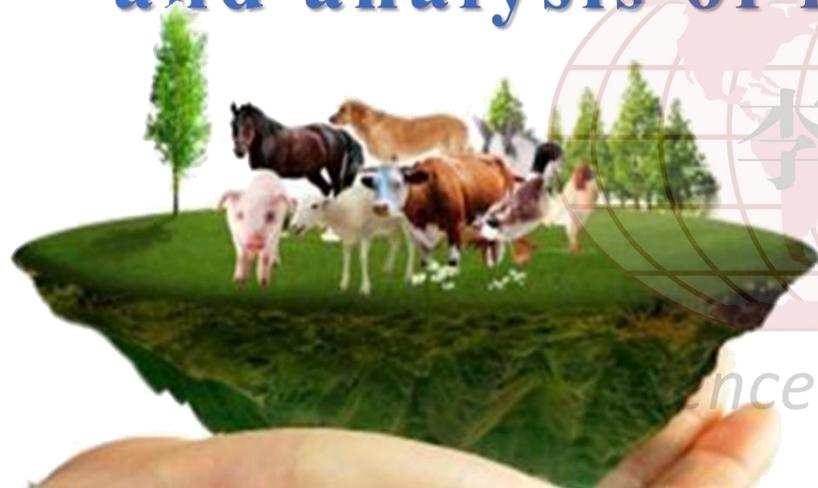




# 猪流感的防控策略和免疫效益分析

Prevention and control strategies for swine influenza  
and analysis of its immunization benefits



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主讲：路伟



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# CONTENTS

# 目录

## catalogue

01

### 猪流感的危害及流行现状

The hazards and current epidemic situation of swine flu

02

### 猪流感的防控策略

Prevention and control strategies for swine flu

03

### 猪流感疫苗的选择策略、免疫方案和评估指标

Selection strategy, immunization scheme, and evaluation indicators for swine influenza vaccines

04

### 免疫猪流感疫苗的效益分析

Benefit analysis of swine influenza vaccine immunization

# 猪流感病毒

## Swine flu virus



### 血清型及亚型

#### Serotype and subtype

- 猪流感-A型猪流感病毒引起，HA有16个亚型，NA有9个亚型，目前已发现猪流感病毒至少有9个血清型
- Porcine influenza A is caused by the swine influenza virus, which has 16 subtypes in HA and 9 subtypes in NA. Currently, at least 9 serotypes of swine influenza virus have been found
- 致病的主要为H1N1、H3N2和H1N2亚型
- The main pathogenic subtypes are H1N1, H3N2, and H1N2



### 保护性抗原

#### Protective antigen

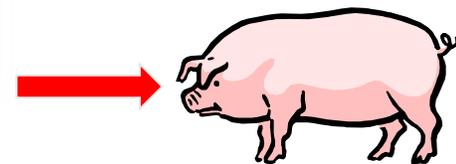
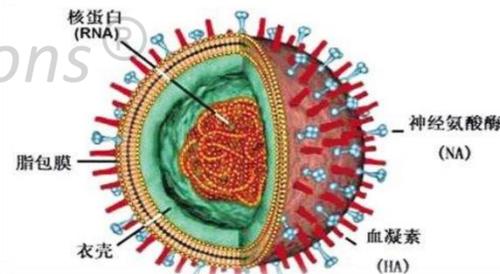
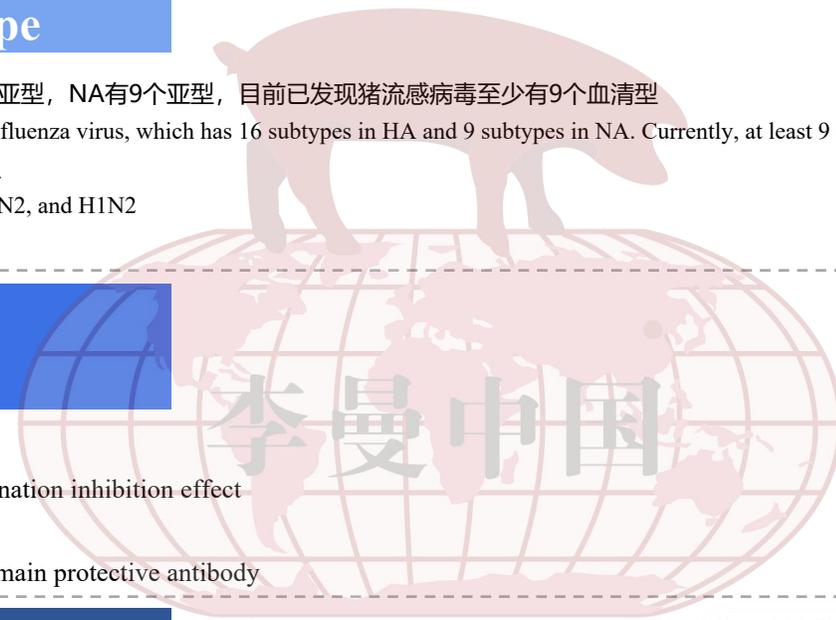
- HA具有免疫原性，有血凝抑制作用
- HA has immunogenicity and hemagglutination inhibition effect
- 产生中和抗体，是主要的保护抗体
- Producing neutralizing antibodies is the main protective antibody



### 流行情况

#### Prevalence

- 世界范围内主要流行H1N1/H3N2/H1N2
- H1N1/H3N2/H1N2 are prevalent worldwide
- 我国以H1N1流行为主，H3N2流行为辅，H1N2检出率低
- In our country, H1N1 is the predominant strain, with H3N2 as a secondary one, and the detection rate of H1N2 is low
- 即使都属H1N1亚型，不同谱系和同一谱系的不同毒株交叉保护不同 (CS H1N1, EA H1N1, pdm/09H1N1)
- Even though they all belong to the H1N1 subtype, different lineages and different strains within the same lineage provide varying degrees of cross-protection (CS H1N1, EA H1N1, pdm/09H1N1)

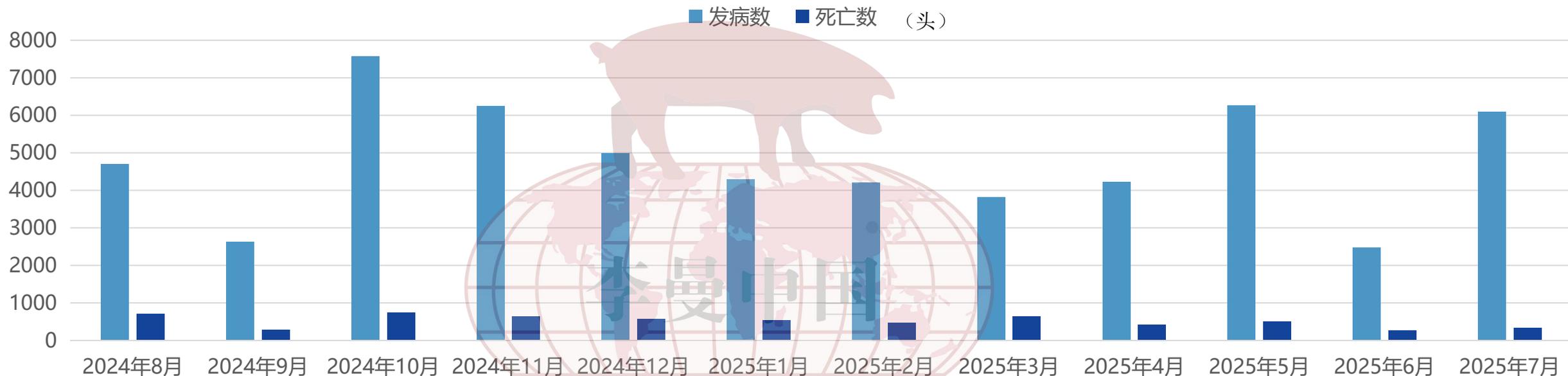


# 猪流感流行现状 (农业农村部数据)

Current situation of swine influenza epidemic (data from the Ministry of Agriculture and Rural Affairs)



## 2024年8-2025年7月全国动物发病报告 (猪流感)

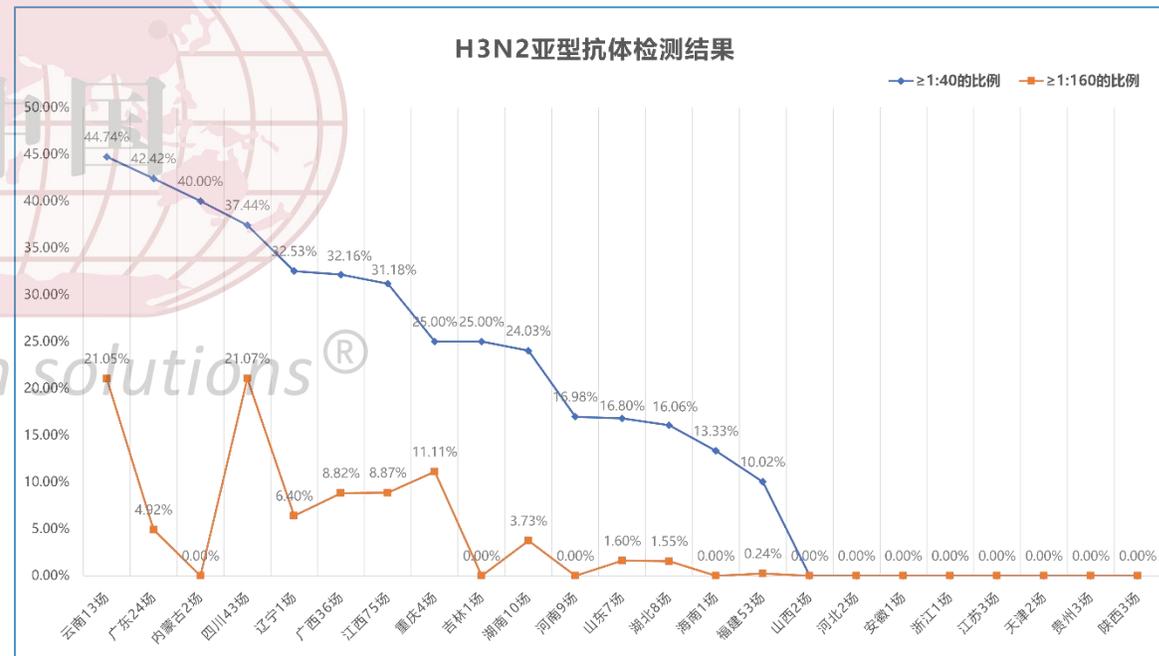
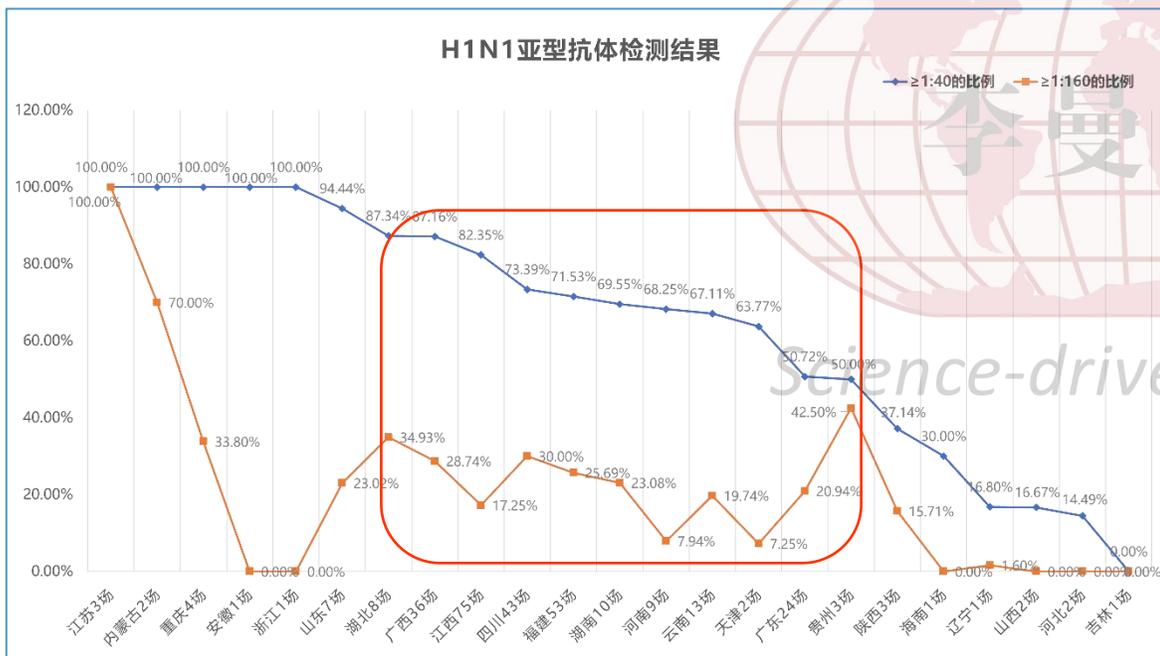


