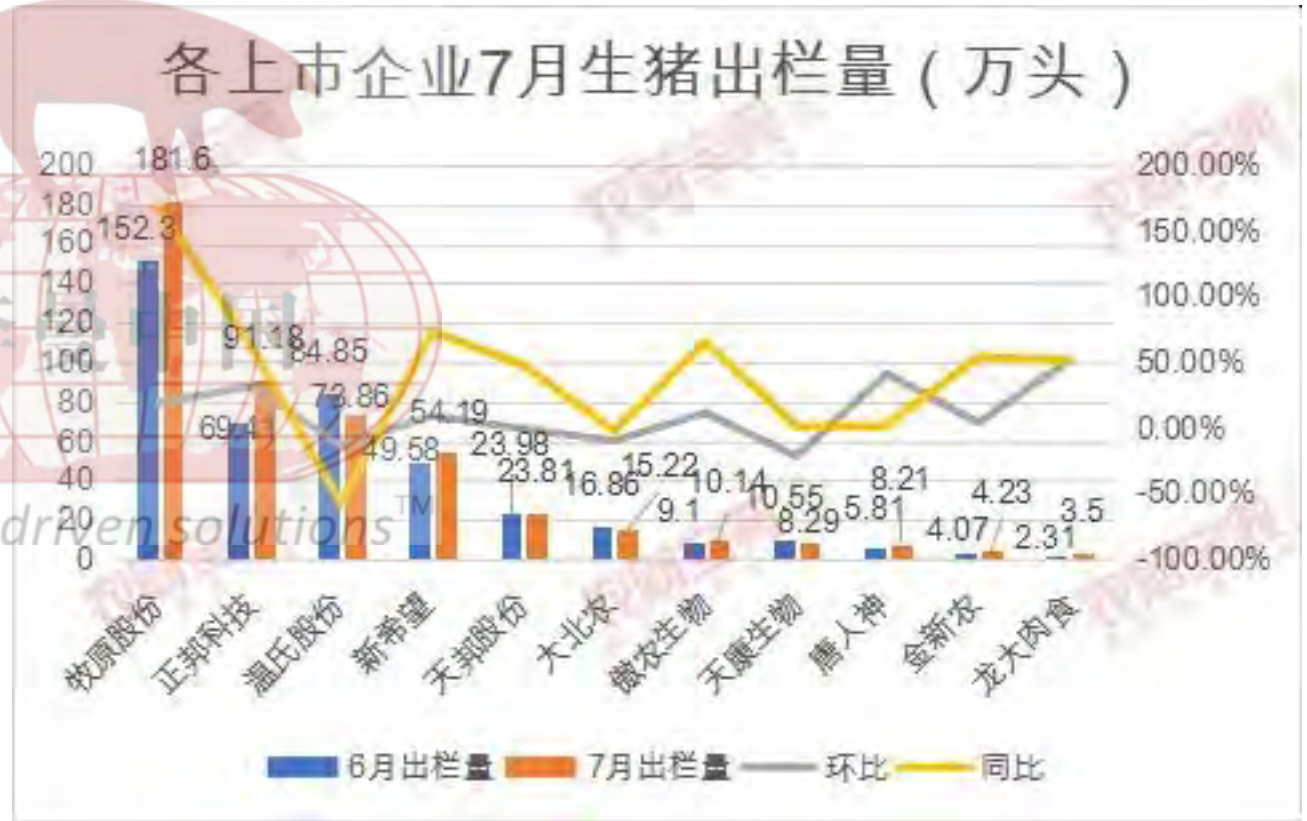
2020-10-14

主要内容

- 非洲猪瘟的重新认识
- 非洲猪瘟病毒特征
- 群体状态下传播与阻断
- 总结

一、非洲猪瘟的重新认识

1、ASF对生猪产业的影响



我国生猪产能呈加快恢复态势：

- 一是，能繁母猪存栏增长，到今年二季度末，能繁母猪存栏达**3629万头**，比一季度末增加近250万头，增幅**7.3%**；
- 二是，生猪存栏连续回升，二季度末，全国生猪存栏**33996万头**，比存栏量低点的2019年三季度末增加**3321万头**，增幅**10.8%**；
- 三是，生猪出栏同比降幅收窄，今年上半年全国生猪出栏**25103万头**，降幅比一季度收窄**10.4个百分点**

“2020中国国际肉类产业周”——中国肉类协会，2020.8.12

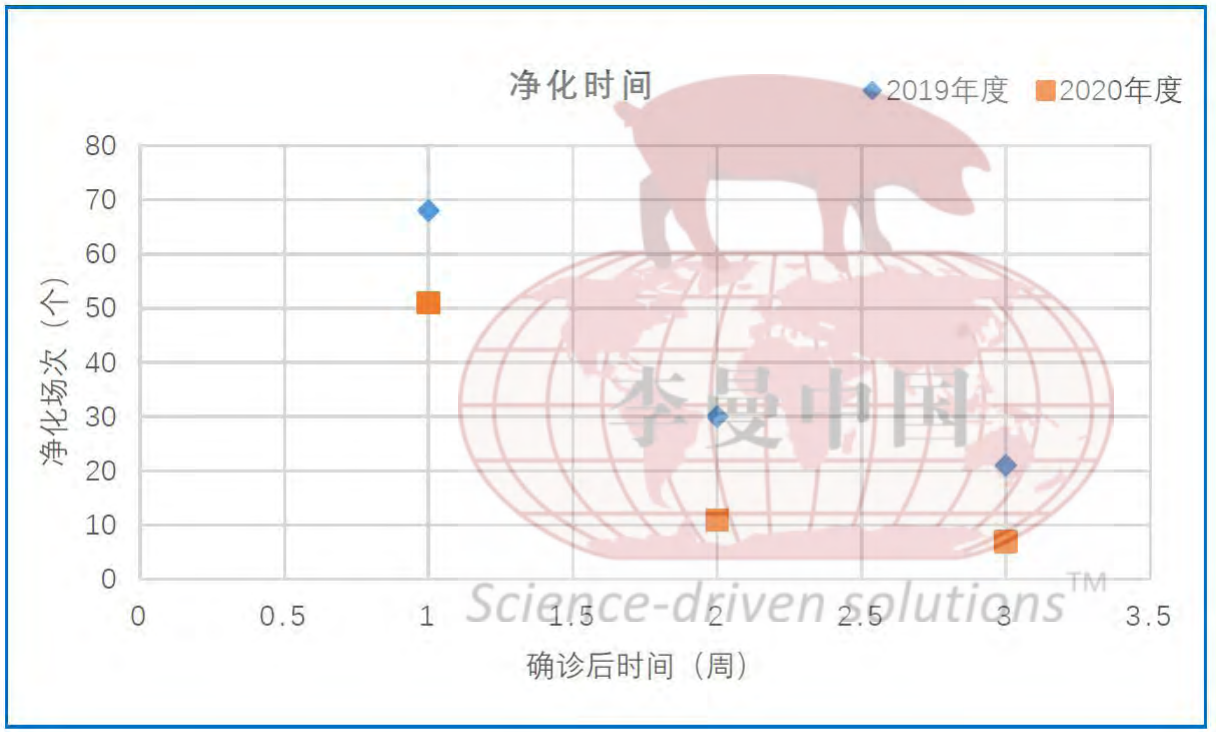
J.Deen教授对发生在中国的非洲猪瘟及经济回报的报告中提到，疫情引起供应量减少，对于生物安全管控好的生猪供应企业，当前是扩张的好机会。

