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Proceedings

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Pig production and progress in disease prevention and control between 2013 and first half of 2015 in China

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1. Pig production in China in last two years

The pig industry in China experiences a huge change in the last two years. The number of sows decrease gradually thus resulting the fewer number of pig stock. Although pork was imported from oversea but local pork was also exported to Russian and other regions. The detailed data are listed in the Table 1 to Table 6. In summary, the China pig industry has gradually reached its goal with fewer sows to produce more pork.

Table 1 The number of the sows in China from Jan, 2013 to June, 2015 (millions)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2013	50.68	50.58	50.33	50.12	50.12	50.07	49.97	50.12	50.07	49.97	49.72	49.38
2014	49.08	48.69	-	46.71	46.24	45.96	45.42	45.11	44.86	44.32	43.70	42.86
2015	41.86	41.14	40.44	39.75	39.07	38.84	-	-	-	-	-	-

Table 2 The number of pig stocks in China from Jan, 2013 to June, 2015 (millions)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2013	44,812	43,961	44,357	44,667	44,756	45,204	45,746	46,158	46,481	46,760	46,854	45,729
2014	43,809	43,415	-	43,014	42,971	43,034	43,276	43,435	43,785	43,721	43,387	42,162
2015	40,567	39,030	38,757	38,749	38,741	38,586	-	-	-	-	-	-

Table 3 The price of live pigs in China from Jan, 2013 to June, 2015 (RMB/Kg)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2013	16.95	15.77	14.07	12.84	13.30	14.09	14.52	15.34	15.66	15.59	15.73	15.71
2014	13.92	13.24	12.13	11.29	13.29	13.05	13.56	14.67	14.60	14.16	14.08	13.73
2015	13.46	13.09	12.64	13.31	14.03	14.81	-	-	-	-	-	-

Table 4The pork price in China from Jan, 2013 to June, 2015(RMB/Kg)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2013	26.38	25.39	23.33	21.6	21.87	22.89	23.56	24.61	25.11	25.02	25.03	25.06
2014	23.4	22.47	20.93	19.31	21.53	21.62	22.14	22.14	23.51	23.23	22.99	22.58
2015	22.14	22.08	21.23	21.72	22.53	23.45	-	-	-	-	-	-

Table 5 The pork imported to China from Jan, 2013 to May, 2015 (thousands of tons)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2013	55.536	26.075	50.076	45.112	50.808	44.730	50.943	55.195	51.948	49.927	50.420	52.514
2014	56.182	34.457	51.376	59.653	56.299	64.619	43.942	41.546	40.787	40.794	43.638	56.233
2015	62.188	35.212	52.910	53.750	54.119	61.712	-	-	-	-	-	-

Table 6 The amount of pork exported to other regions and countries (thousands of tons)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec

2013	5.465	3.245	5.460	6.655	7.402	6.666	6.953	5.931	6.261	5.541	6.663	7.152
2014	7.699	4.289	7.223	6.583	8.454	7.363	8.310	7.652	8.117	7.966	9.705	8.156
2015	7.490	5.895	6.950	6.805	6.322	7.343	-	-	-	-	-	-

Data Source: Ministry of Agriculture of China, State Statistical Bureau,China Custom and database of China Agricultural Research system (CARS-36).

2. Current statuses and achievements in prevention and control of pig diseases

2.1 policies and grants to support piggery development

The government announced the "Long and mid-term national plan to prevent and control animal disease (20120-2020)" in which classical swine fever and swine pseudorabies are priority diseases to be controlled. This plan, for the first time, lists the technical requirements and timeline to control these important pig diseases and thus, different level of management departments and scientists are making their efforts to archive this goal.

China government also supports the piggery development through the various strategies which are playing an important role on piggery. These policies include (1) "Reward to strong county of pig production" encouraging more pigs more grants from central government, (2) "subsidy to excellent breeding" to facilitate the genetic and breeding improvement; (3) "Financial support to intensive pig farm development" to support the construction of intensive and standardized pig farm. (4) "Subsidy to quarantine of pig disease in farm level" aiming to ensure the disease-free pig to market.

Till now, China government has totally selected 96 pig breeding farms as national nuclear breeding farms. The task of these selected farms is to exchange the semen and other genetic materials among them to facilitate the genetic improvement of China breeding pigs.

2.2 Bacterial diseases

The bacterial diseases are still very common diseases in piggery. Traditional *E.coli* is still the main etiology for yellow scour and white scour of piglets. *Heamophillusparasuis* (HPS) *and Streptococcus suis* (SS) are most frequently observed pathogens in nursery pigs in intensive pig farms in the form of singular and co-infection with PCV2 and PRRSV. The prevalence serotypes of HPS and SS are serotype 4, 5, 13 and serotype 2, 7 whereas other serotypes are endemic in some areas resulting the immune failure where the current commercial available inactivated vaccines were used. *Actinobacillus*

pleuropneumoniae is also often noted in the farms with high intensity of fattening pigs due to the larger pigs required by retailers and slaughters. The prevalent serotypes include serotype 1, 2, 3 and 7 while serotype 5 was once the reason for acute case in some farms. The farms affected by aforementioned bacteria normally experience the coinfection with more than two serotypes and if with high and low virulent serotypes, the different syndromes including sudden death and growth retards were observed. Pasteurellosis and Rhinitis caused by P*asterellamultocida* and *Bordetella bronchiseptica* were also endemic in some farms. Swine extra intestinal *Eschericha coli* were gradually reported in intensive farms but their clinical significance is still mysterious.

Vaccination is still the important precaution for prevention of the aforementioned bacterial diseases exception for extra-intestinal *E.coli* infection. The requirement that the inactivated vaccine strain should be the same serotype as the field strain has been accepted by the users. The subunit vaccine, bi-valent inactivated vaccine and live vaccine against above diseases are being developed.

2.2 Viral diseases

Re-emergency of variant-related piglet diarrhea and pseudorabies attracted most attention of administers, scientists and swine practitioners. Novel porcine epidemic diarrhea viruses (PEDV) were isolated whose genomes were featured by mutation, deletion and insertion in PEDV Spike genes. The new isolates were genomic far distant from traditional CV777. This changes lead to antigen drift and are thus partly responsible for immune failure. The new PEDV could be shed in feces and milk, the latter routine may result to the quick infection in new born piglet once sucking, this phenomenon is often confused with congenital infection through reproductive system that is not yet confirmed. Rotavirus A group (RoV) and Transmissible gastroenteritis virus (TGEV) were the secondary important agents for pig diarrhea but this is area-dependent. The traditional strain-based inactivated and live vaccines were available and widely used for combating the pig diarrhea. The attenuated *Salmonella*- and *Lactobacillus*-based vector vaccines which can be orally administered are under development.

The similar situation as that of PED was observed in pseudorabies in China. Since end of 2011, swine pseudorabies caused with new pseudorabies virus (PRV) broke out in many farms in which vaccination has been performed. Server sow abortion, highly piglet mortality and morbidity were recorded in some farms experience while only gE-antibody positive without or minor changes in herd performance happened in some farms.Molecular epidemiology study indicated the isolated PRVs demonstrated the mutations and deletions in gB, gC and RR gene. The genomic sequencing implied the around 92% homology between our new viruses and Bartha strain. The antiserum raised from Bartha vaccine immunized pigs provided lower cross-neutralization to new isolates. However, through intensive and farm-specific vaccination the pseudorabies was well controlled.

Porcine reproductive and respiratory syndrome (PRRS) and PCV2-associated disease (PCVAD) are very common immno-suppressive problems in many intensive farms. The prevalent genotype of PRRSV in

China is American strain, and the highly pathogenicity PRRSV (HP-PRRSV) is more observed than PRRSV CH1a-like strain, indicating the widely distribution of HP-PRRSV. Totally, there are seven strain-based vaccines were produced and clinically used. Among these vaccines, 3 are traditional strains and 4 are HP-derived attenuated PRRSV. The principle of vaccination has been determined. Only PRRSV-active and infected but stable farms are encouraged to use live vaccine and avoid using two different strains-based vaccines in a farm to reduce possible risk of recombination. Live vaccine should be excluded from PRRSV-negative farm**.** At present**,** the strategies for control PRRS in China include air-filtration system and multiple site system aiming to stop virus transmission from sows to piglets. The molecular epidemiological investigation indicated PCV2b were the prevalent sub-genotype while PCV2d was also occasionally identified in the samples. The recombinant PCV2b-1A/1B and PCV2b-1C were also documented in this period. The vaccines, included whole viruses inactivated vaccines, such as WH, DBN, LG, ZJ, baculovirus- and Ecoli expression system-based subunit vaccines are used in intensive farms, but the cost-benefit are different.Comprehensive vaccination campaign with good quality but cheaper vaccine against PCVAD is undergoing in China. Due to the coinfection with HPS or SS, it is recommended to simultaneously immunize with both PCV2 vaccine and HPS vaccine or SS vaccine.

The FMD is a serious threat to Chinese pig industry, and the pigs' FMD information in China from 2013 to 2015 were presented in the below Table 7.