	2024年8月	2024年9月	2024年10月	2024年11月	2024年12月	2025年1月	2025年2月	2025年3月	2025年4月	2025年5月	2025年6月	2025年7月
■ 发病数	4702	2618	7572	6250	4993	4287	4199	3808	4228	6256	2476	6086
■ 死亡数	706	286	732	630	561	542	461	643	420	502	266	324

# 2025年1-6月猪流感H1N1亚型抗体阳性率监测

## Surveillance of antibody positivity rate against H1N1 subtype of swine influenza from January to June 2025

- 1-6月共收集了23省304个猪场4398份血清样本，H1N1亚型样本平均抗体阳性率68.24%；H3N2亚型样本平均抗体阳性率27.19%（HI:血凝抑制抗体）
- A total of 4398 serum samples were collected from 304 pig farms in 23 provinces from January to June, with an average antibody positivity rate of 68.24% for H1N1 subtype samples; The average antibody positivity rate of H3N2 subtype samples is 27.19% (HI: hemagglutination inhibitory antibody)
- 1-6月共收集了14省51个猪场1317份鼻拭子，H1亚型抗原平均阳性率20.58%，H3亚型抗原平均阳性率17.26%（RT-PCR分型试剂盒）
- A total of 1317 nasal swabs were collected from 51 pig farms in 14 provinces from January to June, with an average positive rate of 20.58% for H1 subtype antigen and 17.26% for H3 subtype antigen (RT-PCR typing kit)



判定标准：HI抗体效价≥1:40判定为阳性

（数据来源：华威特生物检测中心）

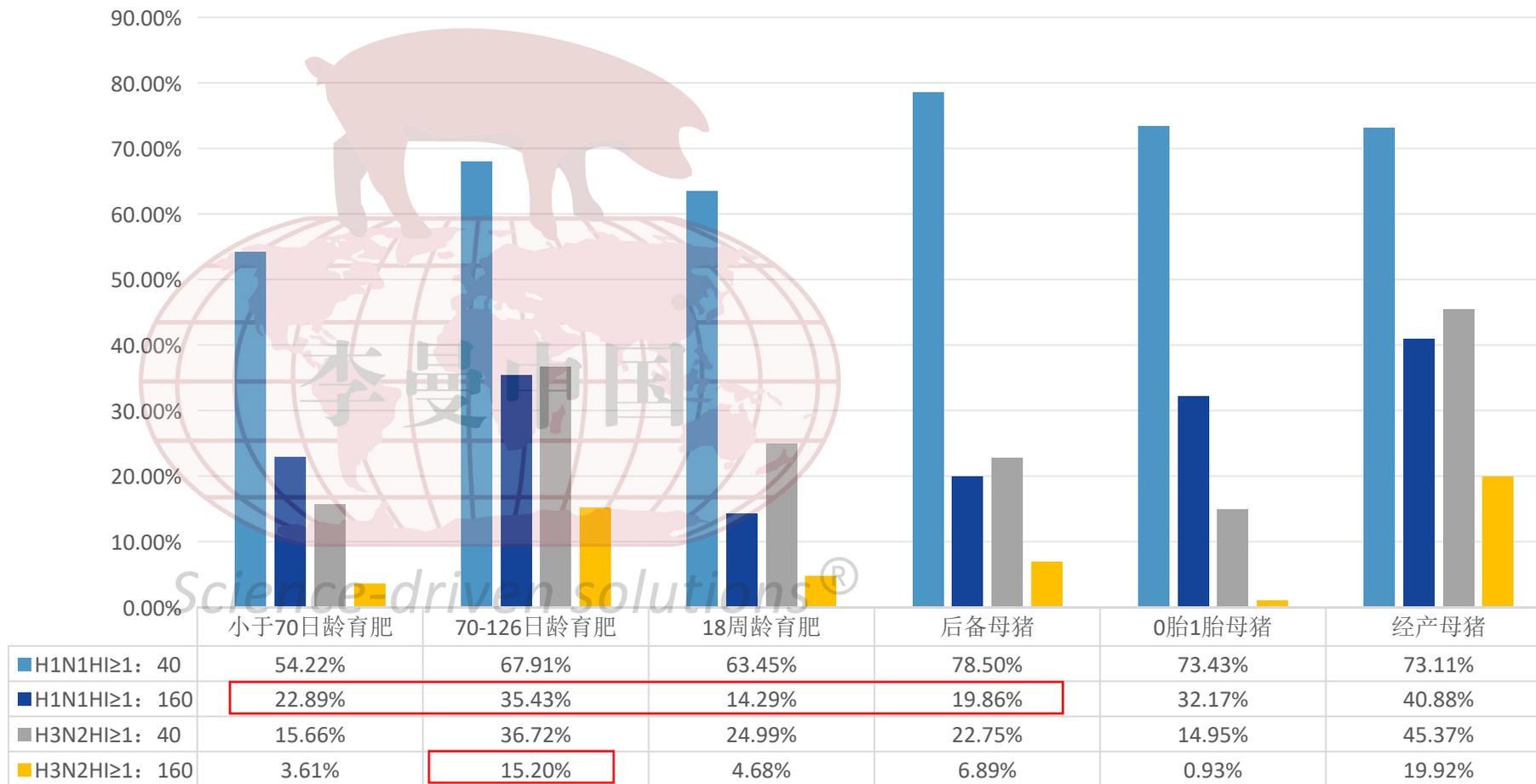
# 1-6月不同猪群的猪流感抗体监测结果

## Monitoring results of swine influenza antibodies in different pig herds from January to June

### 不同猪群抗体结果

育肥猪70日龄以上猪流调感染率超过60%，H1亚型抗体的高亢比例在36.66%（70-126日龄），特别是规模较大的育肥场（>1万头）、聚落式育肥场、楼房式育肥场、自繁自养场以及放养密集区域的育肥场感染压力较大，表现在保育中后期的循环和育肥中前的感染压力，多和蓝耳等混感。

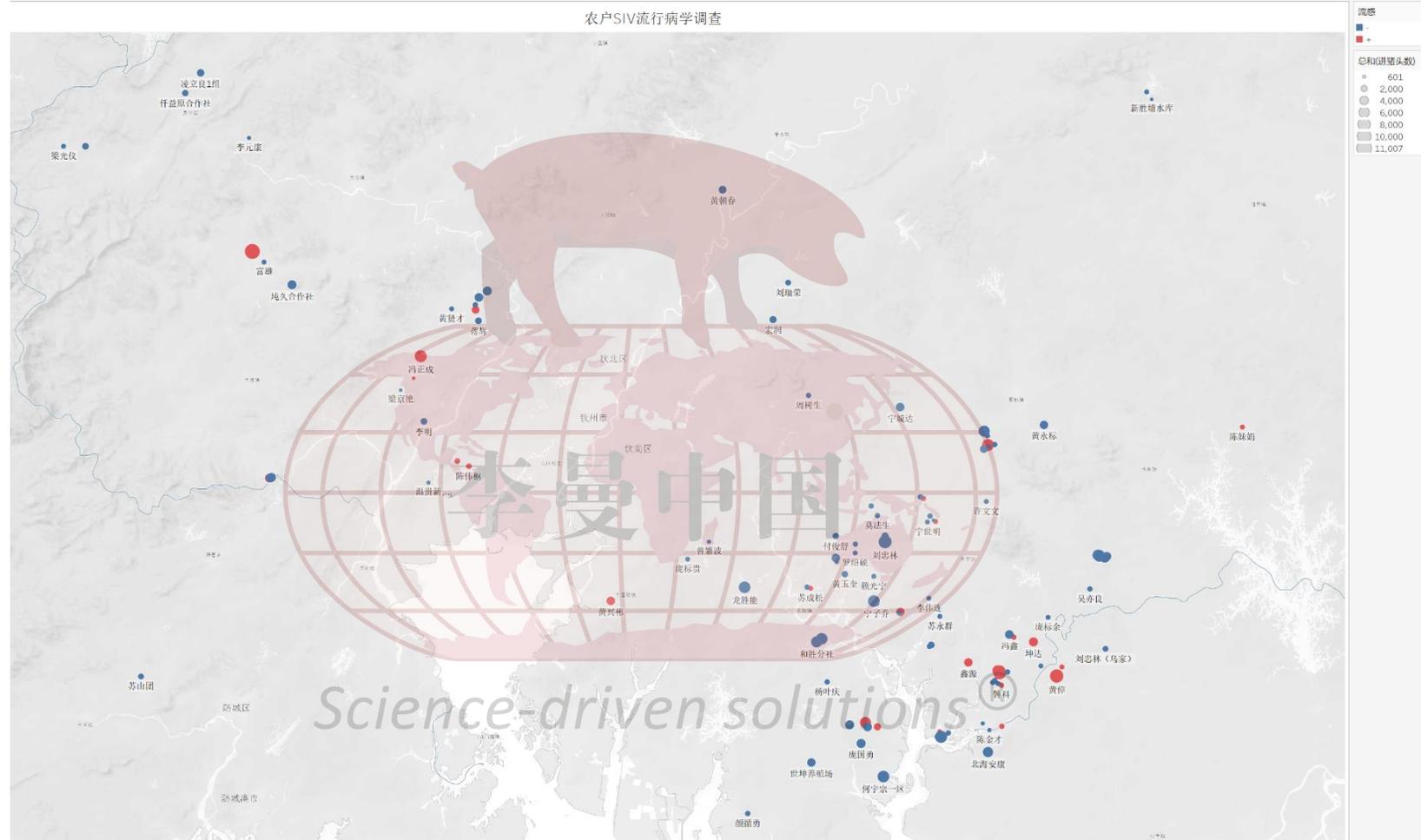
The infection rate of pigs over 70 days old in the field of pig breeding exceeds 60%, and the proportion of high levels of H1 subtype antibodies is 36.66% (70-126 days old), especially in large-scale fattening farms (>10000 heads), settlement style fattening farms, building style fattening farms, self breeding and self raising farms, and fattening farms in areas with high stocking density. This is manifested in the cyclic infection pressure in the later stage of conservation and the infection pressure before fattening, often mixed with infections such as PRRS.