2018.10，李曼中国，郑州

小结1：

- 2018年下半年开始造成能繁母猪存栏、生猪存栏大幅下降；
- 2019年下半年开始恢复增速；
- 2020年存栏和出栏依然处于低位，但是能繁母猪存栏和生猪存栏出现7-10%的增速；
- 大集团在增速中起到重要的作用（重大变化）；
- ASF对产业的影响逐步得到缓解，产能恢复激增；
- 随着ASF群内清除和群体净化技术的逐步“解禁”，ASF对生物安全良好的猪群影响越来越小。

2、群内净化技术（三周净化法）的产业贡献



n（2019）=119；n（2020）=69

1周净化占比：57.1%（2019），73.9%（2020）

从《农民日报》2019.8.31到2020.8.7技术指南

农业农村部办公厅文件

农办牧〔2020〕41号

农业农村部办公厅关于印发《非洲猪瘟常态化防控技术指南（试行版）》的通知

各省、自治区、直辖市农业农村（农牧、畜牧兽医）厅（局、委），新疆生产建设兵团农业农村局，部属有关事业单位：

为进一步强化非洲猪瘟常态化防控，督促指导各地和各类防疫主体全面落实防控措施，我部组织制定了《非洲猪瘟常态化防控技术指南（试行版）》，现印发你们，请结合防控实际，认真做好技术培训和宣传解读，科学有序推进常态化防控工作。

农业农村部办公厅

2020年8月7日

根据样品中病毒的含量，尽快剔除可疑猪和暴露猪群（猪只数量根据样品检测结果和现场布局确定），并立即消毒，清除可能的污染源。

9.3.3 持续检测

异常猪只处理完成后，应持续检测1个最大潜伏期，第1周，对异常猪的周边猪只，接触的地面，以及粪便等开展两次检测，确保无阳性。此后，按照每周1次的频率对全部或部分猪只，以及环境进行采样检测，若仍能检测到异常，则进行再次清除操作。

9.3.4 恢复生产

从发现阳性样品开始，持续监测21天，若检测核酸再无阳性猪只，以及期间检出的车辆、人员、设施设备和外部环境核酸阳性的，应严格做清洗、消毒处理，再次采样检测阴性后，则可以恢复生产。

非洲猪瘟预防与控制的革命

`全面检测+精准清除`技术
正在我国成功控制非洲猪瘟疫情

New Generation `Organized Sampling and Precision Removal`
techniques succeeding in ASFV prevention and control in China

闫之春，2020.8，南农猪业论坛

3、传播性Transmissibility

R0 基本再生率 Basic reproductive rate

R_0，在一个没有感染的群体(或区域)，出现一个病例(个体，场)，在这个病例的感染期内，造成群\区内出现新感染病例的个数。an infection can be thought of as the number of cases one case generates on average over the course of its infectious period, in an otherwise uninfected population.

- R_0>1，Infection spreads 疫情传播(epidemic 迅速流行)
- R_0= 1，Infection remains constant　感染保持不变(endemic 地方性的)
- R_0< 1，Infection dies out 感染逐渐消亡