Table 7 The FMD outbreak in pigs in China from 2013 to 2015

Year	Susceptible	Cases	Deaths	Serotype	Destroyed	Slaughtered
2013	912	21	0	A	912	0
2014	-	-	-	-	-	-
2015	1105	581	314	A	791	0

"-":no data. Source: from OIE website

2.3 Eradication of the infectious diseases

It is compulsory to eradicate classic swine fever and pseudorabies from national pig breeding farms, and, on the principle of own aspiration, the large farms also join the eradication campaign. RT-PCR and IFA are often used to detect classic swine fever virus field strain in tested tonsil. The commercial available vaccines against pseudorabies include Bartha, HB98, SA125 and BUK–based vaccine. The pseudorabies gE-negative vaccine combination with differentiate gE-ELISA kit were the strategy for pseudorabies eradication in which removal of infected sows and boars and biosafety measures were emphasized. To better fight against re-emergent pseudorabies, variant strain-based vaccines are being developed.

3. Challenges we are facing:

(1) Consistently improve genetic quality of breeding pigs.

(2) Understand the epidemiology feature of economically important swine diseases and zoonosis.

(3) Unveil the pathogenesis and immune mechanism of the diseases so as to develop the new bio-products including vaccines, diagnostic kits and drugs.

(4) Produce good quality vaccine and diagnostic kit.

(5) Set up Environment-friendly pig production model with less pollution.

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Japan Country Report

Katsumasa Kure

Value Farm Consulting

Pork Production Trend in Japan

- National Figures (By MAFF) 2012

Sow Inventory (,000) : 900

Annual Pig Production (,000 heads/yr) : 16,772

Per Capita consumption of Pork (kg) : 11.5

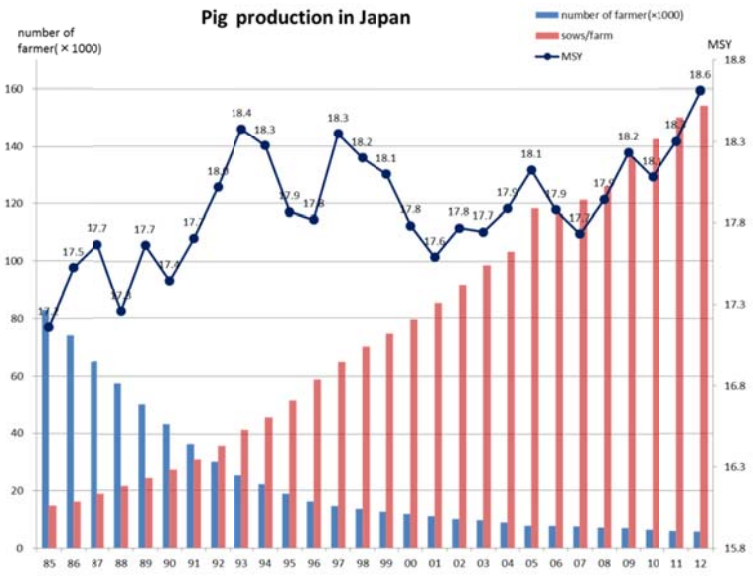
Average market weight (live kg): 112

(≒72.8kgCarcass)

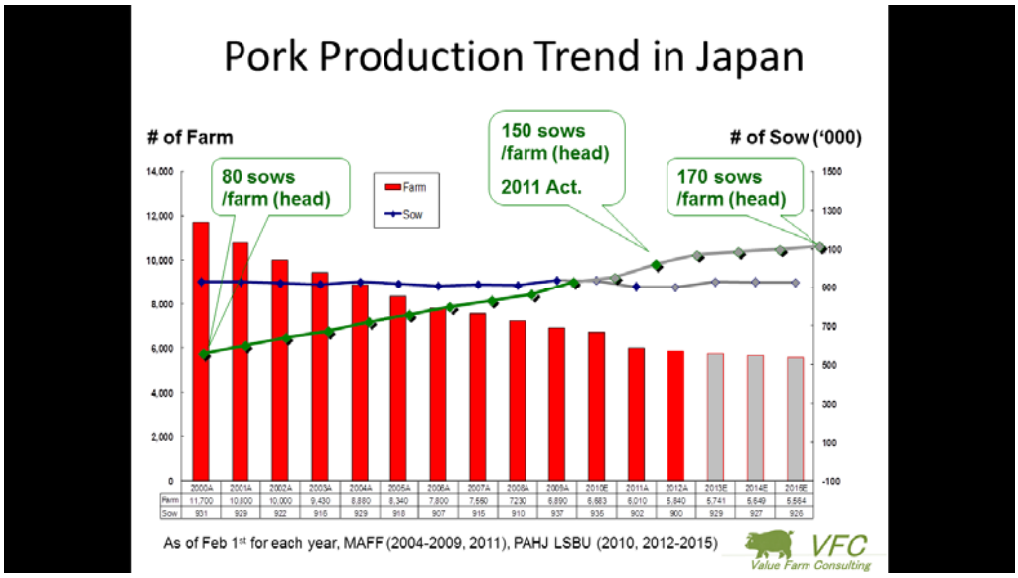
Average market age (weeks): 27.8

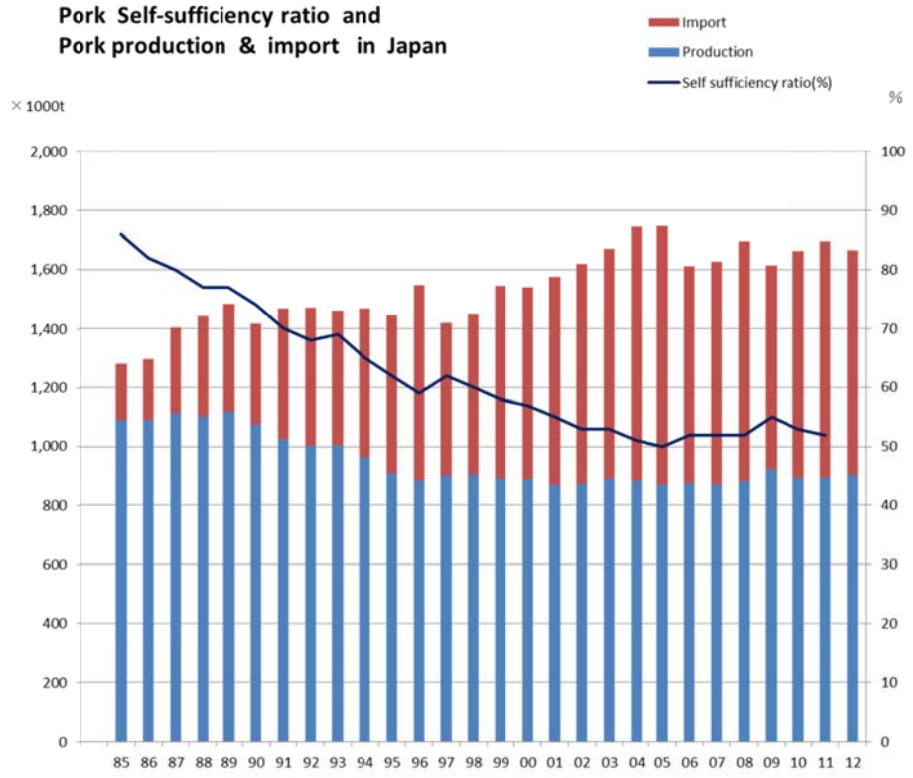
Average Live wt. Price (1st Grade,Yen/kg): 284

Cost of Production Live wt.(Yen /kg) : 276



Pork Production Trend in Japan





- Smaller number , but bigger farms; 1/3 of farms produce more than 80 % of total domestic pork
- From continuous pig flow to more two sites, three sites pig flow
- Heavier carcass weight
- Performance difference becomes wider by farms and areas
- Bigger farms use higher and better technologies
- Environmental regulation must be met; solid and liquid separation, and mechanical composting and high tech water treatment are most popular . Some use bio-bed system .