(数据来源：华威特生物检测中心)

# 某集团养户2025年1-6月猪流感抗原检测情况

Pig influenza antigen testing status of a group's farmers from January to June 2025



2025年1-6月农户SIV检测情况

	1月	2月	3月	4月	5月	6月
检测数量	14	34	66	39	23	15
阳性数量	5	16	18	19	6	4
检出率	35.7%	47.1%	27.3%	48.7%	26.1%	26.7%

# 猪流感的流行现状小结

## Summary of the Current Epidemic Situation of Porcine Influenza



- 根据农业农村部全国主要疫病公布数据：猪流感近十年的检出率已经跻身至病原检出数量**前十位**，且呈逐年上升趋势；
  - 血清学和病原学调查表明：H1和H3亚型猪流感在我国普遍存在，H1N1流行为主，H3N2为辅，**H1N2**区域流行，某些区域或聚落呈循环流行的现象；
  - 不同猪群调查表明：母猪抗体阳性率 > (后备) 中大猪 > 断奶 (保育) 产房仔猪；
  - 中前期育肥、后备和低胎龄母猪猪群易感：批次化放养育肥群 (低于5000头) 感染率平均30%左右 (区域流行偏高)，在特定模式下的大体量的育肥群体，保育中后期和育肥前期持续性循环感染，感染率更高 (受易感猪群进群，密度，人员等因素影响)；
  - 地域流行调查表明：不同地区均有不同程度感染，第四季度和第一季度略高于其他季节。
- 
- According to the data released by the Ministry of Agriculture and Rural Affairs on major national diseases, the detection rate of swine influenza in the past decade has ranked among the top ten in terms of the number of detected pathogens, and is showing an upward trend year by year;
  - Serological and pathogenic investigations have shown that H1 and H3 subtypes of swine influenza are widely present in China, with H1N1 as the main epidemic and H3N2 as a secondary epidemic. H1N2 is prevalent in certain regions or settlements, and there is a cyclic epidemic phenomenon in some areas or settlements;
  - A survey of different pig herds shows that the positive rate of antibodies in sows is higher than that in reserve medium and large pigs, and higher than that in weaned piglets in the nursery;
  - Susceptibility of early to mid stage fattening, gilt, and low gestational age female pig populations: The average infection rate of batch based fattening populations (less than 5000 heads) is around 30% (regional prevalence is higher), and in large-scale fattening populations under specific patterns, the infection rate is higher due to persistent cyclic infections in the middle to late stages of conservation and early fattening (influenced by factors such as susceptible pig populations entering the herd, density, personnel, etc.);
  - Regional prevalence surveys indicate that different regions have varying degrees of infection, with slightly higher rates in the fourth and first quarters compared to other seasons.

# 猪流感对猪群的危害

## The harm of swine flu to swine herds



(肺脏“鲜牛肉样”实变)  
(Lung consolidation resembling "fresh beef")



### 猪流感

呼吸道上皮  
管壁受损伤



细菌性疾病继发  
或混合感染

支原体

病毒性疾病继发  
或混合感染

传胸

副猪

链球

杆菌  
巴氏

蓝耳

圆环

伪狂

FMD

腹泻

感染协同/免疫抑制

Infection synergy/immunosuppression

- 呼吸道道原发病之一，造成低胎龄的妊娠母猪散发流产的风险；易继发感染导致增加用药成本、增加死淘率，拖延猪的上市时间，料肉比上升：育肥猪爆发一次的损失约50-70元/头，欧洲报道约7英镑；
- One of the primary respiratory diseases, it poses a risk of sporadic abortion in pregnant sows with low gestational age; it is prone to secondary infections, leading to increased medication costs, higher mortality rates, delayed market entry of pigs, and an increased feed-to-meat ratio: the loss for each outbreak in fattening pigs is approximately 50-70 yuan per head, with reports in Europe indicating a loss of about 7 pounds;

# 某新建扩繁场低胎龄母猪发生猪流感导致流产

A low parity sow in a newly built breeding farm experienced a miscarriage due to swine flu



样品编号	H1N1 2401 株	结果判定	H3N2 2309 株	结果判定
爱华一场 30660	1:20	可疑	1:10	阴性
爱华二场 1	1:320	阳性	1:80	阳性
爱华二场 2	1:1280	阳性	1:160	阳性
爱华二场 3	1:80	阳性	1:320	阳性
爱华二场 4	1:1280	阳性	1:80	阳性
爱华二场 5	1:640	阳性	1:80	阳性
爱华二场 6	1:320	阳性	1:160	阳性
爱华二场 7	1:1280	阳性	1:1280	阳性
爱华二场 8	1:640	阳性	1:80	阳性
爱华二场 9	1:320	阳性	1:160	阳性
爱华二场 10	1:40	阳性	1:80	阳性

- 感染期间共计流产79头，妊娠1舍72头，妊娠2舍7头：流产猪只咽拭子、流产物检测非瘟、蓝耳、猪瘟、细小、乙脑、伪狂犬、衣原体抗原检测均为阴性。
- During the infection period, a total of 79 pigs aborted, 72 in gestation shed 1, and 7 in gestation shed 2. The throat swabs and abortion products of the aborted pigs tested negative for African swine fever, PRRS disease, hog cholera, parvovirus, Japanese encephalitis, pseudorabies, and chlamydia antigen.

## 三、抗原检测结果统计及分析

样品编号	FAM 通道 (SIV-H1)	结果判定	FAM 通道 (SIV-H3)	结果判定
爱华一场 1-3 合样 <sup>®</sup>	NoCt	SIV-H1 阴性	25.23	SIV-H3 阳性
爱华一场 4-7 合样	NoCt	SIV-H1 阴性	23.44	SIV-H3 阳性
爱华一场 8-11 合样	NoCt	SIV-H1 阴性	30.25	SIV-H3 阳性
爱华二场 1-3 合样	NoCt	SIV-H1 阴性	NoCt	SIV-H3 阴性
爱华二场 4-6 合样	NoCt	SIV-H1 阴性	NoCt	SIV-H3 阴性
爱华二场 7-10 合样	NoCt	SIV-H1 阴性	NoCt	SIV-H3 阴性

# 产房和保育期猪流感的感染和诊断 (聚落式)

## Infection and diagnosis of swine influenza in farrowing houses and during the nursery period (clustered)

- 背景: 2024年1月上旬 (先育肥猪场感染, 后产房)
- Background: Early January 2024 (first infected in the fattening pig farm, then in the delivery room)

猪场 Pig farm	临床表现 Clinical manifestations	剖检病变 Dissecting lesions	检测情况 Test Results
母猪场 Sow farm	<p>产房仔猪9-20日龄咳嗽比例高 从第4批次断奶仔猪开始出现咳嗽症状</p> <p><u>The proportion of coughing in newborn piglets aged 9-20 days in the delivery room is high</u></p> <p>Coughing symptoms began to appear in the weaned piglets from the fourth batch</p>	15日龄仔猪肺部实变 Lung consolidation in 15-day-old piglets	抗体检测Antibody test
<p>育肥场: 每批次断奶后 10-15 天出现咳症状 Fattening farm: Coughing symptoms appear 10-15 days after weaning in each batch</p>			
育肥2场 Fattening farm no.2	<p>咳嗽集中在6-9周龄猪群, 咳嗽比例几乎100%, 持续10-15天</p> <p><u>The coughing is concentrated in the 6-9 week-old pig herd,</u></p> <p>The coughing rate is almost 100%, lasting for 10-15 days</p>	/	抗原和抗体检测Antigen and antibody detection
育肥 1-5-6-8场 Fattening farm no.1-5-6-8	<p>断奶仔猪均存在不同程度呼吸道问题</p> <p>Weaned piglets all have varying degrees of respiratory problems</p>	/	