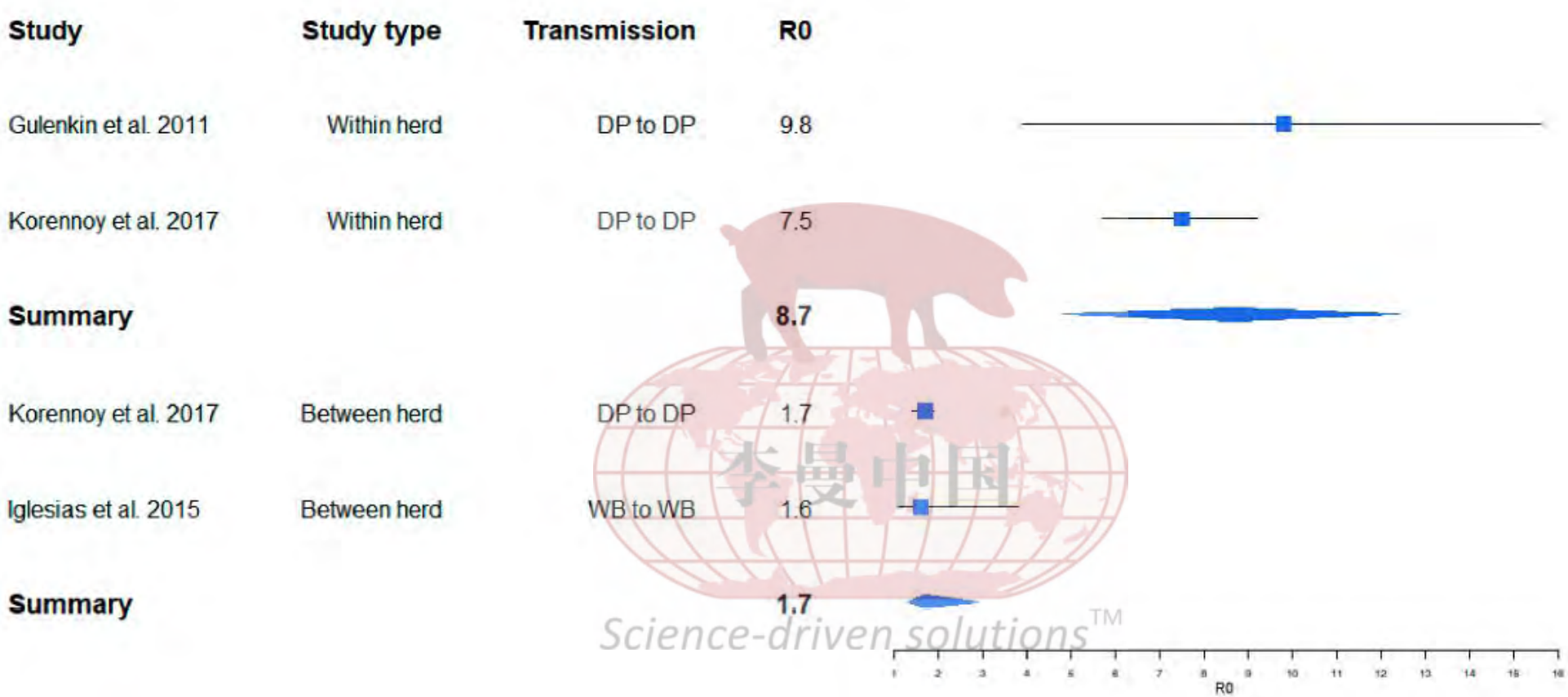
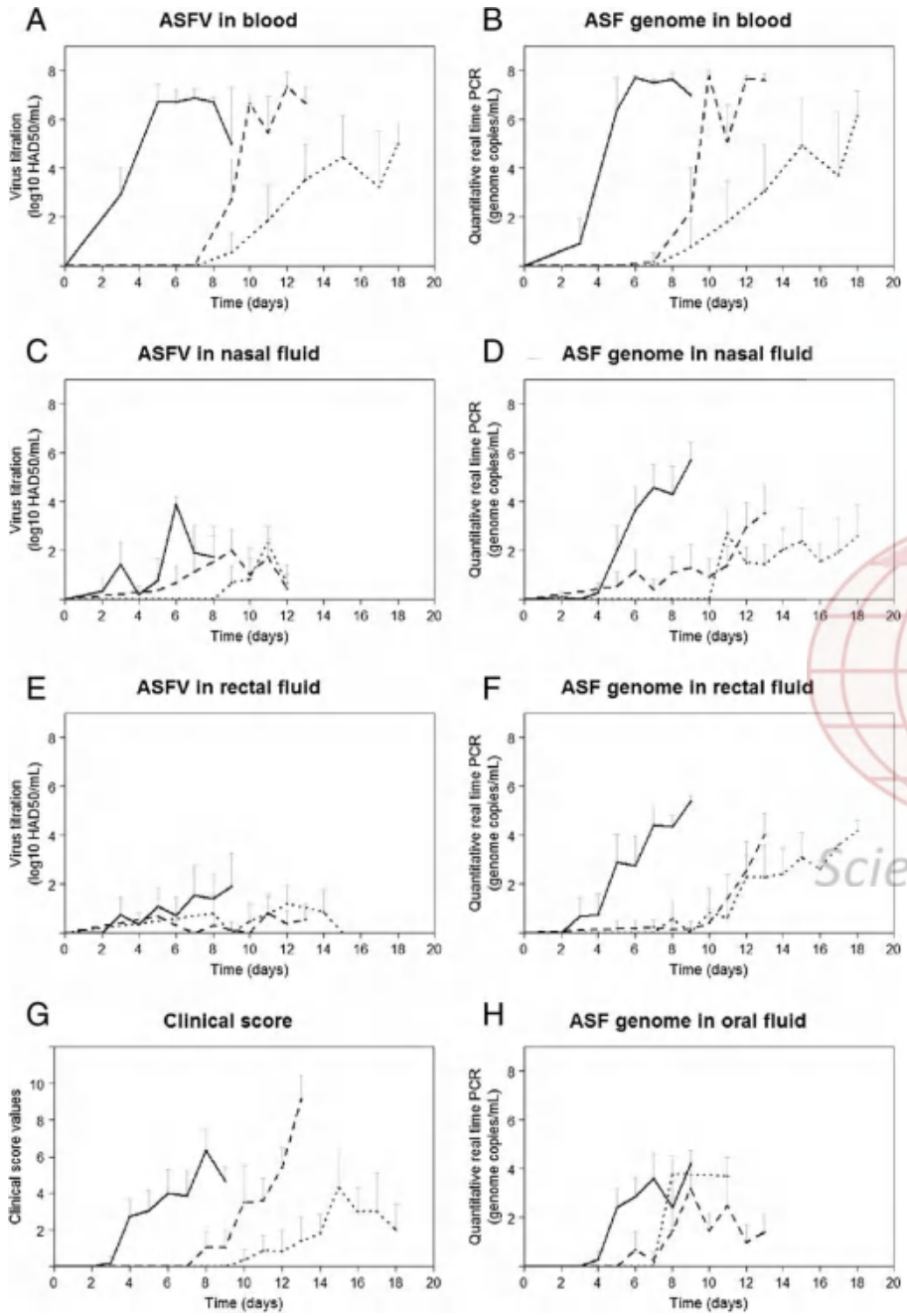


Figure 1. Variation of calculated R_0 for African swine fever (ASF) obtained from ASF field studies. Boxes illustrate the calculated R_0. The lines illustrate the confidence intervals. DP = domestic pig, WB = wild boar.



Guinat et al. Veterinary Research 2014, 45:93
http://www.veterinaryresearch.org/content/45/1/93

VETERINARY RESEARCH

RESEARCH Open Access

Dynamics of African swine fever virus shedding and excretion in domestic pigs infected by intramuscular inoculation and contact transmission

Claire Guinat[1,2*], Ana Luisa Reis[1], Christopher L Netherton[1], Lynnette Goatley[1], Dirk U Pfeiffer[2] and Linda Dixon[1]

启示Implications:

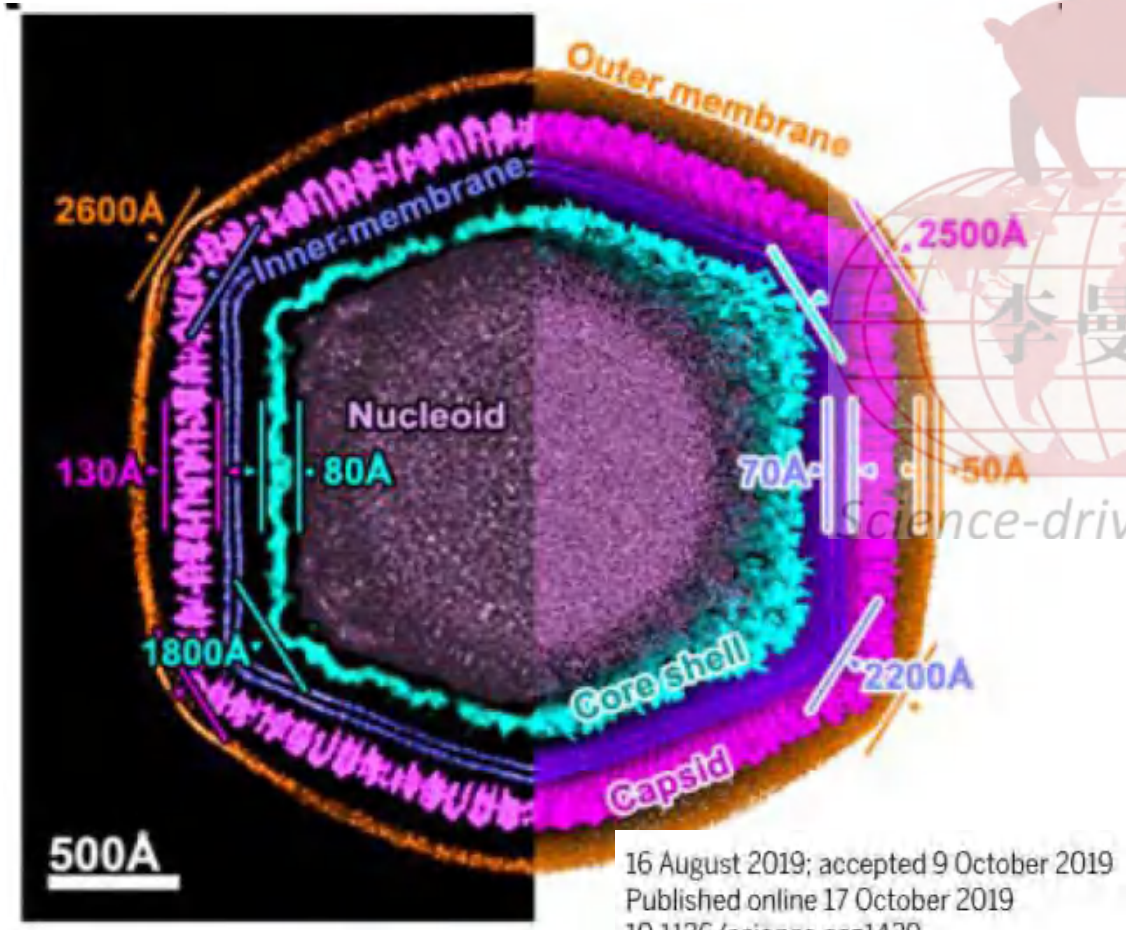
- 接触猪出现感染力通常在10+天以后，很慢，不直接接触猪更慢；
- 外周拭子样品中病毒含量比血液中低很多；
- 首次全群检测后，田间条件下，可能会有大量间接接触猪，多天以后散毒。

小结2:

- ASF对生猪产业的影响在生物安全条件良好的农场影响逐步减少;
- ASF促进了中国规模猪场加速进程;
- ASF让中国猪场重新学习和实践生物安全;
- ASF可以在群内实现净化，并且实践证明该病是最容易净化的疾病，且时间最短;
- ASF完全可以通过生物安全实现：预防、控制、净化和复产。

二、非洲猪瘟的病毒特征

1、病毒很稳定？ Virus is very Stable?



16 August 2019; accepted 9 October 2019
Published online 17 October 2019
10.1126/science.aaz1439

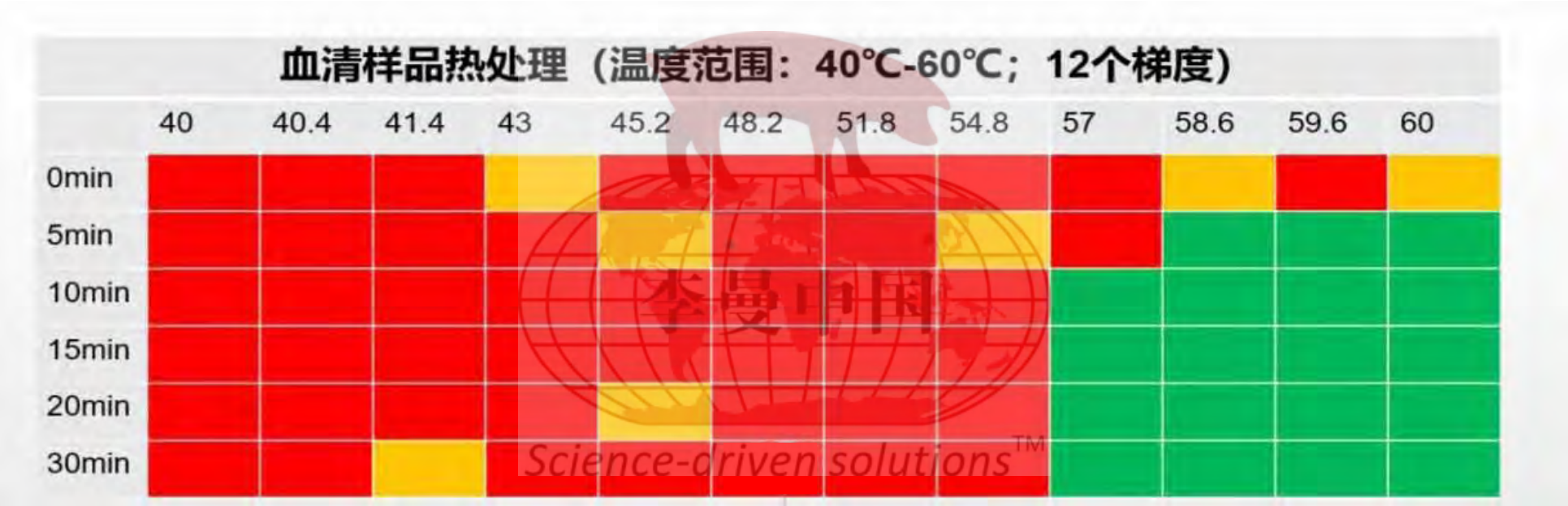
ASFV is very stable in the environment and can remain infectious for more than 3 days in contaminated pens and for up to several weeks in pig feces. After storage at room temperature, ASFV can be isolated from sera or blood after 18 months and from putrefied blood after 15 weeks (EFSA 2009). ASFV persists for weeks to months in frozen or uncooked meat. In cured or processed products, such as Parma ham, infectious virus was not found after 300 days of processing and curing (McKercher et al. 1987). Spanish cured pig meat products, such as Serrano hams and shoulders, were free of viable ASFV by day 140 and Iberian loins by day 112 (Mebus et al. 1993). No infectious ASFV was found in cooked or canned hams heated to 70 °C (158 °F). Infectious ASFV was undetectable by 110 days in chilled deboned meat, bone-in meat, or ground pork and by 30 days in smoked deboned meat (Adkin et al. 2004).