- JASV Benchmarking 2014 key figures（145 Farms)

	Top10%	Top 25%	Median
# weaned/S/Y	26.4(-0.4)	25.1(-0.1)	23.4(-0.6)
# sold/S/Y	25.3(-0.3)	23.4(-0.5)	21.7(-0.6)
Ave. Carcass wt. (kg)	78.0(+0.4)	76.9(+0.4)	75.7(+0.5)
Ave. Carcass price (Yen/kg)	537.4 (+84.8)	515.1 (+83.3)	500.8 (+76.5)
W to M Mortality(%)	2.92(+0.16)	3.87(-0.24)	5.87(+0.22)
ADG (B to M, g)	691(+8)	661(+20)	623(+12)

( ) shows difference from 2013

Key components for successful pork production in Japan

1. Clean Farm; Good sanitation and environment
2. Excellent Biosecurity
3. Segregated Production
4. Age Segregation
5. Avoid comingling
6. Absolute All In All Out at least by Building

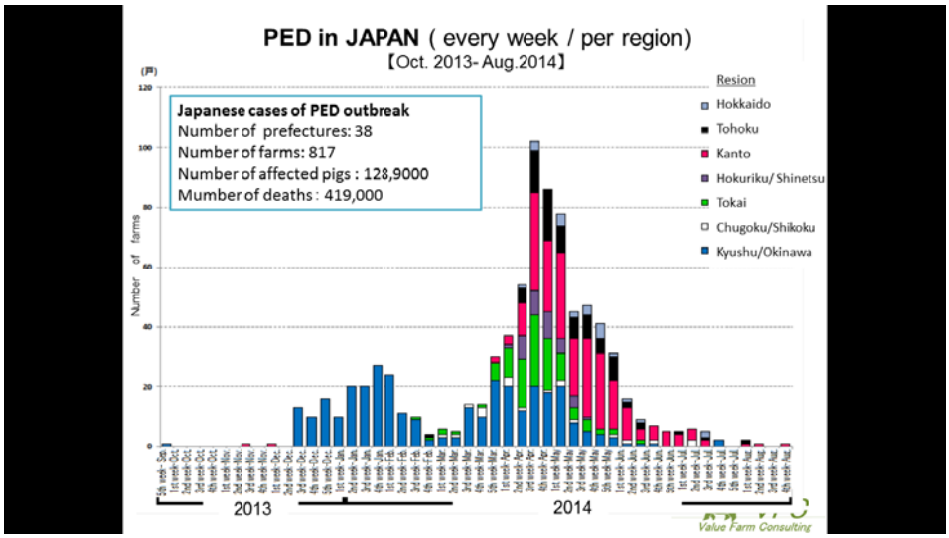
7. Reduction and proper use of antibiotics
8. Early detection of symptom and early treatment

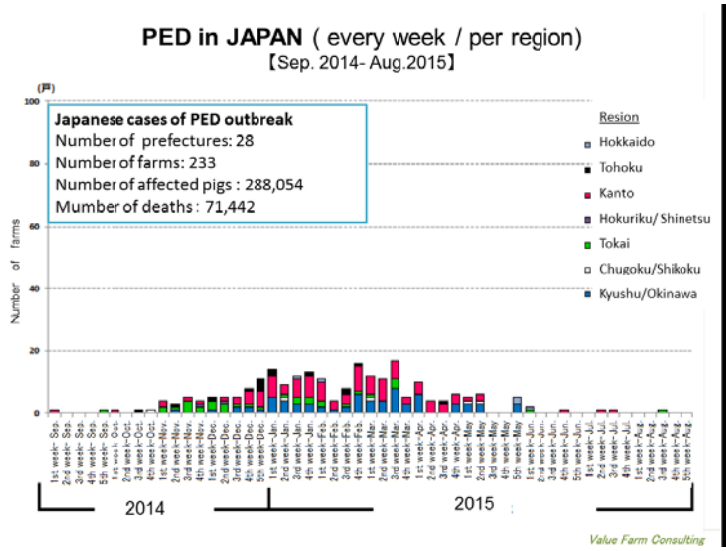
Highlights of Health in Pig Production in Japan

- Japan is free from FMD (Last outbreak was in 2010)

  HC (OIE approved the free status in 2015)
- Aujeszky Disease is under national eradication program
- 37 prefectures are free
- 10 prefectures are still positive but many are near eradication

PED was occurred in 2013 and peaked in April and May in 2014





Other Economic Important Diseases

- PRRS Dr. Yamane estimated 28.3 billion Yen loss annually (2009)
- APP
- Mycoplasma hyopneumonie
- Influenza
- PCVAD
- E.coli as postweanig diarrhea and Edema Disease

While keeping out important foreign epidemic diseases, We must continue to refine our pork production systems for constant and more efficient production !

1. Clean Farm; Good sanitation and environment
2. Excellent Biosecurity
3. Segregated Production
4. Age Segregation
5. Avoid comingling
6. Absolute All In All Out at least by Building

SWINE PRODUCTION AND DISEASE IN KOREA

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Introduction

During a past decade, the number of pigs in Korea has steadily increased every year before FMD outbreak at the end of 2010. After the 2010 FMD outbreak, the Korean swine inventory decreased to its lowest, but quickly rebounded to the highest number in 2014. While the number of pig farms has dramatically decreased every year. The average herd size has increased from less than 977 head per farm in 2007 to 1,949 head per farm in 2014 (Table 1). With respect to the production systems, a multi-site operation system has been introduced in large swine farms though single site operation is still common in Korea.

Swine Production

Approximately 14.6 million pigs were slaughtered in 2010, but the number was decreased by 9.9 million in 2011 on account of FMD. Due to the fast recovery of swine industry, the number of slaughtered pigs per year was 16.1 and 15.6 million in 2013 and 2014, respectively. Pork consumption has increased annually over the past ten years and was 22.2 kg per capita in 2014. The import of pork has increased in the last eight years especially 345,590 ton in 2011 due to the decrease the number of slaughtered pigs in 2010 (Table 1). Common breeds of pigs marketed in Korea (114 kg) have been YLD or LYD (F1 female from a Yorkshire (Y) and Landrace (L) cross, bred with a Duroc (D) as terminal boar). But Berkshire meat is considered to be especially tasty and increasing now on the market.

Swine Health Status

According national surveys for swine diseases and production systems, diarrhea is common in suckling and nursery pigs whereas respiratory diseases are more common in grower-finisher

pigs. Positive rates of antibody and antigen detection for selected diseases are summarized in Table 3.

Table 2 shows vaccination status of the surveyed pig farms during 2012-2013. For PRRS, The rate of vaccinated farms was 78.8% in 2012 while 55.8 in 2013. From 2005 to 2012, the rate of PRRS vaccinated farms had been continuously increased, but it was decreased in 2013. PCV2 vaccine is popularly used in swine farms that the rate of vaccination against PCV2 is 99.7% and 97.7% in 2012 and 2013, respectively. For bacterial disease, sows were commonly vaccinated against atrophic rhinitis (AR) and nursery pigs were commonly vaccinated for *M. hyopneumoniae*. However, the vaccination rate of bacterial vaccines including *P. multcida*, *A. pleuropneumoniae* and *H. parasuis* is decreased in 2013.

As to some of specific diseases, PRRS is still the most economically significant disease substantially affecting pig production in Korea. Despite of a high percentage of seropositive for CSFV, viral antigen has not been detected in Korean swine populations. PCVAD has been one of most serious diseases that decreases productivity and causes reproductive problems and high mortality in nursery and grower pigs. Its economic impact, however, had been decreased after vaccination started and improvement of production environment was made. PEDV is a serious threat to swine production in Korea, causing high mortality in suckling piglets. Recently PEDV has caused illness in piglets all the year around. There were 7 outbreaks of FMD in Korea during 2000-2015. Recently, 185 sporadic outbreaks of FMD was reported from December 2014 to April 2015. FMD serotype was type O. After 28th April 2015, there was no reported outbreak of FMD in Korea. In order to prevent further outbreak of FMD, Korean government has a plan to develop vaccine using with Korean field isolates, and QIA established FMD Vaccine Research Center to develop the FMD vaccine research.

Disease Control

Swine diseases causing significant mortality in Korea have been mainly respiratory diseases such as PRRS, PCVAD and porcine respiratory disease complex (PRDC). After banning antibiotics use in feeds, diarrhea in weaning pigs and ileitis in growers have also become common disease concerns.

National swine disease surveillance system have been taken place in Korea, which is supported by the Korean government, Korea Swine Producers Association (KSPA) and other industry related organizations and were conducted yearly from 2005. In 2014 survey was also carried out randomly selected 350 farms from all over the province of Korea to gather information on swine production systems, disease status, mortality rates, biosecurity measures, vaccination programs, treatment protocols and other factors related to pig mortality.

Serological disease monitoring have been conducted as part of disease survey and control effort. Typically, four blood samples per gilt and 10 sows by parity, and from pigs at 20, 40, 60~89, 90~119, 120~150 days of age, were

obtained from each farm to measure antibody titers and antigens of all the aforementioned diseases. After yearly national surveys of swine farms, the status of various diseases was evaluated based on the level of antibody titers, vaccine programs and the clinical signs specific to pigs on individual farms. The swine disease status of each farm was then classified and the appropriate type of disease control implemented.

Hazard Analysis and Critical Control Point (HACCP) principles were introduced to not only packing plants, slaughter houses and feed mills but also commercial swine production sites using a "Farm to Table" program. Some producers try to raise pigs without the use of antibiotics and to sell their pork at a higher price than antibiotic-fed pigs (i.e., niche market).

Due to the economic significance of PRRS, farms are being surveyed for PRRSV, and their PRRS status is determined by serology and PCR testing. Based on survey results, an appropriate intervention strategy (e.g., eradication or control) will be implemented. The efficacy of the PCV2 vaccines for reducing mortality and weight loss is excellent in many affected farms. Improvement of farm management and environment has also been important factors to reduce the clinical and economic impact by PCV2.