# 产房及保育猪鼻拭子抗原检测结果

## Antigen test results of nasal swabs from farrowing rooms and nursing pigs

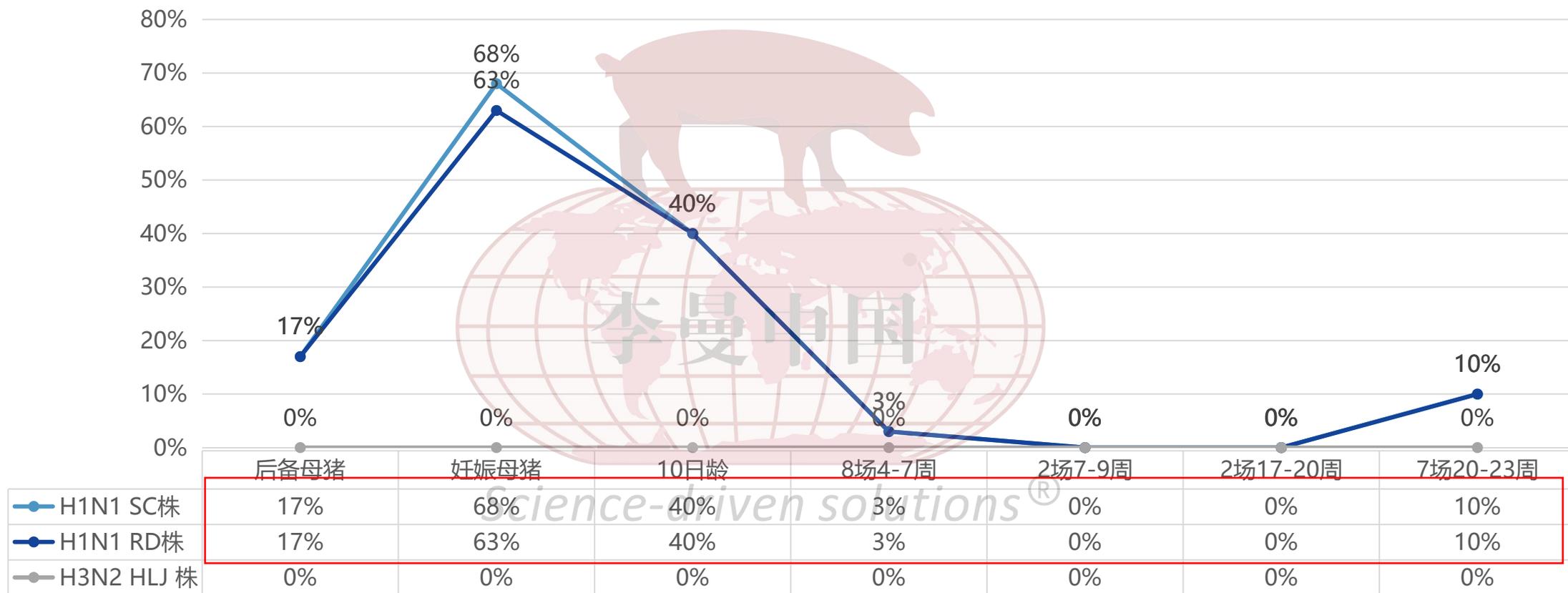


日龄	原始编号	试验编号	H1亚型CT值	H3亚型CT值
3周	B4-7-14	1	32.775	无
	B4-8-15			
	B4-10-16			
	B4-11-17	2	26.428	32.472
	B4-12-18			
	B4-14-20			
	B4-13-19	3	28.408	无
	B4-1-11			
	B4-2-12			
B4-6-13	4周	4	36.824 (假阳)	无
B1-1-1				
B1-2-2				
B1-3-3		5	32.023	29.458
B1-4-4				
B1-5-5				
B1-6-6		6	29.014	无
B1-7-7				
B1-8-8				
B1-12-10	5周	7	28.321	无
B1-11-9				
21				
22		8	28.808	30.008
23				
24				
25		9	29.598	无
26				
27				
28	阴性	无	无	
29				
30	阳性	23.679	23.678	

# 不同猪群猪流感保护性抗体检测结果

Test results of protective antibodies against swine influenza in different pig populations

## 不同猪场不同生长阶段抗体保护率检测结果



感染后阳性率高但保护抗体合格率低（妊娠母猪除外），故产房和保育检出率高

The post-infection positive rate is high, but the qualified rate of protective antibodies is low (excluding pregnant sows), leading to a high detection rate in farrowing rooms and nurseries

判定标准：HI抗体效价  $\geq 1:160$  判为保护

Judgment criteria: HI antibody titer  $\geq 1:160$  is considered as protection

# 猪流感发生后易混合感染其他疾病

After the occurrence of swine flu, it is easy to mix and infect other diseases

- 7-9周龄：出现咳嗽持续10-15天，累计采食量影响10天
- 7-9 weeks of age: Cough persists for 10-15 days, with a cumulative impact on feed intake for 10 day

样品说明	样品类型	蓝耳		副猪		圆环2型		圆环3型		巴氏杆菌		猪流感		支原体		链球菌	
		CT值	结果														
样品1	拭子	36.81	阳性	24.34	阳性	37.83	阳性	None	阴性	28.93	阳性	28.77	阳性	None	阴性	28.96	阳性
样品2	拭子	37.86	阳性	25	阳性	None	阴性	32.55	阳性	36.58	阳性	29.05	阳性	None	阴性	27.47	阳性
样品3	拭子	28.01	阳性	23.79	阳性	None	阴性	33.51	阳性	29.94	阳性	27.4	阳性	None	阴性	26.87	阳性
样品4	拭子	None	阴性	27.31	阳性	33.44	阳性	None	阴性	None	阴性	22.62	阳性	None	阴性	27	阳性
样品5	拭子	33.54	阳性	22.96	阳性	35.35	阳性	None	阴性	None	阴性	22.7	阳性	None	阴性	27.4	阳性
样品6	拭子	37.73	阳性	22.16	阳性	28.05	阳性	None	阴性	None	阴性	22.77	阳性	None	阴性	25.69	阳性
样品7	拭子	None	阴性	27.19	阳性	24.39	阳性	32.17	阳性	30.04	阳性	27.7	阳性	None	阴性	30.86	阳性
合计		7		7		7		7		7		7		7		7	
阴性对照1		None	成立														
阴性对照1		19.95	成立	23.95	成立	17.99	成立	28.93	成立	30.04	成立	26.36	成立	28.98	成立	23.05	成立

# 产房到育肥猪流感的感染和诊断 (楼房式)

## Infection and diagnosis of influenza in farrowing to finishing pigs (Building type)



猪场 Pig farm	临床表现 clinical manifestations	检测情况 Test Results	备注 Remarks
1场	<p>(1) 母猪: 正常 (2) 保育仔猪: 40天开始出现呼吸道症状, 50日龄左右开始出现猪只伤亡, 死亡率2.7%。</p> <p>(1) Sow: Normal (2) Nursery pigs: Respiratory symptoms began to appear at 40 days old, and casualties among pigs began to occur around 50 days old, with a mortality rate of 2.7%.</p>	<p><b>抗体检测结果:</b> (1) 母猪抗体平均阳性率91%, 入群的后备、妊娠50日龄、妊娠90日龄和产房母猪阳性率分别为100.00%、86.67、100.00%和83.33%;</p> <p><b>抗原检测结果:</b> 自检猪流感抗原检测后备母猪及育肥猪咽拭子阳性, CT值34-38。华威特检测中心: <b>抗原阳性</b>, CT值24-33</p> <p><b>Antibody test results:</b> (1) The average positive rate of antibodies in sows is 91%. The positive rates of sows in the herd, at 50 days of gestation, at 90 days of gestation, and in the farrowing house are 100.00%, 86.67%, 100.00%, and 83.33%, respectively;</p> <p><b>Antigen test result:</b> The self-inspection of swab samples from gilts and fattening pigs for swine influenza antigen testing yielded positive results, with CT values ranging from 34 to 38. The Huawei Testing Center reported antigen positivity, with CT values ranging from 24 to 33</p>	蓝耳阳性场
2场	<p>(1) 保育40日龄开始出现呼吸道问题, 有明显流鼻涕、扎堆发烧减料现象; (2) 50-120日龄开始死淘, 死亡率每天约0.1%。</p> <p>(1) Respiratory problems began to emerge in the nursery birds at 40 days of age, with obvious symptoms such as runny nose, clustering, fever, and reduced feed intake; (2) Mortality begins to occur from 50 to 120 days of age, with a mortality rate of approximately 0.1% per day.</p>	<p><b>抗原检测结果:</b> 母猪及产房至60日龄商品猪都能检测到猪流感抗原阳性; 死亡保育猪和配怀舍母猪鼻拭子均有CT值检出: 抗原阳性。</p> <p><b>Antigen test result:</b> Sow and commercial pigs from the farrowing house to 60 days old can all be tested positive for swine influenza antigen; Nasal swabs from both dead nursery pigs and sows in the mating and gestation sheds tested positive for CT values: antigen positive.</p>	蓝耳阳性场

# 大型育肥场/自繁自养育肥猪场猪流感的循环感染

## Circulating infection of swine influenza in large-scale fattening farms/self breeding and self raising fattening pig farms



- 福建某18000头育肥场，从两个母猪场进断奶猪育肥，该场**育肥前期**呼吸道问题严重，中大猪出现死淘；抗原检测有蓝耳、传胸和支原体感染，**HI检测猪流感从93日龄开始转为强阳性。**
- A 18000 head fattening farm in Fujian province, where weaned pigs were fattened from two sow farms. During the early stages of fattening, the farm had severe respiratory problems, resulting in the death of medium and large pigs; Antigen testing includes PRRS, chest transmission, and mycoplasma infection, while HI testing for swine influenza turns strong positive from 93 days of age.
- 广东某集团一**自繁自养**场，育肥猪12头，固定样品个体，从49日龄起+30天采集一次，79、109、139、169日龄共计5次集中流调监测结果：阳性率和抗体值逐步升高，167日龄全部转阳，超过160；推测在79-109日龄之间流感病毒感染；结合临床90-100日龄开始的**反复和持续性呼吸道问题**，诊断有流感参与。
- A self breeding and self raising farm of a certain group in Guangdong, with 12 fattening pigs and fixed sample individuals, collected once every 30 days from 49 days old. A total of 5 centralized epidemiological monitoring results were conducted at 79, 109, 139, and 169 days old: the positive rate and antibody value gradually increased, and all pigs turned positive at 167 days old, exceeding 160; It is speculated that influenza virus infection occurred between 79-109 days of age; Diagnosis of influenza involvement based on recurrent and persistent respiratory problems starting at 90-100 days of clinical age.

猪流感病毒抗体				
检测项目	样品总数	阳性份数	阳性率	
SIV-H1N1 2401 株	23	23	100.00%	
SIV-H3N2 2309 株	23	3	13.04%	
样品编号	H1N1 2401 株	结果判定	H3N2 2309 株	结果判定
1-1 / 148日龄	1:160	阳性	1:20	可疑
2-1 / 1-2 93日龄	1:160	阳性	1:10	阴性
4-1-1	1:320	阳性	1:20	可疑
4-1-2	1:160	阳性	1:20	可疑
4-1-3	1:160	阳性	1:10	阴性
4-3-1	1:320	阳性	1:10	阴性
4-3-2	1:320	阳性	1:40	阳性

日龄阶段	H1N1 2401株		H3N2 2309株	
	>1:40比例	>1:160比例	>1:40比例	>1:160比例
49日龄	41.67%	0.00%	0.00%	0.00%
79日龄	50.00%	0.00%	0.00%	0.00%
109日龄	100.00%	25.00%	0.00%	0.00%
139日龄	83.33%	25.00%	0.00%	0.00%
169日龄	100.00%	91.67%	0.00%	0.00%

11-1	1:80	阳性	1:20	可疑
11-2	1:40	阳性	1:40	阳性
11-3	1:80	阳性	1:20	可疑
11-4	1:40	阳性	1:160	阳性

# 猪流感的防控策略

## Prevention and control strategies for swine influenza

自1918年以来，60%以上的猪流感病毒进化分支起源于人类病毒  
Since 1918, over 60% of the evolutionary branches of swine influenza viruses have originated from human viruses

### 生物安全

气溶胶  
(空气过滤系统?)

人-猪传播  
(人员管控?)