Diseases of Swine, 11th Edition

但是 BUT：

血清样品热处理后，接种PAM细胞，60h后红细胞吸附试验

After heat treatment of serum samples（Pos）, PAM cells were inoculated and Hemoadsorption test was conducted 60h later



病毒对温度特别敏感！ **ASFV is particularly sensitive to temperature !**

注：红色表示吸附；橙色表示可疑；绿色表示无吸附

Note: red indicates adsorption; Orange is suspicious; Green means no adsorption

ASFV最新“消除动力学特征”

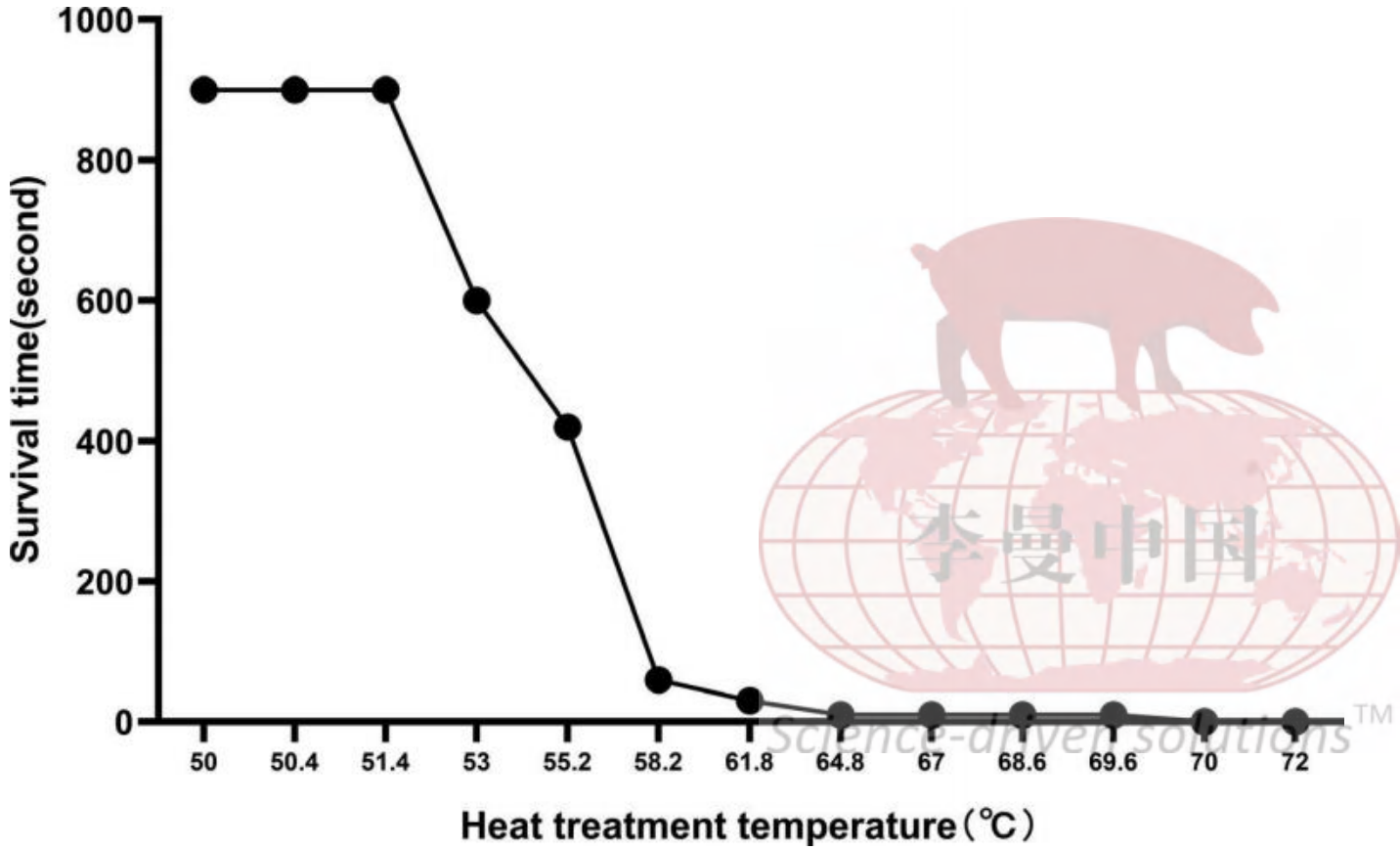


FIGURE 1 Survival time of African swine fever (ASF) isolates subjected to high ambient temperatures. ASF cultures performed under standard conditions, starting amount in each reaction well of 4.6×10^6 ASF virus copies measured by standard TCID assay (OIE, 2019b; Zhao et al., 2019). ASF cultures initially placed in laboratory oven (Dongguan Zotai Instrument Technology Co., Ltd.) held at the temperature shown. Presence of ASF in each test well held at the reaction times and temperatures shown, determined by standard qPCR (Fernández-Pinero et al., 2013; OIE, 2019b)

Vet Med Sci. 2020

Lang Gong[1,2]
Runda Xu[1,2]
Zengjie Wang[3]
Qiwei Deng[4]
Heng Wang[1,3]
Guihong Zhang[1,3,4]

[1]*Key Laboratory of Zoonosis Prevention and Control of Guangdong Province, College of Veterinary Medicine, South China Agricultural University, Guangzhou, People's Republic of China*
[2]*Guangdong Laboratory for Lingnan Modern Agriculture, Guangzhou, People's Republic of China*

提示：65℃以上物理温度方可有效杀死ASFV

2、群体中“污染重点”及消除

Transboundary and Emerging Diseases

Transboundary and Emerging Diseases

ORIGINAL ARTICLE

Survival of African Swine Fever Virus in Excretions from Pigs Experimentally Infected with the Georgia 2007/1 Isolate

K. Davies[1], L. C. Goatley[1], C. Guinat[1,2], C. L. Netherton[1], S. Gubbins[1], L. K. Dixon[1] and A. L. Reis[1]

[1] The Pirbright Institute, Surrey, UK
[2] Department of Production and Population Health, The Royal Veterinary College, Hatfield, UK

Table 1. Number of samples collected of each sample type on days relative to the onset of pyrexia in infected pigs. The total number of samples collected of faeces, urine and oral fluid relative to the onset of fever in infected pigs is shown. These samples were tested by quantitative PCR (qPCR) and virus titration (VT) and the day that the samples tested positive for ASFV are also shown relative to the onset of pyrexia

		Onset of Pyrexia (days) 出现发烧的天数					
	Sample type	−1	0	1	2	3	Total
Samples collected	Faeces	4	6	9	6	1	26
	Urine	2	4	5	4	–	15
	Oral fluid	–	3	5	4	–	12
qPCR positive	Faeces	–	1	–	1	–	2
	Urine	1	2	1	1	–	5
	Oral fluid	–	2	2	1	–	5
VT positive	Faeces	–	1	–	1	–	2
	Urine	–	2	–	1	–	3
	Oral fluid	–	–	–	–	–	–