National Eradication Program

In early 2013, a CSF eradication program was implemented by KSPA in cooperation with the Korean government and other swine affiliated organizations. The eradication program consists of four stages, from planning to CSF-free certification and maintenance of free status after successfully eradicating CSF. However, **outbreak** of **CSF was confirmed on** December **2013** and 300 head of pigs were culled.

Aujeszky's Disease (AD) was first identified in Korea in 1988. However no more AD outbreaks since surveyed in 2005 by extensive national eradication program with DIVA vaccine and culling strategy.

In order to control FMD, biosecurity measures such as disinfection, standstill, installing GPS in the farm visiting vehicles, tattooing of market hogs, periodic blood testing (antigen, SP and NSP), and monitoring the oversea FMD status are carried out. Three steps for FMD eradication were also prepared and began to implement.

Conclusion

The Korean swine industry has made a substantial improvement on pork quality and safety, biosecurity and production system, leading to higher profitability. Producers and veterinary professionals have also mounted great efforts on swine disease control and eradication for increasing productivity.

For the sustainable development of swine business, Korean pig industry will have to overcome various obstacles including disease control, the high labor cost, lack of reliable employees, alternatives of antibiotics, and more importantly, environmental factors (manure treatment, odor complaints and soil

contamination etc.). Lastly, animal welfare is also important considerations in the near future.

Reference

Report of disease status in Korea in 2007, 2009, 2010, 2011, 2012, 2013 and 2014 by Korean Pig Producers Association

Acknowledgement

Korean Pig Producers Association

Animal and Plant Quarantine Agency

Sang Won Seo, CTC Bio

Table 1. Changes in swine production in the last eight years

Items	2007	2008	2009	2010	2011	2012	2013	2014
Number of farms	9,832	7,700	8,000	7,900	6,300	6,000	5,600	5,177
Pig inventory (k head)	9,606	9,087	9,585	9,881	8,171	9,916	9,912	10,090
Number of sows(k head)	1,004	913	966	976	903	962	895	937
Number of pigs/farm	977	1,183	1,204	1,230	1,287	1,642	1,770	1,949
Number of slaughter pigs	13,597	13,806	13,935	14,619	9,851	9,997	16,130	15,688
Pork imports (k ton)	247.4	214.2	209.8	169.2	345.5	236.2	185.0	273.8
Consumption/capita/y(kg)	19.2	19.1	19.1	19.3	18.8	20.3	20.9	22.2
Feed production (k ton)	5,409	5,307	5,327	5,535	3,630	5,639	6,136	5,962

Table 2. Vaccination Status by Organism or Disease in 2012 and 2013 (%)

Organism or Disease	Year	
	2012	2013
CSF (Classical swine fever)	93.7	91.1
PRRSV (Porcine reproductive and	78.8	55.8

respiratory syndrome)		
PCV2 (Porcine circovirus type 2)	99.7	97.7
M. hyopneumoniae	91.5	81.4
B. bronchiseptica	92.7	85.3
P. multocida	23.4	16.3
A. pleuropneumoniae	45.8	25.6
H. parasuis	21.5	8.6

Table 3. Result of Blood Test by National survey in 2014 (positive ratio %)

Period	No. of samples	PRRS		PCVAD		CSF		Pm	Mhyo	HPS	App 2	App 5
		Ab	Ag	Ab	Ag	Ab	Ag	Ab	Ab	Ab	Ab	Ab
2012	32.200	65.5	1.1	75.9	0.8	89.0	0	79.1	46.9	60.5	61.3	67.4

2013 1st	13,982	65.6	1.4	81,2	0.8	87.2	0	84.3	55.7	66.0	60.9	69.9
2013 2nd	13,861	63.5	1.1	83.4	1.5	82.4	0	88.8	54.3	69.9	65.8	74.2
2014 1st	13,396	70.2	0.6	87.9	2.8	85.9	0	89.4	49.3	74.1	80.1	84.1
2014 2nd	13,734	73.4	2.2	86.0	4.5	87.6	0	87.9	49.7	65.5	79.1	83.7

* Ab: Antibody, Ag: Antigen

Country Reports, Philippine Swine Industry Profile

Dr. Wilfredo P. Resoso

Immediate Past President

Philippine College of Swine Practitioners

Swine Industry Profile & Health

The Swine Industry Performance Report presents the industry situation in terms of inventory by farm type, age classification; volume of production; supply and disposition; and, monthly average farmgate, wholesale and retail prices.

This report is released every year covering January to December as reference period.

The Livestock and Poultry data system of the Philippine Statistics

Authority (PSA) is supported by two (2) major surveys, namely:

1) The Backyard Livestock and Poultry Survey (BLPS) which covers one (1) of the four (4) replicate samples of the Palay and Corn Production Survey (PCPS). It consists of 15,020 sample households in 1,079 sample barangays nationwide; and,

2) The Commercial Livestock and Poultry Survey (CLPS) which covers around 1,282 independent farms as of January 2014. A swine farm is considered commercial when it has a farm capacity of at least 21 head of adult swine or 10 adults and 22 young.

Both surveys for swine are simultaneously conducted every quarter in all provinces.

Another survey that supports the statistical requirements of the Livestock and Poultry sector is the Survey of Slaughterhouses and Poultry Dressing Plants (SSHPDP*). This covers around 1,387 Accredited (AAA, AA) and Locally Registered Meat Establishments (LRMEs) nationwide and is undertaken in coordination with the National Meat Inspection Service (NMIS).

* Formerly known as Survey of Abattoirs and Dressing Plants (SADP)

Production Parameters:

Based on the total population, production performance is measured by computing the numbers of pigs sold per sow per year (PS/S/Y). The average country performance on pigs sold per sow per year is 18 – 19 heads. The government through the initiative of DOST – PCAARRD had launched the molecular biotechnology project on genomics to improve the production efficiency of the swine industry with the end view of attaining 20 – 21 heads sold per sow per year.Average litter size born alive (ALSBA) is about 10.07. Pre-weaning mortality is 8.5 % and the average weaning litter size is about 9.17 heads. Average farrowing interval is 165 days per cycle and resulted to a farrowing index of 2.2. Fatteners are usually slaughtered at 100 – 120 kgs bodyweight at 180 days slaughter age. Weanlings sold at Php 2500.00 first ten kilos and succeeding kilogram weight at Php150.00 per kilo. Breeder gilts (F1) five to six months old sold at Php18,000.00 to Php21,000.00. Average cost of feed farm mix or commercial is about Php18.00 – 19.00 per kilo.

Common Health Problems:

Constant threat of infectious and non-infectious causes is always a factor in analyzing the productivity performance of the swine industry. Below is the table enumerating common and emerging swine diseases to wit:

Common Swine Diseases	Emerging Diseases
Classical Swine Fever/Hog cholera	Porcine Reproductive Respiratory Syndrome (PRRS)
Porcine Parvo Virus Infection	Swine Influenza (SIV)
Pasteurellosis (swine plague)	Porcine Multisystemic Wasting Syndrome (PMWS)
Bordetellosis	Porcine Dermatitis Nephropathy Syndrome (PDNS)
Actinobacillus pleuropneumonia	Porcine Epidemic Diarrhea(PED)
Hemophilus parasuis (Hps)	Transmissible Gastroenteritis(TGE)
Bacterial Diseases/Parasitic	

What does the future hold with respect to swine diseases? There will be the emerging and re-emerging of new swine diseases due to climate change . Consumer awareness of antimicrobial resistance issue is one of the priority agenda in discussing food safety and security.

Swine diseases account for twenty percent (20 %) value of the total economic losses in the swine production. In the past 5 – 10 years , pneumo-enteric problems or outbreak affected the industry and affected the supply and demand situation of pork.

HIGHLIGHTS

 As of January 1, 2015, the country's total swine inventory reached almost 12.00 million heads. This was 1.68 percent higher than last year's inventory of 11.80 million heads. Stocks in backyard farms

went up by

1.64 percent. Likewise, stocks in commercial farms grew by 1.75 percent against the 2014 level.