### 管理保健

季节变化  
加强管理

提高抵抗力和  
药物治疗

### 疫苗免疫

流调  
检测

流行  
毒株

# 空滤系统对猪流感病毒的过滤效果

## Filtration effect of air filtration system on swine influenza virus



表2: 不同粒径范围和空气采样器的RT-PCR结果和病毒分离结果。来自急性感染猪的流感病毒和PRRSV的RT-PCR (逆转录聚合酶链反应) 和病毒分离阳性样本, 以及生物检定法检测的PEDV阳性样本。结果用不同粒径范围 (安德森级联冲击器采样) 分类呈现。

病毒		安德森级联冲击器采样(粒径范围, 微米)								样本数总计	气旋采样器总计
		0.4-0.7	1.1-0.7	1.1-2.1	2.1-3.3	3.3-4.7	4.7-5.8	5.8-9.0	9.0-10.0		
猪流感	1PCR	*6/15 (40.0%)	3/15 (20.0%)	5/15 (33.3%)	6/15 (40.0%)	12/15 (80.0%)	12/15 (80.0%)	13/15 (86.7%)	13/15 (86.7%)	70/20 (58.8%)	14/15 (93.3%)
	2VI	0/6	0/3	0/5	1/6 (16.7%)	1/12 (8.33%)	6/12 (50%)	4/13 (30.8%)	8/13 (61.5%)	20/70 (28.6%)	5/14 (35.7%)
PRRSV	PCR	1/34 (2.9%)	0/34	0/34	1/34 (2.9%)	2/34 (5.9%)	1/34 (2.9%)	2/34 (5.9%)	7/34 (20.6%)	14/272 (5.1%)	8/34 (23.5%)
	VI	0/1	0	0	1/1 (100%)	2/2 (100%)	1/1 (100%)	0/2 (0%)	7/7 (100%)	11/13 (84.6%)	6/8 (75%)
PEDV	PCR	6/6 (100%)	6/6 (100%)	6/6 (100%)	6/6 (100%)	6/6 (100%)	6/6 (100%)	6/6 (100%)	6/6 (100%)	48/48 (100%)	6/6 (100%)
	生物鉴定法	#NA	NA	NA	NA	NA	NA	NA	NA	NA	Δ3/3 (100%)

1PCR: 逆转录聚合酶链反应检测结果 (包括CT值低于40的样本)。

2VI: 病原分离的结果。

\*阳性样本占检测的总样本数的比例 (%)。

#NA: 不适用。

Δ用RT-PCR 阳性空气样本接种易感猪以进行生物鉴定法检测。

# 人流感病毒对猪群的传播及影响



## 1、 Use of face masks to decrease exposure to swine influenza A virus in swine farm workers

- **总体暴露率:** 832份样本中, 9.50% (79份) 检测到IAV, 工作后样本阳性率 (12.26%) 显著高于工作前 (6.73%) 。
- ✓ **无口罩组:** IAV检测率最高 (24.27%), 显著高于所有戴口罩组 ( $P < 0.001$ ) ;
- ✓ **戴口罩组:** N95口罩组: 5.77%阳性率; 防尘口罩组: 8.33%阳性率; 外科口罩组: 10.89%阳性率;

## 2、 Detections of human seasonal H3N2 influenza A virus reverse-zoonoses in swine during the 2022-2024 influenza season

- 监测2022-2024年人类季节性H3N2流感病毒 (IAV) 向猪群的逆向传播
- **研究结果:**
- **基因特征与传播动态 NA基因来源:** 11例源自人类季节性H3N2谱系, 其余与猪流感病毒NA谱系相关;
- **系统发育证据:** 至少8次独立人类到猪传播事件, 北卡罗来纳与伊利诺伊州病毒持续传播超12个月。

### 防控策略优化:

- **人群防护:** 养猪场工作人员接种人类季节性流感疫苗, 强化个人防护装备 (如口罩、手套) 使用;
- **猪群免疫:** 开发针对性猪流感疫苗免疫猪群, 减少病毒在猪群中的定殖与重配。

## 1. Use of face masks to reduce exposure to swine influenza A virus among swine farm workers

- **Overall exposure rate:** Among 832 samples, IAV was detected in 9.50% (79 samples), with a significantly higher positive rate in post-work samples (12.26%) compared to pre-work samples (6.73%).
- ✓ **Non-mask group:** The detection rate of IAV was the highest (24.27%), which was significantly higher than that of all mask-wearing groups ( $P < 0.001$ );
- ✓ **Mask-wearing group:** N95 mask group: 5.77% positive rate; dust mask group: 8.33% positive rate; surgical mask group: 10.89% positive rate;

## 2. Detection of human seasonal H3N2 influenza A virus reverse-zoonoses in swine during the 2022-2024 influenza season

- Monitoring the reverse transmission of human seasonal H3N2 influenza virus (IAV) to swine populations from 2022 to 2024
- **Research results:**
- **Genetic characteristics and transmission dynamics:** NA gene origin: 11 cases are derived from the human seasonal H3N2 lineage, while the rest are related to the swine influenza virus NA lineage;
- **Phylogenetic evidence:** There have been at least 8 independent transmission events from humans to pigs, with the virus continuing to spread for over 12 months in North Carolina and Illinois.

### Optimization of prevention and control strategies:

- **Group protection:** Vaccinate pig farm workers against human seasonal influenza and strengthen the use of personal protective equipment (such as masks and gloves);
- **Pig herd immunity:** Develop targeted swine influenza vaccines to immunize pig herds, reducing virus colonization and reassortment within the herd.

# 疫苗免疫是有效的防控手段

## Vaccination is an effective means of prevention and control

(1) 阴性的猪群免疫流感疫苗可将病毒的R0（病毒繁殖指数）从10.66降低至1（Romagosa A等，2011），因此接种猪流感疫苗后可减少猪流感的发生。

(2) 接种疫苗的猪只可**缩短**猪流感病毒感染时间、**降低**肺组织病毒载量、**降低**猪流感病毒重组的风险（蒙特塞拉特·托雷莫雷尔，2022）

(3) 接种疫苗能够降低产房呼吸道发生，降低用药成本和增加日增重（cameron schmitt, 派斯通2025）。

(1) Inoculating a herd of negative pigs with influenza vaccine can reduce the R0 (virus reproduction number) of the virus from 10.66 to 1 (Romagosa A et al., 2011). Therefore, vaccination against swine influenza can decrease the occurrence of swine influenza.

(2) Vaccinated pigs can shorten the duration of swine influenza virus infection, reduce viral load in lung tissues, and lower the risk of swine influenza virus recombination (Montserrat Torremore, 2022)

(3) Vaccination can reduce the incidence of respiratory tract diseases in the production area, lower medication costs, and increase daily weight gain (Cameron Schmitt, Pipestone 2025).

## Vaccines decrease risk of influenza virus reassortment in pigs



# 国内外猪流感疫苗

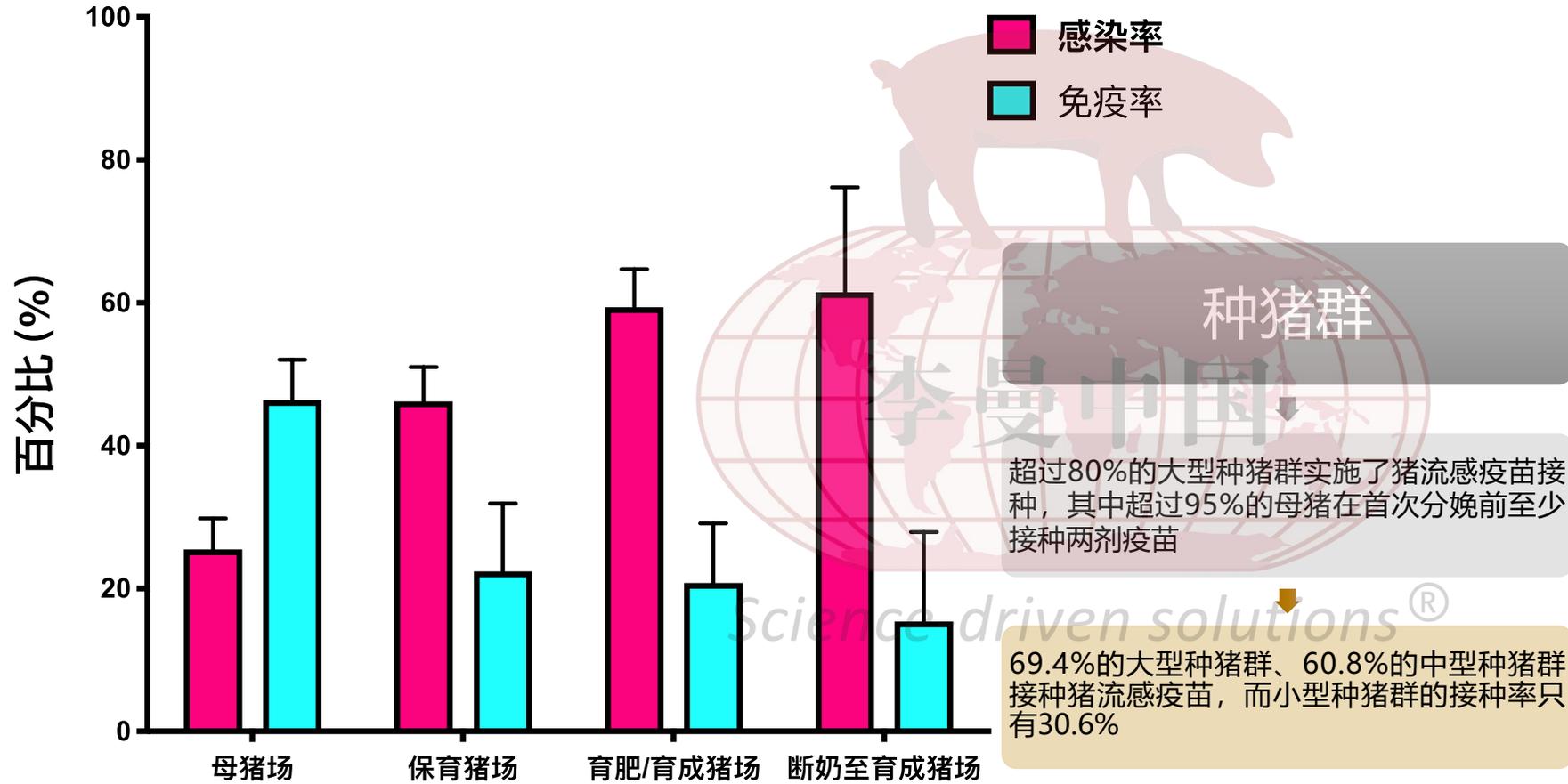
## Swine flu vaccines at home and abroad



生产商	产品	
国外	Swine Influenza Vaccine, H1N1 & H3N2, Killed Virus	
	Swine Influenza Vaccine, H1N1 & H1N2 & H3N2, Killed Virus, Erysipelothrix Rhusiopathiae Bacterin	
	Swine Influenza Vaccine, H1N1 & H1N2 & H3N2, Killed Virus	
	Swine Influenza Vaccine, H1N1 & H1N2 & H3N2, Killed Virus, Mycoplasma Hyopneumoniae Bacterin	
	Elanco US Inc.	Swine Influenza Vaccine, H1N1 & H1N2 & H3N2, Killed Virus
	Intervet Inc.	Swine Influenza Vaccine, N1 & N2, RNA Particle
		Swine Influenza Vaccine, H1, RNA Particle
	Huvepharma, Inc.	Swine Influenza Vaccine, DNA
Medgene Labs	Swine Influenza Vaccine, H3, Killed Baculovirus Vector	