Table 3. Estimated duration of survival of infectious ASFV in excretions at different temperatures. Estimated duration of survival of infectious ASFV in faeces, urine and oral fluid stored at 4, 12, 21 and 37°C, calculated assuming an infectious dose of 10 HAD_{50} initial mean viral titre of each sample type and half-life value (Table 2) for each sample type at 4, 12, 21 and 37°C

	Estimated survival of ASFV (days)				
	Viable ASFV				
		Temperature			
Sample type	Mean initial titre ($TCID_{50}$)	4°C	12°C	21°C	37°C
粪便 Faeces	$1 \times 10^{4.83}$	8.5	6.5	5.1	3.7
尿 Urine	$1 \times 10^{2.94}$	15.3	7.5	4.8	2.9
口腔液 Oral Fluid	–	–	–	–	–

提示：消毒的重点和效果/方法

Tip: focus and effect of disinfection/Method

3、消毒药与ASFV作用特点

TABLE 2 Effect of selected disinfectants on ASF virus detection via qPCR assay

Disinfectant group and identity	Final dilution (w/v)	ASF titre following addition of disinfectant					
		1 min	*p*-value	15 min	*p*-value	30 min	*p*-value
Quaternary ammonium and glutaraldehyde mixture (omnicide)	1:50	6.63 ± 0.05	>0.05	6.30 ± 0.01	<0.001	5.96 ± 0.02	<0.001
	1:150	6.66 ± 0.01	>0.05	6.33 ± 0.16	>0.05	5.88 ± 0.14	<0.05
	1:300	6.67 ± 0.02	>0.05	6.36 ± 0.22	>0.05	5.97 ± 0.04	<0.01
Sodium hydroxide 2% solution (caustic soda)	1:25	ND	<0.001	ND	<0.001	ND	<0.001
	1:50	ND	<0.001	ND	<0.001	ND	<0.001
	1:100	5.35 ± 0.51	>0.05	3.97 ± 0.69	<0.05	ND	<0.001
Chlorine 5% solution (84 product)	1:100	ND	<0.001	ND	<0.001	ND	<0.001
	1:200	5.42 ± 0.65	>0.05	ND	<0.001	ND	<0.001
	1:300	4.69 ± 0.84	>0.05	4.07 ± 0.62	<0.05	ND	<0.001
Sodium hypochlorite 5% solution (bleach)	1:250	5.78 ± 0.47	>0.05	5.19 ± 0.18	<0.01	ND	<0.001
	1:500	6.48 ± 0.08	>0.05	5.79 ± 0.21	<0.05	ND	<0.001
	1:1,000	6.50 ± 0.17	>0.05	6.43 ± 0.15	>0.05	6.02 ± 0.12	<0.05

季铵盐-戊二醛

苛性钠

84

次氯酸钠

Note: African swine fever (ASF) virus culture by standard methods (OIE, 2019b; Zhao et al., 2019). Starting amount of ASF virus added to each reaction: 4.6×10^6 copies, measured by TCID assay. Data presented as log mean of ASF titre in qPCR assay (Fernández-Pinero et al., 2013) ±*SD*. *p* Value data derived by one-way analysis of variance, using SPASS software. ND indicates ASF virus DNA below the level of detection in qPCR assay used (Fernández-Pinero et al., 2013).

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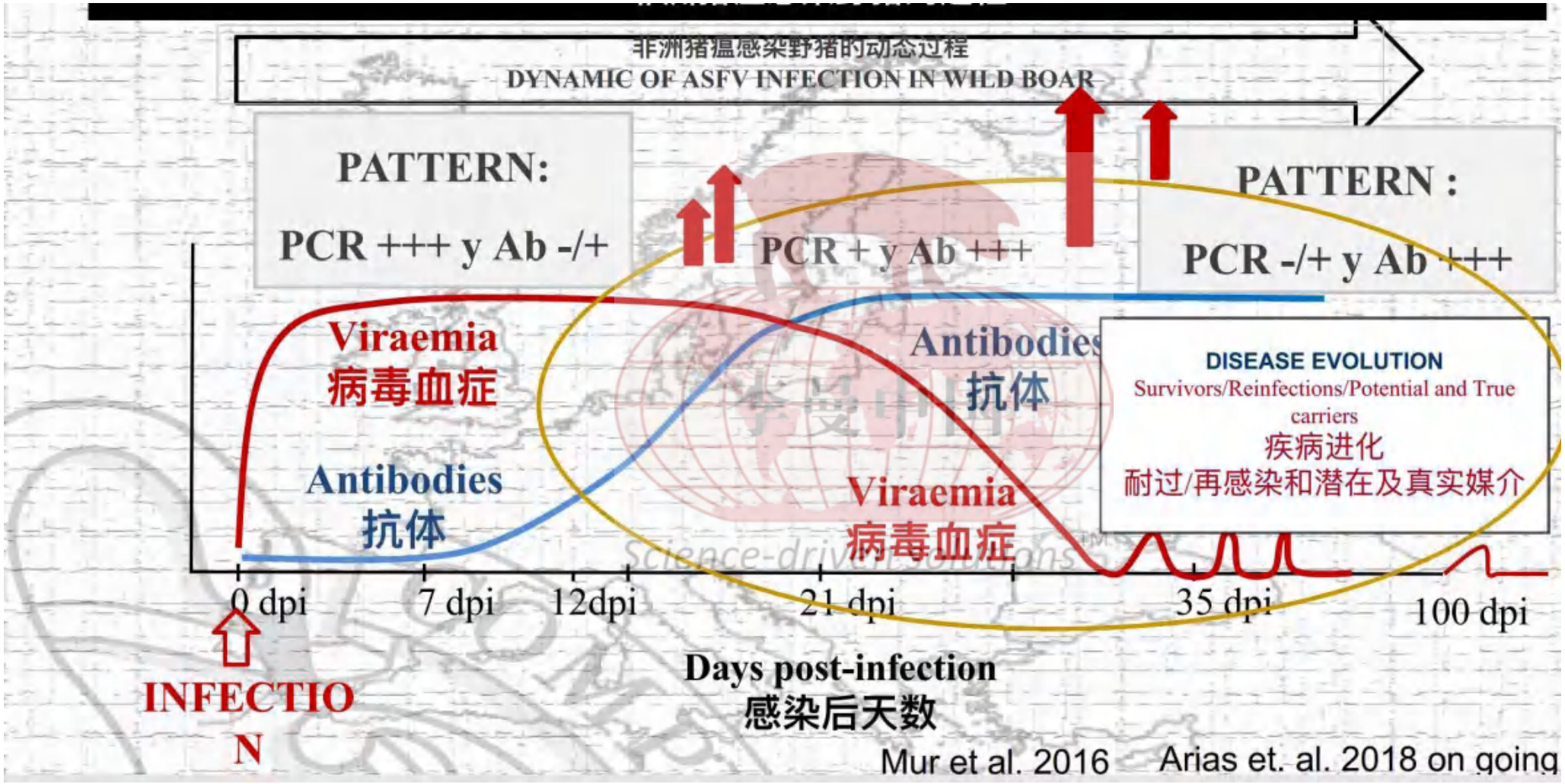
4、感染动力模型