Table 1. Swine Inventory by Farm Type and by Age Classification, Philippines, as of January 1, 2013 - 2015 ('000 Head)

ITEM	2013	2014	2015	% Change	
				14/13	15/14
TOTAL	11,843.05	11,801.66	11,999.72	(0.35)	1.68
Backyard	7,750.24	7,656.83	7,782.29	(1.21)	1.64
Commercial	4,092.81	4,144.83	4,217.43	1.27	1.75
Sow Backyard	1,537.46	1,552.55	1,597.02	0.98	2.86
Commercial	1,017.87	1,016.43	1,023.14	(0.14)	0.66
Gilt Backyard	519.59	536.11	573.88	3.18	7.04
Commercial	586.83	581.64	580.78	(0.88)	(0.15)
Fattener 1/	452.06	443.63	438.43	(1.87)	(1.17)
Backyard	134.77	138.02	142.35	2.41	3.14
Commercial	3,385.26	3,394.46	3,495.32	0.27	2.97
Grower 2/	2,377.50	2,375.77	2,439.37	(0.07)	2.68
Backyard	1,007.76	1,018.68	1,055.95	1.08	3.66
Commercial	3,699.23	3,716.58	3,720.01	0.47	0.09
Others 3/	2,562.94	2,546.08	2,510.40	(0.66)	(1.40)
Backyard	1,136.29	1,170.51	1,209.61	3.01	3.34
Commercial	2,634.28	2,556.43	2,606.60	(2.96)	1.96
	1,339.87	1,274.92	1,370.95	(4.85)	7.53
	1,294.40	1,281.51	1,235.64	(1.00)	(3.58)

P Preliminary
1/ Fattener is marketable hog 4 months old and over
2/ More than 2 mos. but less than 4 mos.
3/ Include piglets, weanlings and boars

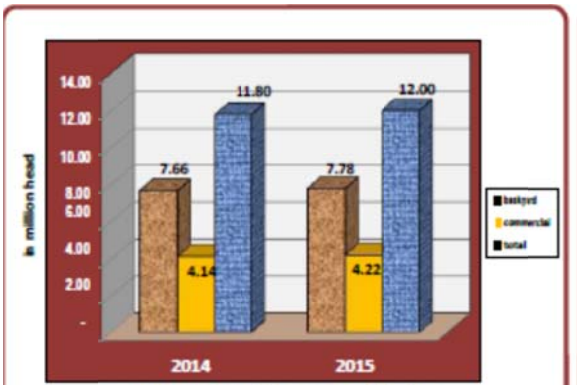

Figure 1. Swine Inventory by Farm Type, Philippines, as of January 1, 2014-2015

About 65 percent of the total stocks were raised in backyard farms and 35 percent were in commercial farms.

In 2014, total hog production was 2,032.30 thousand metric tons liveweight. It was 1.00 percent higher than last year's level of 2,012.17 thousand metric tons liveweight.

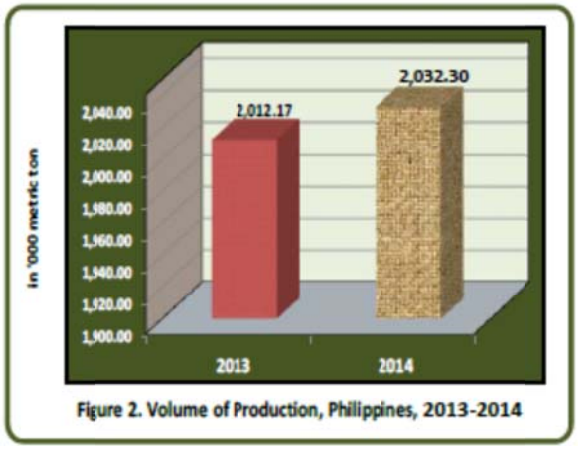

Figure 2. Volume of Production, Philippines, 2013-2014

Prices at all trade levels registered increases in 2014 compared with prices in the same period in 2013. Annual average farmgate price per kilogram of live hogs went up by 4.75 percent. Wholesale price per kilogram grew by 5.65 percent. Retail price per kilogram of pork in Metro Manila increased by 8.29 percent.

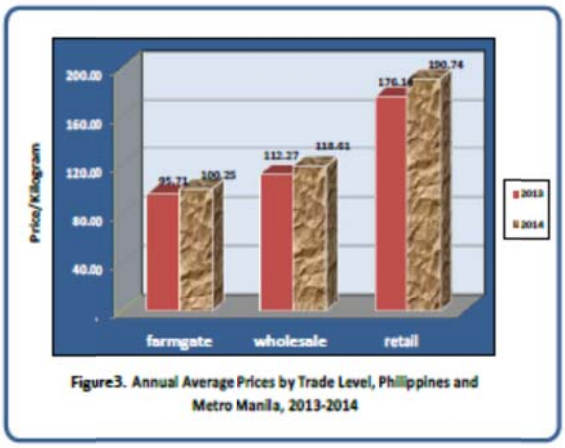

Figure3. Annual Average Prices by Trade Level, Philippines and Metro Manila, 2013-2014

INVENTORY

- As of January 1, 2015, total Sows inventory was 1.60 million heads. It was 2.86 percent higher than the 2014 level of 1.55 million heads. Sows accounted for 13.38 percent of the total swine population.
- Total inventory of Gilts during the period was 580.78 thousand heads. It dropped by 0.15 percent from the 2014 level of
- 581.64 thousand heads.
- As of January 1, 2015, the total inventory of Fatteners reached
- 3.50 million heads. This was 2.97 percent higher than last year's level of 3.39 million heads. Fatteners shared 29.13 percent to the total swine population.
- The total inventory of Growers as of January 1, 2015 was recorded at 3.720 million heads or 0.09 percent higher than last year's inventory of 3.717 million heads. Growers shared 31.00 percent in the total swine stock.
- **Piglets, weanlings** and **boars** which were classified as "others", contributed 21.72 percent to the total swine population. Their combined inventory of 2.61 million heads went up by 1.96 percent from the January 1, 2014 level.

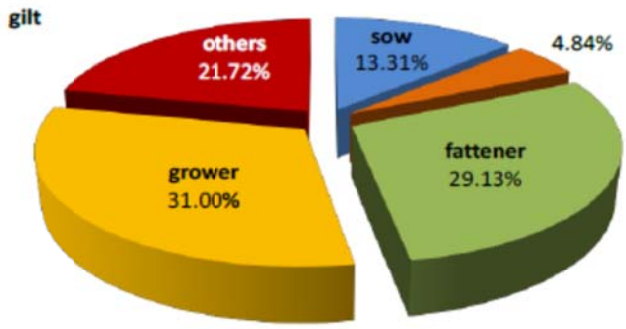

Figure 4. Distribution of Inventory by Age Classification, Philippines, as of January 1, 2015

TOP PRODUCING REGIONS

Table 2. Swine Inventory of Top Producing Regions by Farm Type, Philippines, as of January 1, 2015P

(Number of Head)

TOTAL (Backyard & Commercial)		BACKYARD		COMMERCIAL	
Region	**Inventory**	**Region**	**Inventory**	**Region**	**Inventory**
Central Luzon	1,935,084	Western Visayas	1,153,991	Central Luzon	1,437,159
CALABARZON	1,574,036	Bicol Region	721,878	CALABARZON	1,197,823
Western Visayas	1,295,787	Central Visayas	702,096	SOCCSKSARGEN	328,069
Central Visayas	939,817	Davao Region	697,080	Northern Mindanao	296,851
Northern Mindanao	884,673	Northern Mindanao	587,822	Central Visayas	237,721
Bicol Region	863,382	Zamboanga Peninsula	502,890	Davao Region	151,001
Sub-Total	**7,492,779**		**4,365,757**		**3,648,624**
Others	4,506,943		3,416,533		568,808
Philippines	**11,999,722**		**7,782,290**		**4,217,432**
Percent share					
Central Luzon	16.13	Western Visayas	14.83	Central Luzon	34.08
CALABARZON	13.12	Bicol Region	9.28	CALABARZON	28.40
Western Visayas	10.80	Central Visayas	9.02	SOCCSKSARGEN	7.78
Central Visayas	7.83	Davao Region	8.96	Northern Mindanao	7.04
Northern Mindanao	7.37	Northern Mindanao	7.55	Central Visayas	5.64
Bicol Region	7.20	Zamboanga Peninsula	6.46	Davao Region	3.58
Sub-Total	**62.44**		**56.10**		**86.51**
Others	37.56		43.90		13.49
Philippines	**100.00**		**100.00**		**100.00**

P - Preliminary

As of January 1, 2015, the top contributors to the country's total swine population were Central Luzon with 16.13% share; CALABARZON with 13.12%; Western Visayas with 10.80%; Central Visayas with

7.83%, Northern Mindanao with 7.37% and Bicol Region with 7.20%. These regions had a combined share of 62.44%.

 Western Visayas had the highest share of 14.83 percent in the backyard inventory while Central Luzon ranked first in commercial inventory with 34.08 percent share.

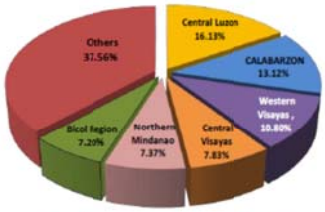

Figure 5. Shure in the Inventory of Top Producing Regions, Philippines, as of January 1, 2015

PRODUCTION

Table 3. Volume of Hog Production by Quarter and Semi-Annual, Philippines, 2012-2014

(in '000 m.t. liveweight)

Quarter	2012	2013	2014	% Change	
				13/12	14/13
Jan - Mar	474.05	475.75	481.71	0.36	1.25
Apr - Jun	460.14	480.50	484.29	4.42	0.79
Jan - Jun	**934.19**	**956.25**	**966.00**	**2.36**	**1.02**
Jul - Sep	466.36	474.53	482.00	1.75	1.57
Oct - Dec	573.07	581.39	584.31	1.45	0.50
Jul - Dec	**1,039.43**	**1,055.93**	**1,066.31**	**1.59**	**0.98**
TOTAL (Jan - Dec)	**1,973.62**	**2,012.17**	**2,032.30**	**1.95**	**1.00**

In 2014, total hog production was 2,032.30 thousand metric tons liveweight. This was 1.00 percent higher than the previous year's production output of 2,012.17 thousand metric tons liveweight. Higher increases in production were noted during the first and third quarters of the year.