# 美国猪场猪流感感染率和免疫率

Infection and immunization rates of swine influenza in pig farms in the United States



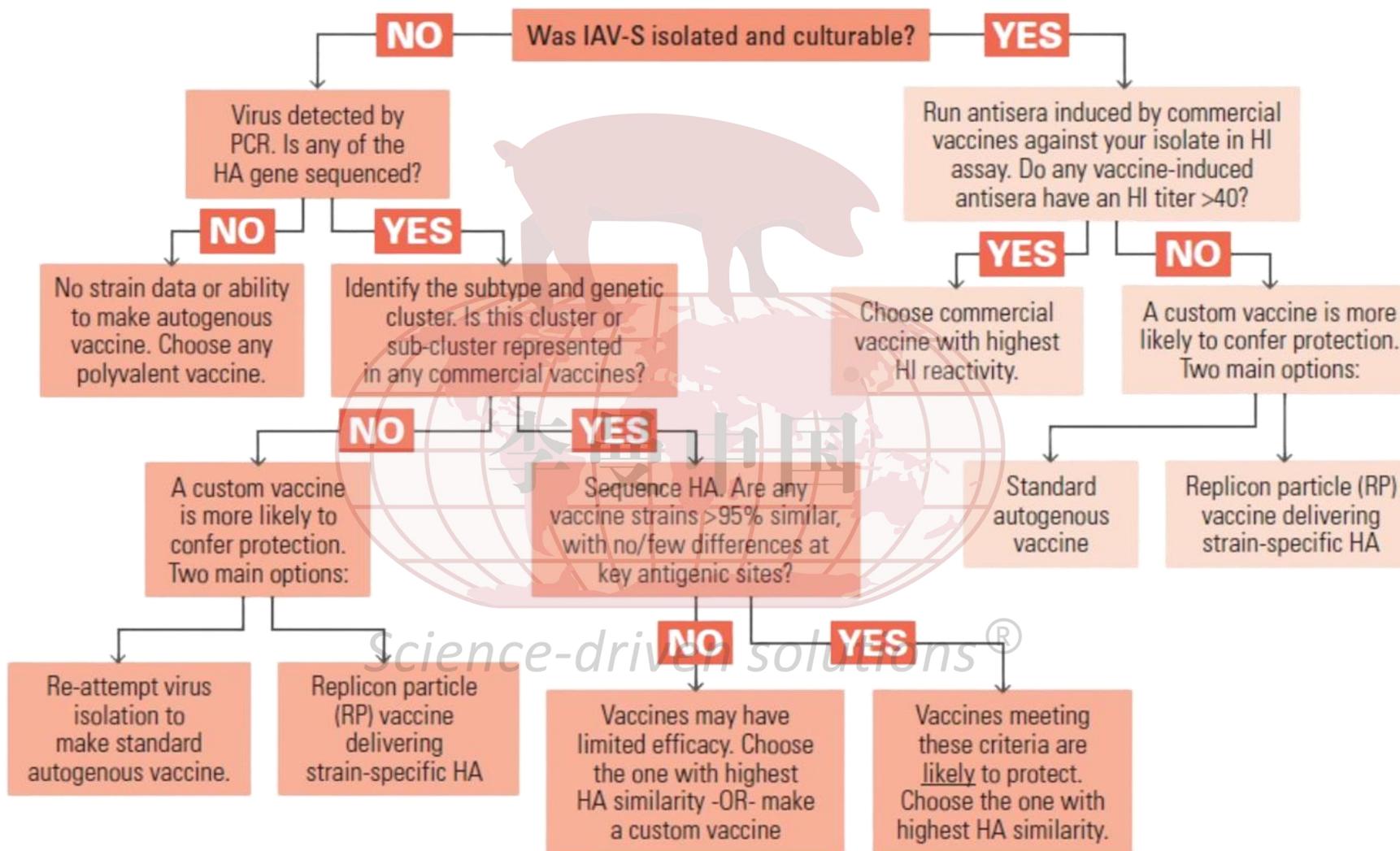
## 育肥群

大型育肥猪场中，**42.4%**的猪场接种H1N1流感疫苗，**41.5%**的猪场接种H3N2流感疫苗；中型育肥猪场中，**39.4%**的猪场接种H1N1流感疫苗，**29.4%**的猪场接种H3N2流感疫苗；

小型育肥猪场中，只有**4.4%**的猪场为猪只接种H1N1流感疫苗，**5.0%**的猪场为猪只接种H3N2流感疫苗

# 猪流感疫苗的选择策略

## Selection strategy of swine influenza vaccine



国际上针对特定猪群的猪流感疫苗选择策略

International strategy for selecting swine influenza vaccines targeting specific pig populations

# 规模化猪场猪流感的防控策略

## Prevention and control strategies for swine influenza in large-scale pig farms



Science driven solutions<sup>®</sup>

**为什么流调/配型?**

**同一亚型不同毒株交叉保护也不同，特别是不同时间段的分离**

**Why is there a flow adjustment/matching model?**

**The cross protection of different strains of the same subtype is also different, especially for isolation at different time periods**

# 规模化猪场猪流感的流调和配型策略

## Flow and matching strategies for swine influenza in large-scale pig farms



疑似发病猪鼻或咽拭子、肺脏或气管分泌物等

### (1) 抗原

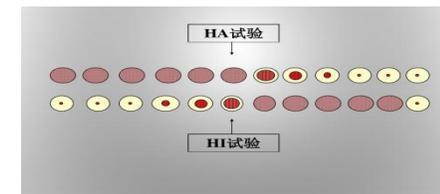
血凝 (HA) ;  
RT-PCR/荧光定量PCR;  
病毒分离-鸡胚或细胞;  
分离毒株鉴定并做HI<sup>®</sup>



华威特检测中心

康复猪或经产母猪、后备猪、中大猪的血清

ELISA;



与流行抗原进行血凝抑制试验 (HI)

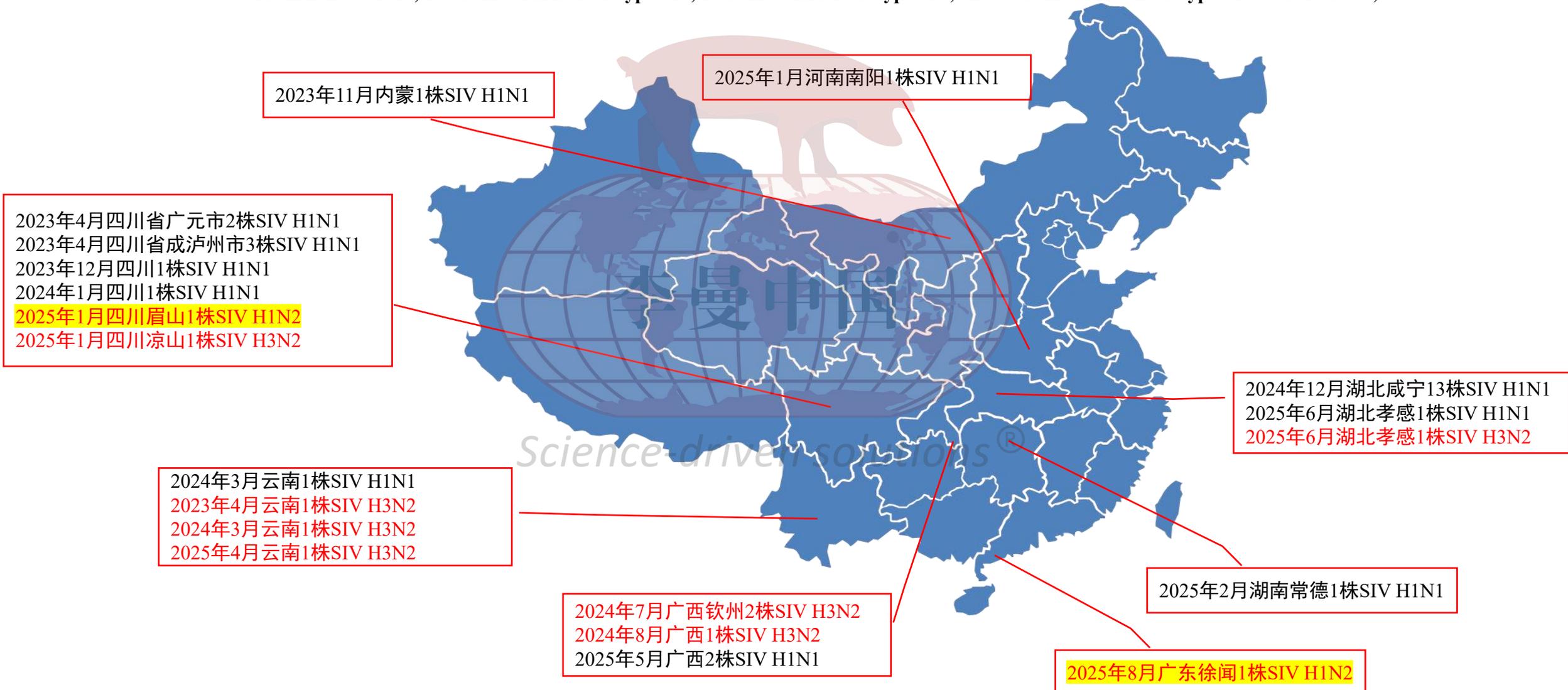
### (2) 抗体



# 2023-2025年猪流感流行毒株分离鉴定

## Isolation and identification of swine influenza epidemic strains from 2023 to 2025

- 2023年-2025年分离出27株H1N1亚型SIV、1株H1N2亚型SIV、8株H3N2亚型SIV;
- From 2023 to 2025, 27 strains of H1N1 subtype SIV, 1 strain of H1N2 subtype SIV, and 8 strains of H3N2 subtype SIV were isolated;



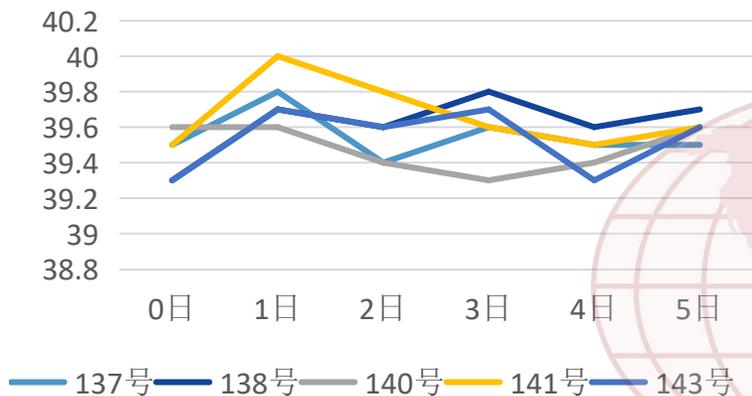
# 猪流感疫苗对分离的流行株攻毒保护

## Porcine influenza vaccine provides protection against isolated epidemic strains



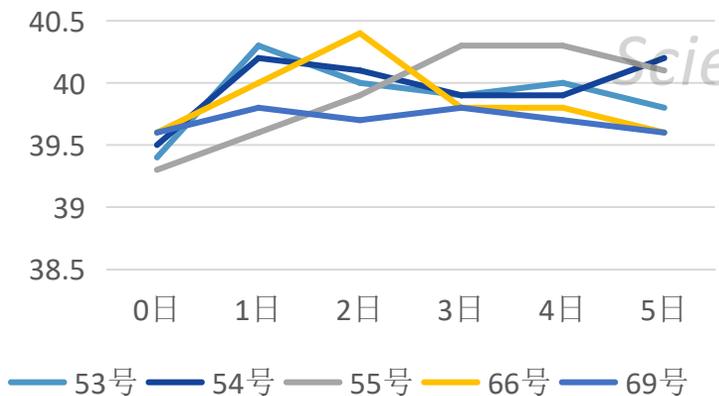
- **免疫程序:** 一免后14日二免, 2.0ml/头, 颈部肌肉注射
- **攻毒试验:** 二免后14日攻毒, 检测指标体温、鼻腔排毒、肺脏病变等。
- **Immunization schedule:** The second immunization is administered 14 days after the first immunization, at a dosage of 2.0 ml per animal, via intramuscular injection into the neck
- **Virulence test:** Challenge with the virus 14 days after the second vaccination, and measure indicators such as body temperature, nasal virus shedding, and lung lesions.