非洲猪瘟感染野猪的动态过程
DYNAMIC OF ASFV INFECTION IN WILD BOAR
PATTERN:
PCR +++ y Ab -/+
PCR + y Ab +++
PATTERN :
PCR -/+ y Ab +++
Viraemia
病毒血症
Antibodies
抗体
Antibodies
抗体
Viraemia
病毒血症
DISEASE EVOLUTION
Survivors/Reinfections/Potential and True carriers
疾病进化
耐过/再感染和潜在及真实媒介
0 dpi
7 dpi
12dpi
21 dpi
35 dpi
100 dpi
INFECTIO
N
Days post-infection
感染后天数
Mur et al. 2016
Arias et. al. 2018 on going

三、群体状态下传播与阻断

关键点:

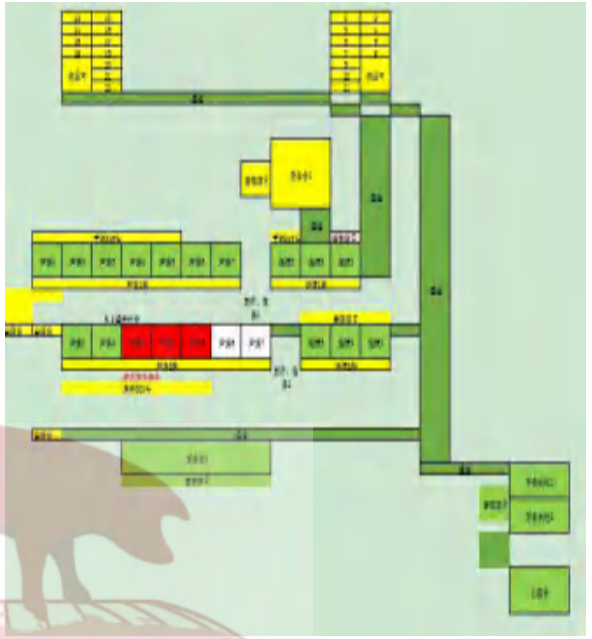
◆精准排查

◆限制传播

◆精准动态管理清除技术

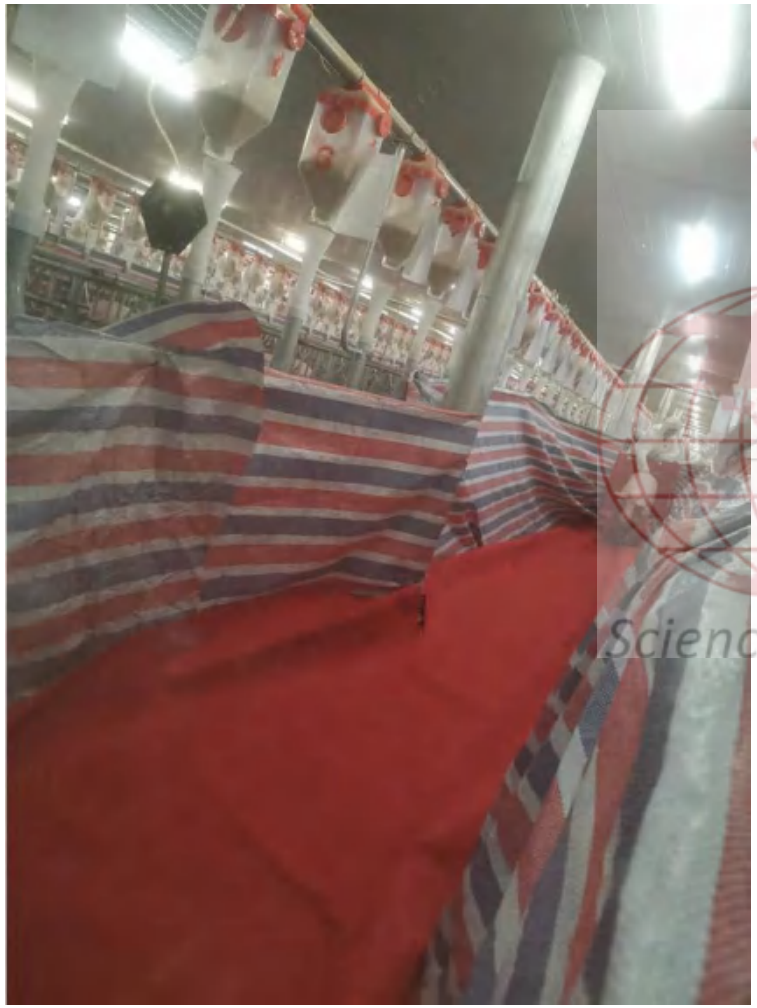
◆全面恢复生产

1、精准排查



过道（头）	A1	过道（尾）	B1	过道（头）	C1	过道（尾）	D1	过道（头）
	A2		B2		C2		D2	
	A3		B3		C3		D3	
	A4		B4		C4		D4	
	A5		B5		C5		D5	
	A6		B6		C6		D6	
	A7		B7		C7		D7	
	A8		B8		C8		D8	
	A9		B9		C9		D9	
	A10		B10		C10		D10	
	A11		B11		C11		D11	
	A12		B12		C12		D12	
	A13		B13		C13		D13	
	A14		B14		C14		D14	
	A15		B15		C15		D15	
	A16		B16		C16		D16	
	A17		B17		C17		D17	