PRICES

 The annual average farmgate price of live hogs in 2014 was P100.25 per kilogram. This was

4.75 percent higher than the 2013 level of P95.71 per kilogram.

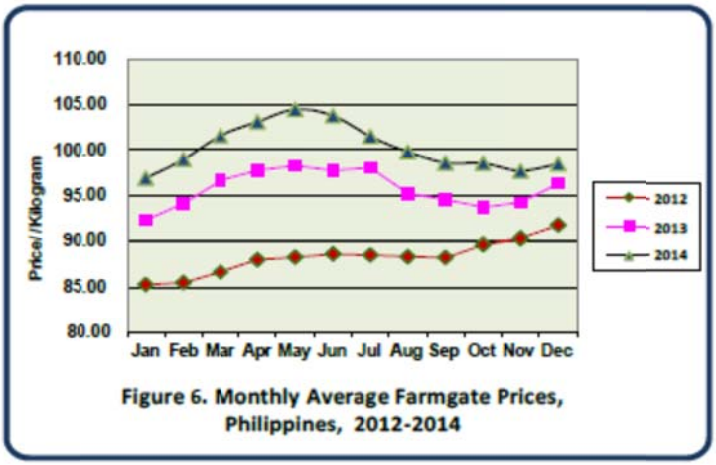

Figure 6. Monthly Average Farmgate Prices, Philippines, 2012-2014

At the wholesale level, the January-December 2014 average price per kilogram of live hogs in Metro Manila was P118.61. It increased by 5.65 percent from last year's annual average price of P112.27 per kilogram.

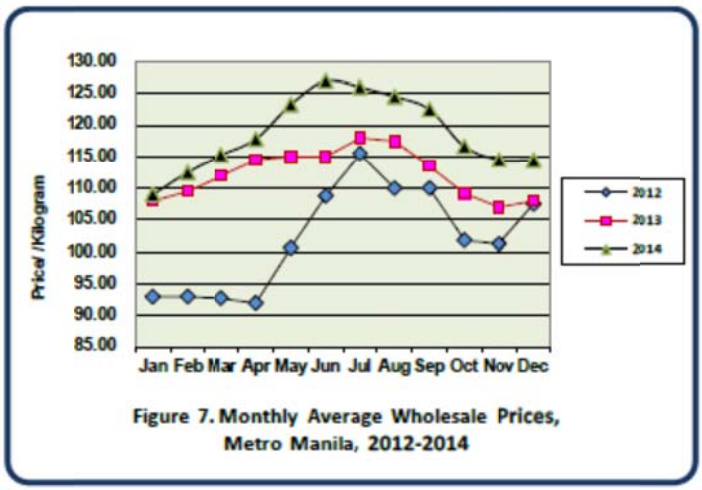

Figure 7. Monthly Average Wholesale Prices, Metro Manila, 2012-2014

In 2014, the annual average retail price of pork in Metro Manila went up to P190.74 per kilogram. This was 8.29 percent higher than the previous year's average price of P176.14 per kilogram. Higher prices were recorded in June, August and September of 2014. The lowest price was noted during the month of January at P176.39 per kilogram.

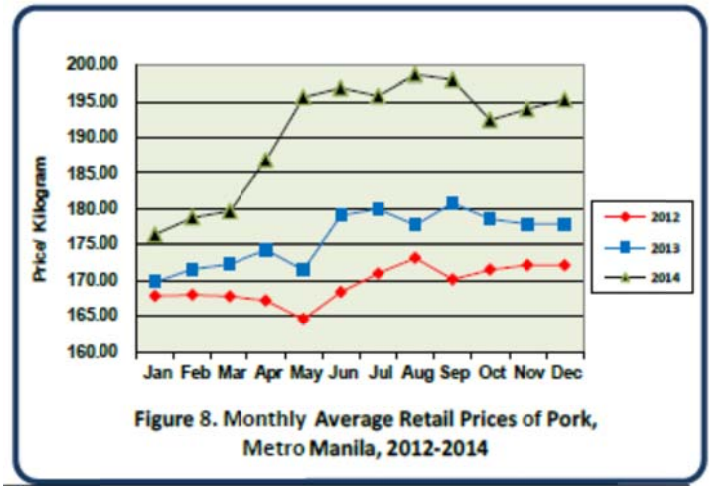

Figure 8. Monthly Average Retail Prices of Pork, Metro Manila, 2012-2014

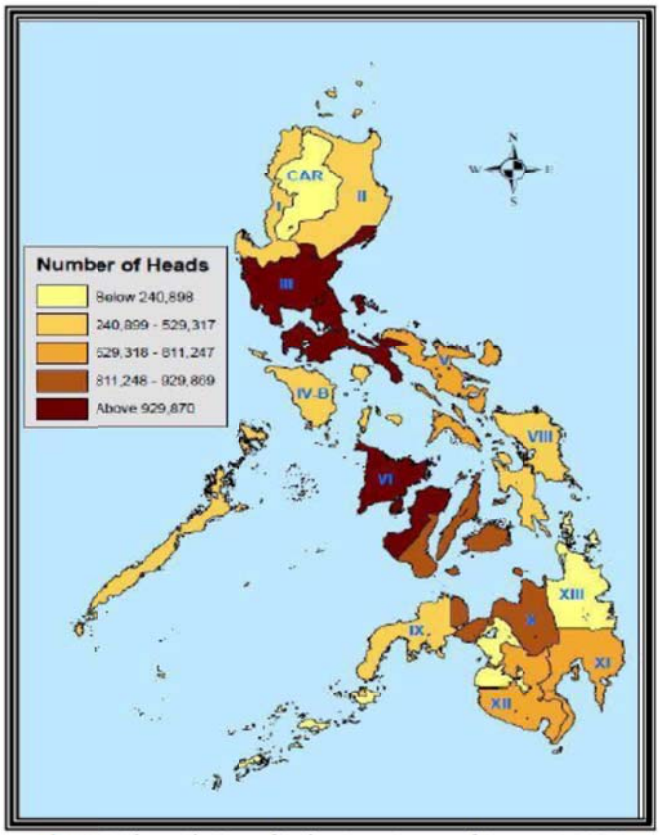

Figure 9. Thematic Map of Swine Inventory as of January 1, 2014

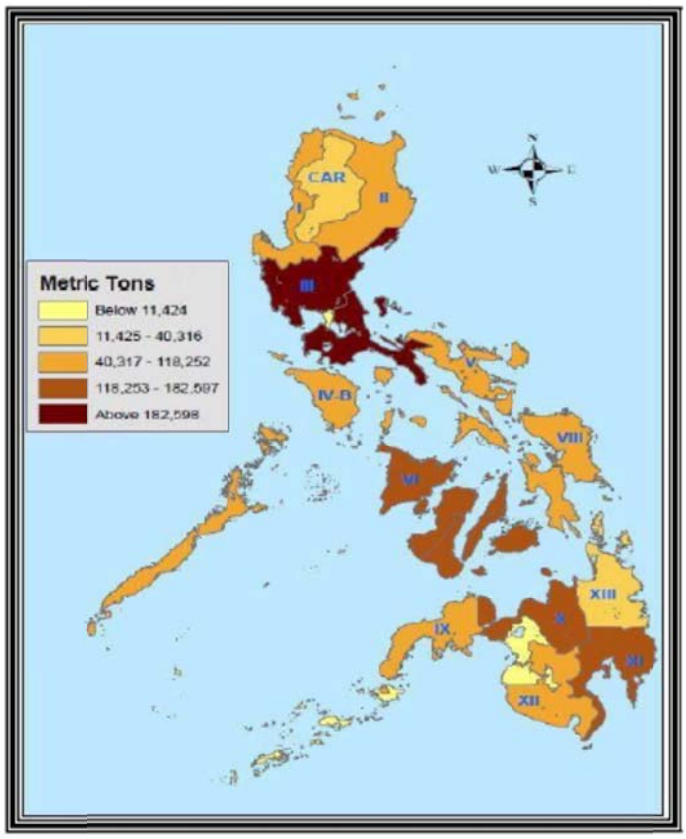

Figure 10. Thematic Map of Swine Production, 2014

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2. Swine Industry Profile of selected South East Asian Countries – FAO TCP/RAS/3215 Assistance on Diagnosis and Management of PRRS and other swine diseases.

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Thailand Pig Industry Today and Future for "One World One Health": Food safety and food security aspects

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INTRODUCTION

In recent years, livestock sector has expanded significantly and the East Asia and Latin America have been taking the lead in growth. In Asia, meat production has increased primarily poultry, pigs and dairy, with poultry having the largest growth. The large increase in demand for livestock products in the developing world and the emergence of production systems to meet that demand have been a challenge for the "livestock revolution" (Delgado et al., 1999). The global demand for livestock products is expected to double by 2050, with both demand for and the production of livestock products increasing faster in developing countries than that in developed countries.