免疫组



动物编号	攻毒后天数		
	3	4	5
137	—	—	—
138	—	—	—
140	—	—	—
141	+	—	—
143	+	—	—

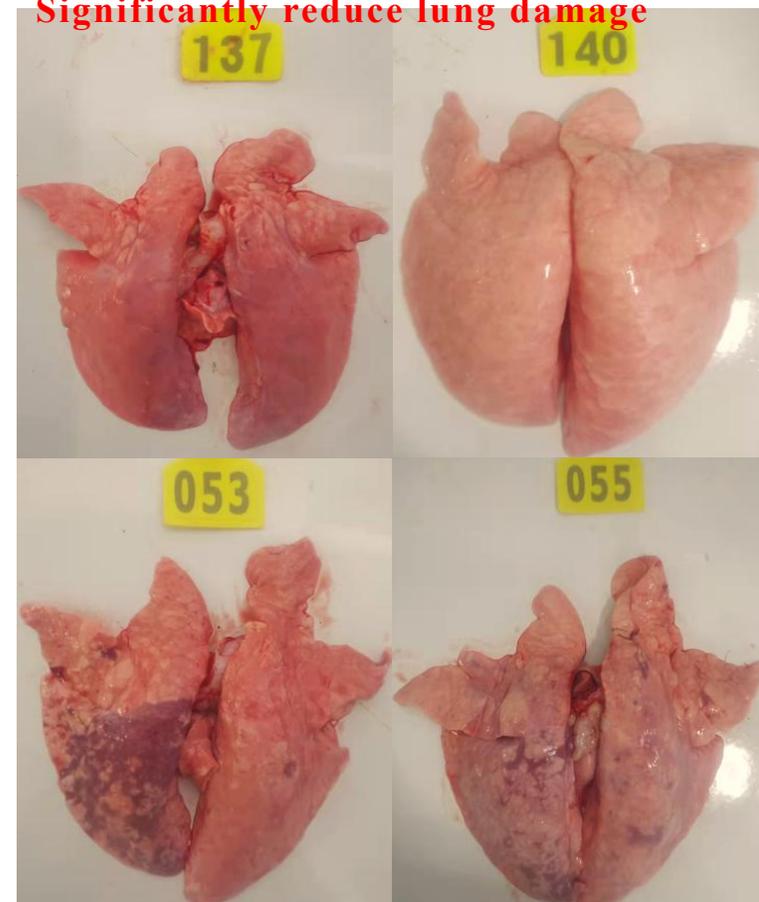
对照组



动物编号	攻毒后天数		
	3	4	5
53	+	+	+
54	+	+	+
55	+	+	+
66	+	+	+
69	+	+	+

显著减少肺脏损伤

Significantly reduce lung damage



# 猪流感二价灭活疫苗——华感健

## Bivalent inactivated swine influenza vaccine - Huaganjian



证书号第 1127162 号



### 发明专利证书

发明名称：猪流感二价灭活疫苗的制备方法及其产品

发明人：武华;路伟

专利号：ZL 2011 1 0091935.1

专利申请日：2011年04月13日

专利权人：华威特（北京）生物科技有限公司  
华威特（江苏）生物制药有限公司

授权公告日：2013年01月23日

本发明经过本局依照中华人民共和国专利法进行审查，决定授予专利权，颁发本证书并在专利登记簿上予以登记。专利权自授权公告之日起生效。

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局长 田力普



第 1 页 (共 1 页)



### 中华人民共和国 新兽药注册证书

证号：(2017)新兽药证字 54 号

新兽药名称：猪流感二价灭活疫苗 (H1N1 LN株+H3N2 HLJ株)

注册分类：三类

研制单位：华威特（北京）生物科技有限公司、华威特（江苏）生物制药有限公司

品有限公司

根据《兽药管理条例》，该兽药符合规定，准予注册，特发此证。

发证日期：二〇一七年十二月四日



国内首创



# 华感健的独特优势

## The unique advantages of Huaganjian



1

国内流行毒株  
Domestic  
epidemic  
strains

- 采用流行的H1N1和H3N2亚型的毒株，每个亚型的HA不低于1:256;
- 二免后4-7d充分产生保护力
- 免疫保护期不低于6个月
- Using the prevalent H1N1 and H3N2 virus strains, the hemagglutination (HA) titer of each subtype is not lower than 1:256;
- Full protective immunity is generated 4-7 days after the second vaccination
- The immune protection period is not less than 6 months

2

传代细胞培  
养  
Subcultured  
cell culture

- 内毒素 < 10EU/ml
- 抗生素零添加
- 批间差异小
- Endotoxin < 10EU/ml
- No added antibiotics
- The inter-batch variability is small

3

进口双相佐剂  
Imported  
biphase  
adjuvant

- 水包油包水剂型
- 好抽易打
- 使用方便
- Oil-in-water-in-oil formulation
- Easy to smoke and easy to hit
- easy to use

4

抗原浓缩纯化  
Antigen  
concentration  
and purification

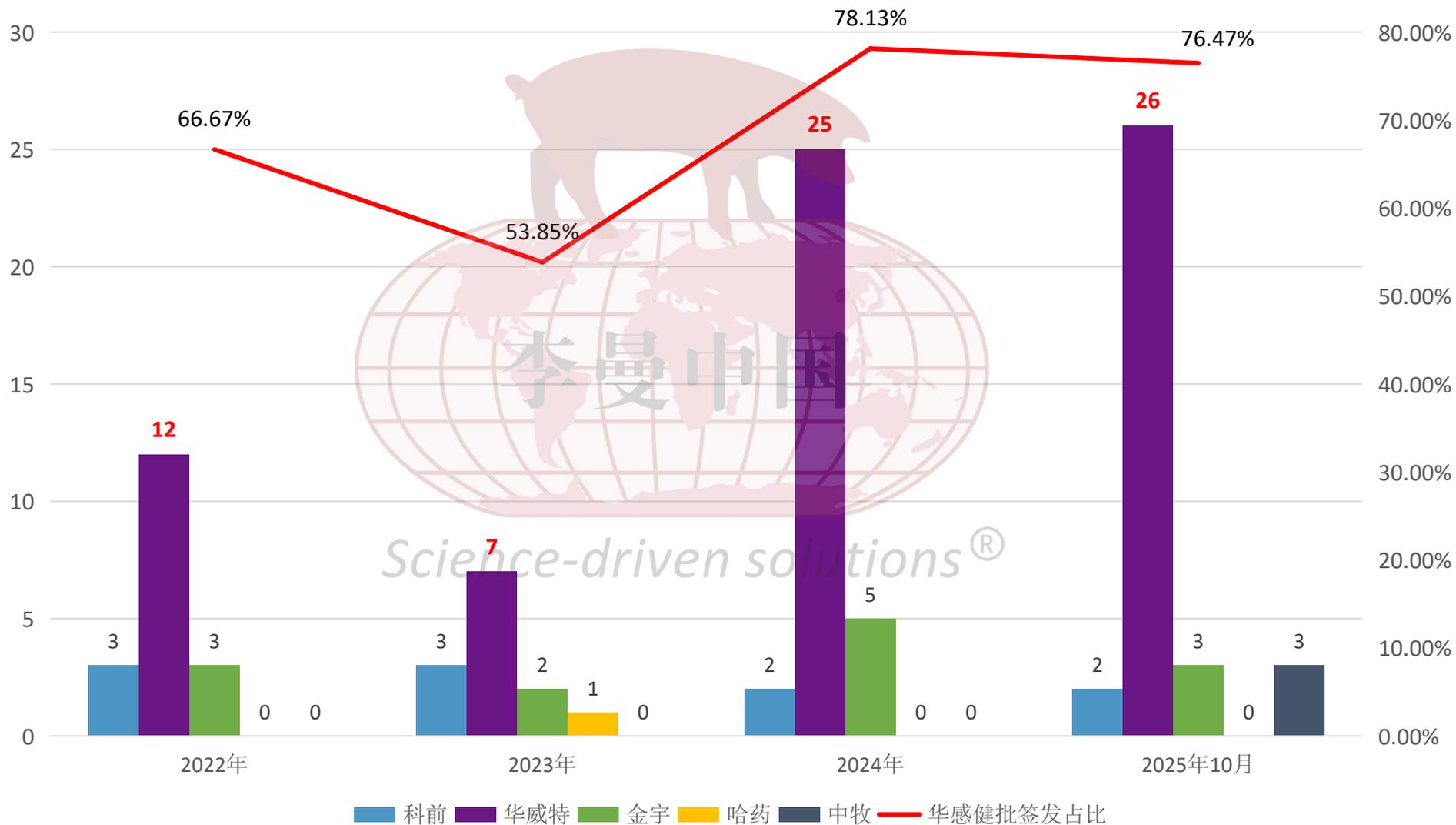
- 异源蛋白少 < 300μg/头份
- 使用更安全
- Heterologous protein content is less than 300μg per aliquot
- Safer to use