2、限制传播

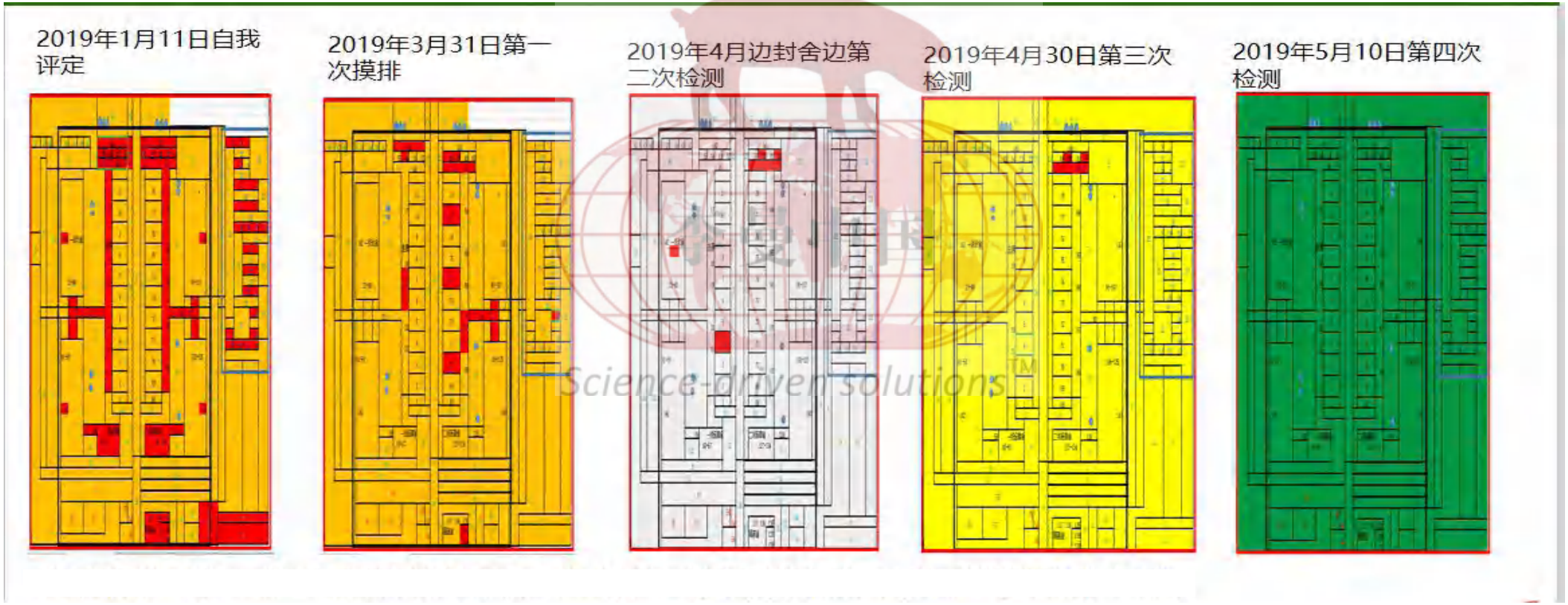


离群VS清除

“救命板”，限制群内传播

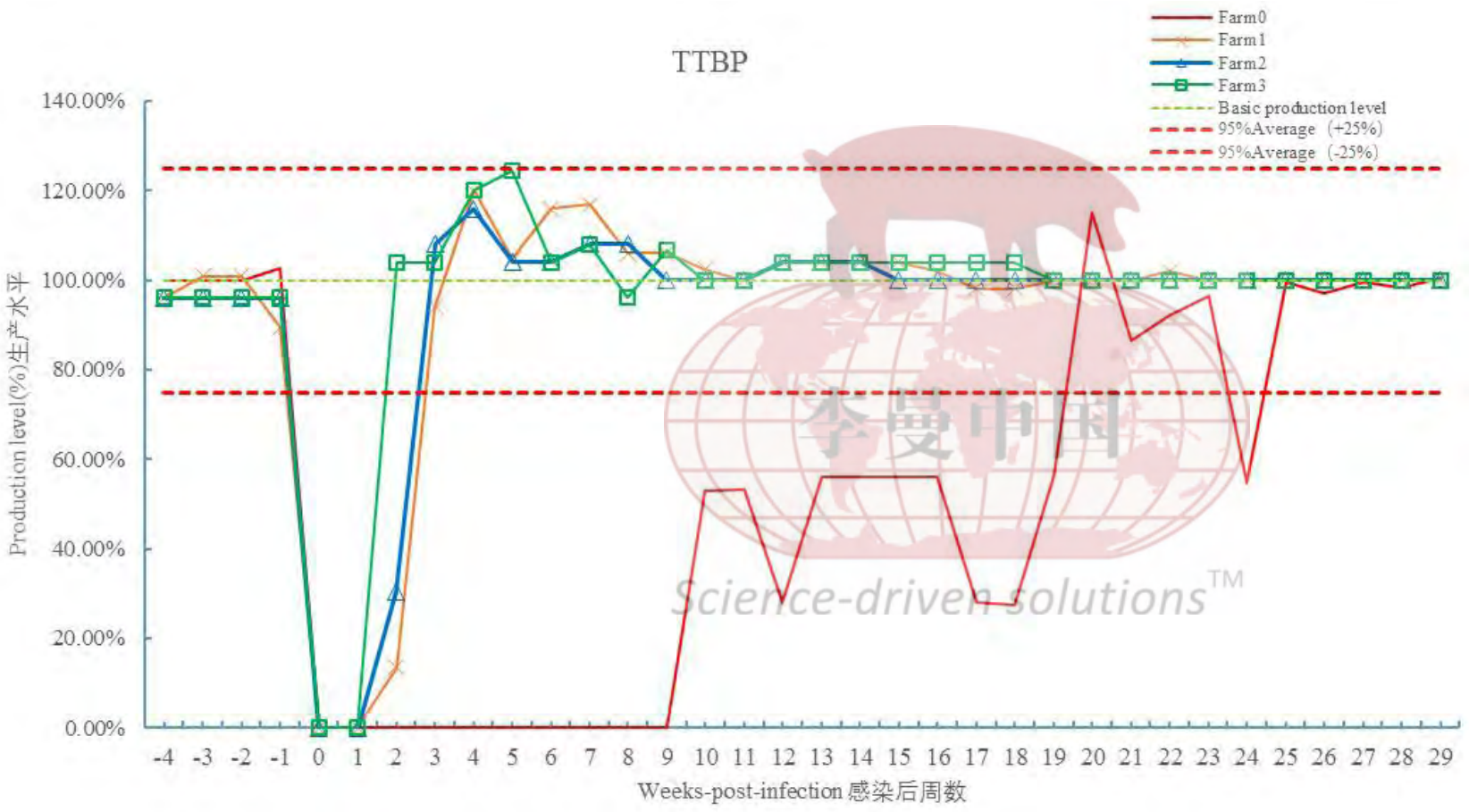
消除“排毒”

3、精准动态管理清除技术



4、TTBP（在群复产） Resume Production

Professor Bob Morrison



TTBP:PRRS,PED

恢复至基本生产水平的时间：4-8周

NHLH Academy of Swine Research 新希望六和养猪研究院

Xiaowen LI, Weisheng WU, Junxian LI et al, 2019.8

四、总结

- ASF群内净化全面进入新时代，也是企业管理的“分水岭”；
- 生物安全是实现ASF预防、控制、净化、复产四项核心技术最经济和最有效的方法；
- 实现上述四项核心技术直接受益的是PRRS防控的“新局面”，并且是“谁用谁知道”；
- ASF防控的启发：重要疾病净化成为新一代兽医的工作重点。

谢谢大家!
Thanks for your attention !