Pigs have been long known to serve as reservoirs for zoonotic pathogens, our understanding regarding zoonotic disease ecology in pigs is rather superficial (Zimmerman et al., 2012). Some of these viruses, bacteria and parasites are emerging or re-emerging in nature, while others appear sporadically or transmit to humans only under certain circumstances (Krauss et al., 2003). Reducing these diseases in animals and humans often requires adopting primary or secondary prevention techniques, or a combination of both. However, this requires extensive understanding of husbandry practices, ecological preconditions, human risk behaviors, and the modes of transmission for swine-associated zoonoses (Graham et al., 1998).

Currently, one of major challenges to the global and national meat trade is infectious disease. Disease is a critical issue that needs to be managed in order to maintain global supply chain of meat. The recent outbreaks of infectious diseases in pigs such as Porcine epidemic diarrhea (PED), Porcine reproductive and respiratory syndrome PRRS, Foot-and-mouth disease (FMD), Nipah virus infection, African swine fever (ASF), Swine Influenza, and *Streptococcus suis* infection have alerted the food industry to the importance of risk management as a vital element in disease control. In addition, the outbreaks of highly pathogenic avian influenza (HPAI) in Asia provides a good example to combat with emerging zoonotic disease. In the past, there was little trust between food industry and other stakeholders in global food systems (i.e. FAO, OIE, WHO, intergovernmental agencies and academic institutions). Although there was some limited communication back and forth among these various stakeholders, there were clear differences in priorities of those stakeholders. However, an important consequence of the HPAI H5N1 in Asia has persuaded all the stakeholders that they have many shared interests and those deficiencies in the capacity to control animal diseases also restrict trade and reduce the economic growth. Therefore, it notes that a risk management of zoonotic diseases and food safety related issues needs an interdisciplinary team or "One Health" approach to ensure safety of food supply chain of livestock sector including pig industry.

To facilitate a better understanding of prevention and control of infectious diseases in pig industry, therefore this paper aims to review the current situation of pig industry in Thailand. In

addition, this study also sets out the basic issues and revisits some relevant issues on “One World One Health” regarding food safety and food security in pig industries in Thailand and in other developing countries.

Pig industry in Thailand: From the past till today

Currently, most of the pork produced in Thailand is consumed domestically. Pig population are mostly concentrated on the central and eastern parts of Thailand. Export markets are limited to Hong Kong, Cambodia, Lao PDR, Vietnam and Singapore. Since late 2014, Thailand started to export fresh pork to the Russian Federation. Those pigs were produced in the eastern part of Thailand in which FMD is free in that region. In addition, finished (processed) pig meat based products are more widely exported. Most of the industry’s output comes from medium and large sized farms as these dominate the industry. Modern pig feeding and management systems have been widely accepted by farmers. In recent years, the development of commercial pig raising farms has been obviously seen. Contract growing of pigs (known as vertically integrated farming system) takes place with feed milling companies providing piglets, animal feed, veterinary services and farm management skills to contracted pig growers. This has opened the way for Thailand to increase exports of pork to other countries in the Asia Pacific region.

“One World One Health” and pig industry in Thailand

The global spread of severe acute respiratory syndrome (SARS) highlighted the need to detect and control disease outbreaks at their source, as envisioned by the 2005 revised International Health Regulations (IHR) (Gostin et al., 2003). In the meantime, the pandemic outbreaks of HPAI of H5N1 subtype have also raised global awareness of the need to strengthen intersectoral communication, coordination and collaboration between the animal and human health sectors (Tiensin et al., 2009).

The concept of multi-sectoral or multi-disciplinary approaches for public sector governance is an essential element through which a country acquires the authority to provide and manage public goods and services. Emerging and re-emerging diseases pose a substantial and continued threat to public health, animal health, ecological systems, and food security. Global public health is a shared responsibility of both the animal health and human health authorities. As we are all aware, the concept of multi-sectoral approach for public sector governance is an essential element to improve food safety and food security. This concept has also been applied in pig industry in Thailand in order to enhance safety of animal food supply chain including pig sector. The cooperation between research institutes, the pig husbandry sector, the government and business has always been good. In the future, the **private-public partnership** will be expanded with even more.

A food safety control system has become a significant issue in Thailand that will ensure the safety of livestock products This has raised concerns about the food supply chain management of livestock products and how Thailand will prepare for and prevent food safety incidents involving livestock products. Therefore, strengthening “food supply chain management of livestock products” is vital to ensure a supply of safe foods for all stakeholders in the food supply chain. In this regard, the pilot project entitled “Institutional Strengthening on Food Safety and Quality in Supply Chain Management of Livestock Products” has been implemented. This project aims to strengthen the institutional mechanism for food safety and quality control in

supply chain management of livestock products based on guidance given in the *FAO/WHO Guidelines for Strengthening National Food Control Systems*. This will be done by enhancing the role of the relevant food safety authorities dealing with livestock products for sale on the domestic market to include both domestic production and imports. The understanding of food supply chain management in pig industry in both normal and emergency situations is needed in order to prevent and control the emerging infectious diseases and food safety related issues (Tiensin and Chuxnum, in preparation).

The pig industry in Thailand is promoting the linkages among animal health, public health, and food safety. These linkages collectively leverage the strengths of each stakeholder. An example of this kind of collaboration "One World One Health" would bring better trust, understanding, communication and collaboration among pig producers, consumers, governmental agencies, and relevant stakeholders. The goals are to leverage resources, to advocate harmonized trading policies, and to work together for better food safety and food security. Coordination and collaboration between veterinary services, public health services, private sector, and other relevant stakeholders constitute a key component of good veterinary and public health governance, and are crucial for the effective action and optimal management of human and material resources.

Disease is one of the major challenges and threats faced by the global meat trade

Pigs are anatomically and physiologically similar to humans in terms of dentition, ocular, dermal, cardiovascular, renal, and digestive systems. While these have led to great advances in human and pig health, including substituting human organs with swine organs, these shared biological characteristics sometimes have the potential to permit pathogens to cross the species barrier (Deschamps et al., 2005 and Wolfe et al., 2007). Although, pigs have been long known to serve as reservoirs for zoonotic pathogens, our understanding regarding zoonotic disease ecology in pigs is rather superficial (Zimmerman et al., 2012). As such, although many swine pathogens are well-controlled, some zoonotic pathogens have become well-established in swine populations, imparting health and economic burdens (Morens and Taubenberger, 2010).

A major challenge to the global pig and meat trade is disease. Disease is a critical issue that need to be managed in order to maintain global supply chain and food security. Emerging swine-associated zoonoses occurred worldwide during last decades. A number of emerging zoonotic swine pathogens are thought to have a worldwide distribution: swine influenza viruses (SIV), hepatitis E virus (HEV), *Streptococcus suis, Streptococcus porcinus*, *Burkholderia pseudomallei, Cysticercus cellulosae* (pork tapeworm), *Giardia intestinalis*, Trichinellosis, and livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA) (Meng et al., 1997 and Uddin et al., 2013).

Influenza virus -- Since at least the 1918 influenza pandemic, public health professionals have been aware of cross-species influenza-like infections between man and pigs, but the connection was not evident until the 1920s when Dorset et. al. (1922) reported (Dorset and McBryde, 1922). Pigs' susceptibility to both human and avian influenza viruses permit them to be infected with both mammalian and avian origin viruses. This may result in reassortment of genetic materials between multiple subtype and species adapted influenza viruses, leading to new influenza A viruses (Ma et al., 2009). A 2007 review of SIV infections in man documented 50 human infections, with a 14% case-fatality rate. At that time such infections were generally perceived as rare and infrequent risk of human to human transmission. Since then, novel

influenza virus detections have increased, and the reported numbers of swine-like influenza virus infections in man have tremendously escalated (Myers et al., 2006).

Nipah virus -- There are several emerging and re-emerging zoonotic paramyxoviruses which have involved pigs in their transmission cycle. During 1998–1999, Nipah virus was identified in Malaysia and Singapore causing widespread zoonosis. Spillover from Pteropus bats triggered an outbreak in the pig population in Malaysia in 1998. A high proportion of pigs experience morbidity to Nipah virus infection, however most cases recover after several days of clinical illness. This illness, however, decreases the economic value of the commercially farmed pigs. During the outbreak the virus rapidly spread among swine farms, when the farmers attempted to take sick pigs to market to minimize economic loss (Chua et al., 1999). Overall human mortality due to Nipah viral infection was 40%. A similar virus caused more than 70% case fatality among humans in Bangladesh where pig's role in the ecology of the virus remains obscure (Hsu et al., 2004).

Streptococcus suis -- is a family of pathogenic gram positive bacterial strains that represents a primary health problem in the swine industry worldwide. *S. suis* is also an emerging zoonotic pathogen that causes severe human infections clinically featuring with varied diseases/syndromes (such as meningitis, septicemia, and arthritis). Over the past few decades, continued efforts have made significant progress toward better understanding this zoonotic infectious entity, contributing in part to the elucidation of the molecular mechanism underlying its high pathogenicity (Feng et al., 2014). In Thailand, infection of *S. Suis* in humans sporadically occurred in the north and the northeast of Thailand (Kerdsin et al., 2015).