# 2022-2025年猪流感疫苗市场批签发情况

Market Batch Issuance Status of Swine Influenza Vaccines from 2022 to 2025



## 2022-2025年10月猪流感疫苗市场批签发情况



# 猪流感疫苗的免疫方案

## Immunization regimen for swine flu vaccine



猪群	免疫程序	防控目标	免疫剂量	评估指标
后备猪	<p>8-10周首免（母猪免疫后测母源抗体），2-3周后二免，配种前1个月加强1次， 入经产母猪群免疫方案同经产母猪</p> <p>The first vaccination is given at 8-10 weeks (after the sow is immunized, maternal antibodies are tested), the second vaccination is given 2-3 weeks later, and a booster is administered one month before mating, The immunization program for sows entering the multiparous herd is the same as that for multiparous sows</p>	<p>呼吸道防控，防入群带毒感染经产母猪</p> <p>Respiratory prevention and control, preventing infection of sows through the introduction of group-carrying viruses</p>	2ml/头/次	<p>抗体监测/抗原监测</p> <p>Antibody monitoring/antigen monitoring</p>
经产母猪	<p>母猪普免或跟胎： (1) 首免2-3周后二免，普免3次/年； (2) 或产前2-4周跟胎免疫1-2次；（母源抗体时间不同）</p> <p>Sow universal vaccination or vaccination according to parity: (1) The second vaccination is given 2-3 weeks after the first vaccination, and general vaccination is given 3 times a year; (2) Or immunize the fetus 1-2 times 2-4 weeks before birth; (maternal antibody duration varies)</p>	<p>防低胎龄妊娠期感染及流产；母源抗体保护产房和保育中前期的感染</p> <p>Prevent infection and miscarriage during low gestational age pregnancy; maternal antibodies protect against infection in the delivery room and early stages of conservation</p>	2ml/头/次	<p>免疫后母猪抗体或者母源抗体</p> <p>Post-immunization sow antibody or maternal antibody</p>
商品猪	<p>母猪免疫后母源抗体保护可持续至8周左右； 建议8-10周龄首免（可测母源确定），2-3周后二免； （优先免疫感染压力大的猪场/高发季节的猪群）</p> <p>The maternal antibody protection provided by sows after immunization can last for about 8 weeks; It is recommended to administer the first vaccination at 8-10 weeks of age (maternal antibody can be tested to confirm), followed by the second vaccination 2-3 weeks later; (Prioritize immunization for pig farms under high infection pressure/pig herds during high-incidence seasons)</p>	<p>防育肥期感染流感，与蓝耳、支原体和传胸易混感或继发感染造成经济损失</p> <p>Preventing influenza infection during the fattening period can lead to economic losses due to easy co-infection or secondary infection with PRRS, Mycoplasma, and contagious pleuropneumonia</p>	2ml/头/次	<p>死淘率、料肉比、用药成本、肺脏损伤等</p> <p>Mortality rate, feed-to-meat ratio, medication cost, lung damage, etc</p>

# 猪流感疫苗免疫效果评估及免疫效益分析

## Evaluation of immune effect and analysis of immune benefit of swine influenza vaccine



# 疫苗免疫对肺脏损伤的影响-试验设计

## The impact of vaccine immunization on lung injury - Experimental design



### ➤ 免疫试验方案 Immunoassay protocol

组别	日龄	疫苗及剂量	日龄	疫苗及剂量	日龄	疫苗及剂量	日龄	疫苗及剂量	日龄	疫苗及剂量
流感+蓝耳	7d	硕腾支原体1头份	14d	流感1头份+蓝耳活苗0.5头份	21d	BI圆环1头份	28d	流感1头份	35d	蓝耳活苗0.5头份
流感		硕腾支原体1头份		流感1头份		BI圆环1头		流感1头份		
蓝耳		硕腾支原体1头份		蓝耳活苗0.5头份		BI圆环1头份				蓝耳活苗0.5头份
对照		硕腾支原体1头份				BI圆环1头份				

免疫数量：约1500头/组/栋；对照组蓝耳和流感均不免疫

Immunization quantity: approximately 1500 heads/group/building;

the control group is not immunized against either PRRS or influenza

# 疫苗免疫对肺脏损伤的影响结果

## The impact of vaccine immunization on lung damage



国外研究表明，通过疫苗的免疫攻毒可显著减少肺脏损伤：

- 1、评价指标：肺组织肺炎病变百分比（计算肺炎减少率：对照组病变率 - 疫苗组病变率 / 对照组病变率）；
- 2、免疫方案：间隔2-3周免疫2次；
- 3、攻毒时间间隔：疫苗接种完成至攻毒间隔10-84天，攻毒至解剖间隔固定4天；
- 4、结论-肺炎减少率：所有疫苗组肺炎病变均显著低于对照组（ $P < 0.003$ ），效果范围为62.5%-99.7%。

（来源：第56届AASV）

Foreign research has shown that immunization through vaccination can significantly reduce lung damage:

1. Evaluation index: Percentage of pneumonia lesions in lung tissue (calculation of pneumonia reduction rate: lesion rate in control group - lesion rate in vaccine group / lesion rate in control group);
2. Immunization schedule: Immunize twice at 2-3 week intervals;
3. Time interval for challenge: The interval between the completion of vaccination and challenge is 10-84 days, and the interval between challenge and dissection is fixed at 4 days;
4. Conclusion - Pneumonia Reduction Rate: The incidence of pneumonia lesions in all vaccine groups was significantly lower than that in the control group ( $P < 0.003$ ), with an efficacy range of 62.5%-99.7%.

(Source: 56th AASV)

- 本实验对群体免疫统计肺脏实变的猪的差异：单免流感疫苗可以**减少15%**的猪的肺脏病变，蓝耳+流感免疫可以**减少24%**的猪的肺脏病变。
- This experiment investigated the differences in lung consolidation among pigs with group immunity: the single influenza vaccine reduced lung lesions in 15% of pigs, while the combined PRRS and influenza vaccine reduced lung lesions in 24% of pigs.

# 育肥猪免疫流感疫苗的经济效益案例1

## Economic Benefit Case 1 of Immune Influenza Vaccine for Fattening Pigs



群体	免疫方案	评估方案
育肥	8周左右首免，3周后加强1次，2ml/次	用药成本、死淘率、料肉比/日增重

广东某集团连州服务部/高山地区，靠近湖南温差大

上一批成绩

养户	饲养头数	出栏体重	饲养天龄	头均日增重	出栏率	死淘	药费/头	料比	三户平均以往成绩
卢杰	1273				94.01%	5.99%	57.62	2.62	出栏率 93.68%
卢文源	563				93.80%	6.20%	57.83	2.65	药费/头 63.81
冯有银	703				93.24%	6.76%	76	2.69	料比 2.65

华感健实验成绩 (12.20-6.8)

养户	饲养头数	出栏体重	饲养天龄	头均日增重	出栏率	死淘	药费/头	料比	三户平均实验成绩
卢杰	1287	124.6	162	0.7691	97.28%	2.72%	50.99	2.507	出栏率 96.85%
卢文源	578	129.41	164	0.7891	96.19%	3.81%	68.25	2.505	药费/头 63.29
冯有银	718	125.59	156	0.8051	97.08%	2.92%	70.65	2.506	料比 2.506

两个养户用药成本下降，一个养户上升，平均用药成本持平；死淘率均有下降，平均下降3.17%；

料肉比均有下降，平均下降0.147；

The medication cost decreased for two farmers and increased for one, with the average medication cost remaining unchanged; the mortality rate decreased for all, with an average decrease of 3.17%;

The feed-to-meat ratio has decreased, with an average decrease of 0.147;

## 育肥猪免疫流感疫苗的经济效益案例2

### Economic Benefit Case 2 of Immune Influenza Vaccine for Fattening Pigs

- 某集团育肥猪免疫效果评估部分结果
- Some results of the immune effect evaluation of fattening pigs in a certain group

公司	免疫场次	免疫数量	结栏数量	开展时间
广西来宾	6	28979	10686	2024.11-12
咸宁农牧	18	40536	40536	2024.10-11
石门畜牧	11	28861	20456	2024.11-12
郴州农牧	3	9440	5438	2024.12-2025.1
<b>合计</b>	<b>38</b>	<b>107816</b>	<b>77116</b>	

共免疫38场次，10.8万头，8周左右首免，2-3周后加强1次，2ml/次，统计死淘率、日增重和料肉比；结栏7.5万头（部分猪因首免发病或各组料耗无法分开未统计）

A total of 38 vaccination sessions were conducted, involving 108,000 pigs. The first vaccination was administered around 8 weeks of age, followed by a booster vaccination 2-3 weeks later, at a dosage of 2ml per session. Mortality rates, daily weight gain, and feed-to-meat ratio were recorded. A total of 75,000 pigs were fattened (some pigs were not included in the statistics due to illness caused by the first vaccination or due to the inability to separate feed consumption across different groups)

# 育肥猪免疫流感疫苗的经济效益案例2

## Economic Benefit Case 2 of Immune Influenza Vaccine for Fattening Pigs



### ➤ 结果统计:

	实验组别	进猪数量	死亡数
合计	对照组	29759	1325
	免疫组	44485	1338



免疫组死亡率低于对照组1.44%，日增重高于对照组22g/d，料肉比免疫组较对照组节约0.05。

The mortality rate in the immunized group was 1.44% lower than that in the control group, the daily weight gain was 22g/d higher than that in the control group, and the feed-to-meat ratio in the immunized group was 0.05 lower than that in the control group.

# 猪流感疫苗免疫价值

## Immune value of swine influenza vaccine



# 总结 Summary:



- 我国猪流感主要以甲型H1N1流行为主，但同一亚型不同毒株的交叉保护存在较大差异；
- 猪流感是呼吸道疾病的门户病，当母猪出现发烧不食，产房仔猪和中大育肥猪出现呼吸道疾病时，需进行猪流感的诊断；
- 猪流感的防控包括生物安全、管理及免疫保健，特别需要加强流感感染人员的监测、管理和与未免猪群的接触等；
- 疫苗免疫是猪流感防控的最有效的措施，猪场免疫前需进行系统的流调，免疫后进行科学的评估。
- 猪流感疫苗免疫后能够减少猪流感对低胎龄母猪的流产影响，能降低育肥死淘率、用药成本、肺脏损伤和料肉比等。
- The main outbreak of swine influenza in China is H1N1, but there are significant differences in cross protection between different strains of the same subtype;
- Porcine influenza is a gateway disease of respiratory diseases. When sows have fever and do not eat, piglets in the delivery room, and medium and large fattening pigs have respiratory diseases, diagnosis of swine influenza is necessary;
- The prevention and control of swine influenza includes biosafety, management, and immune health care, especially the need to strengthen the monitoring, management, and contact of influenza infected individuals with pigs;
- Vaccination is the most effective measure for the prevention and control of swine influenza. Before immunization, pig farms need to conduct systematic epidemiological investigations, and after immunization, scientific evaluations should be conducted.
- Immunization with swine influenza vaccine can reduce the impact of swine influenza on miscarriage in low gestational age sows, lower the mortality rate of fattening, medication costs, lung damage, and feed conversion ratio.



华威特 (江苏) 生物制药有限公司  
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# 路伟

## 华威特副总裁

扬州大学兽医博士，高级兽医师，泰州市生猪产业联合会副会长，中国医药城113人才。获得新兽药证书1项，吉林省科学技术进步奖特等奖，吉林省科学技术成果1项，国家发明专利1项，参编著作1部，在中外期刊杂志发表论文10余篇。

多年从事动物疫苗研发、生产、销售和技术服务工作及其相关管理工作，擅长猪病临床与实验室诊断、猪场个性化免疫方案制定、疫苗的免疫效果评估。



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