Multiple factors were associated with the increase of swine zoonoses in humans including: the density of pigs, poor water sources and environmental conditions for swine husbandry, the transmissibility of the pathogen, occupational exposure to pigs, poor human sanitation, and personal hygiene. Swine zoonoses often lead to severe economic consequences related to the threat of novel pathogens to humans, drop in public demand for pork, forced culling of swine herds, and international trade sanctions. Due to the complexity of swine-associated pathogen ecology, designing effective interventions for early detection of disease, their prevention, and mitigation requires an interdisciplinary collaborative ''One Health'' approach from veterinarians, environmental and public health professionals, and the swine industry (Uddin et al., 2013)

Food safety and food security issue is a concern in pig industry

Global food system has fueled competitive marketing practices. The liberalization of the global trade, and the fact that the consumers in the industrialized countries are more and more demanding food to be not only economical, but also healthy, tasty, safe and sound in respect to animal welfare and the environment, are changing the so far quantity-oriented food production, guaranteeing the nutrient supply for a nation, into an international quality-oriented food market, where commodities, production areas, production chains and brands compete each other.

The competitiveness of food production will soon be more dependent on the reliability of the safety and the quality of the food and acceptability of the production procedures than on quantity and price. Thus, apart from the steady increase of the national and international

standards for food safety and public health, there is a growing influence of the consumer's demands (often completely ignorant of agriculture) on the animal production, its allied industries, advisers, consultants and food animal veterinarians. All of this means that the agricultural supply of food production is facing remarkable changes in the years to come, which is both challenge and opportunity for food animal producers, packing plants and meat processors as well as for the veterinary profession. In countries that have implemented a consistent mandatory meat inspection, this classical harvest food safety procedure and the more and more stringent rules for post-harvest food safety measures improving the hygiene standards during slaughter, meat processing, storage and distribution have led to a remarkable decline of meat related food-borne diseases in man. However, although meat inspection and food hygiene have been regarded as sufficient to guarantee safe meat, new approaches to food safety and meat quality are becoming necessary. Despite the generally recognized achievements in making food safer over the decades with the mandatory meat inspection and the principles of food hygiene being the most successful means in protecting the consumer against food-borne health risks, there are still deaths due to food-borne disease in humans.

The pig industry faces a number of challenges and opportunities, and its success and sustainability depends upon several factors. Much of the discussion revolved around broad issues relating to food security and how the pig industry can balance competing societal concerns. In relation to both these and other issues, some consideration was given to how pig producers can best be supported as individuals, and as an industry. A general topic of discussion related to how the pig industry can contribute to food security issues and how the research community can aid that effort. In the future the pig industry will be increasingly required to balance issues such as production efficiency, food security, environmental issues and animal welfare. In particular, issues relating to food security may be in conflict with animal welfare concerns.

In addition to residues in pig industry, beta-agonist is banned from food production in many countries around the world, including countries across Europe, Russia, mainland China, Republic of China (Taiwan) and Thailand, due to its suspected health effects. Since 1998, more than 1,700 people have reportedly been "poisoned" from eating pigs fed the drug. If imported meat is found to contain traces of the drug, it is turned away, while fines and imprisonment result for its use in banned countries. Currently consumers are concerned on chemical and veterinary drug residues. Therefore, pig industry has to focus on current health crises in order to produce safe pork for consumers.

Nowadays, there will be an increase in public awareness regarding the health and nutrition of livestock and humans that will drive important changes in the food system. People are demanding more information about the food they consume. Traceability of all the food we consume will become commonplace.

Antimicrobial resistance – a challenge of pig industry

The incidence of antimicrobial resistance is increasing worldwide. It is a complicated issued in this region by inadequate data and less concern among relevant stakeholders in pig industries. The crisis of antimicrobial resistance is the uncontrolled and inappropriate use of antibiotics globally. Antibiotics are used in humans by too many people to treat the wrong kind of infections at the wrong dosage and for the wrong period of time. In addition, antibiotics are widely used in the animal production for human consumption. It is much easier to disseminate

antibiotic-resistant bacteria by global food distribution and inadequate waste management procedures than by person-to-person spread—and once resistant strains have developed, they appear to spread easily. The use of antibiotics as growth promoters was recently banned in several countries such as the EU member countries. In this regard, Thailand has also banned the use of antibiotics as growth promoters in livestock industries.

Thailand's integrated 'Antimicrobial Resistance (AMR) Strategy' has been developed in collaboration with the Ministry of Public Health, the Department of Livestock Development at the Ministry of Agriculture and Cooperatives, universities, and relevant associations and stakeholders. Although Thailand has measures to contain and prevent AMR, these measures need to be fully integrated and this can only be achieved through cooperation among the various local and global stakeholders. For instance, a joint committee on AMR control programme has been established and a strategic framework on AMR control was also jointly drafted between public health and animal health sector. Meetings with relevant stakeholders (i.e. government agencies, academic institutions, livestock producers' associations, pharmaceutical companies, sellers' association, and professionals' associations) have been regularly organised to share and update information in order to progress on AMR control activities. In addition, AMR monitoring and surveillance activities have been conducted by both public health and animal health sectors. Such programmes should be maintained or expanded at national level and adapted into policy for sustainability with system monitoring. AMR cannot be eradicated, but a multidisciplinary approach involving a wide range of partners will limit the risk of AMR and minimise its impact on health, now and in the future (Tiensin and Chuxnum, in preparation**)**.

Animal welfare in livestock production – implications for pig producers, consumers, and public health

The majority of pigs in the world are raised indoors in barren, cramped confined animal feeding operations (often referred to as "factory farms"). As well as being intensively restrictive, these crates limit physical interactions between the sow and her piglets except for suckling. After the piglets are weaned, the sows are impregnated and subjected to the same treatment again, creating a cruel cycle of stress and deprivation until they are slaughtered. After decades, livestock producers especially pig producers are currently undertaking a variety of initiatives to improve the welfare of animals in their farms. Awareness of problems associated with animal rearing, transport, and slaughter indicates that for many people at least, animal welfare is coming to be seen as a potential problem or concerned issue nationally and globally.

The environmental impact **of** pig production

Global issues such as greenhouse gas emissions from livestock production are becoming internationally recognized. Livestock farms produce staggering amounts of animal manure and waste water. The way these wastes are stored and used has profound effects on human health and the environment. In the context of the intensification of pig production and consequent higher animal densities, the environmental effects have to be considered. The main direct environmental impact of pig production is related to the manure produced. Their manure and urine are funnelled into massive waste lagoons. These cesspools often break, leak or overflow, sending dangerous microbes, nitrate pollution and drug-resistant bacteria into water supplies and land fiends.

However, appropriate storage can reduce the amount of greenhouse gases released, and the production of combustibles through bio-digestion can help to make optimum use of the natural resources involved in the production cycle. The level of manure utilization defines the amount of nutrients released into the environment. Such nutrients can contribute significantly to increased soil fertility when used appropriately, but an overload of nutrients and other substances can lead to soil and water degradation. High-density pig production can release excessive amounts of nitrogen and phosphorus into the environment, and the high doses of copper and zinc fed to pigs to promote growth eventually accumulate in the soil. The Life Cycle Assessment (LCA) approach to measuring greenhouse gas emissions related to pork production indicates that it tends to have lower emissions than ruminant production systems (FAO, 2015).

As we are concerned for the **environmental impact** of **pig production**, all within the Thai pig industry recognise their responsibilities for minimising the impact of their production systems. For many years, they have worked pro-actively to produce pigs in a more environmental friendly manner. Thai pig producers are efficient in their use of feed in rearing their pigs which, as a Life Cycle Analysis (LCA) demonstrates, is a significant overall contributor to the emission of greenhouse gases within the pig production chain. Our efforts have led to the development of better practices in manure management, and address air and water quality on farms across the country.

DISCUSSION AND CONCLUSION

This paper highlights the importance of an intersectoral approach for addressing complex multidisciplinary issues associated with global health safety and security (including, emerging infectious diseases, zoonoses, and food safety). “One World One Health” concept could be integrated in pig industry today and the future for improving and strengthening food safety and food security aspects. The livestock revolution including pig industry will continue, driven by an increase in the global demand for meat. In the developing countries in particular the demand for meat and milk will continue to grow. This increasing demand for livestock products will bring new challenges for the veterinary profession. The consequences of infectious diseases and emerging diseases in domestic animal population especially pig industry are multiple, pervasive, and often subtle. Nor is it only zoonotic infections, residues and antimicrobial resistance that can affect human health and well-being. If human health and animal health are well understood to include the integrity of the social, economic, and political framework that we depend on for stability and security, then animal epidemics can represent a serious threat indeed.

The majority of emerging human pathogens are zoonotic. Frequently changing husbandry practices and environmental factors (e.g. large scale domestic animal production, urbanization, interaction between wild and domestic swine populations with humans, population increases, etc.) may predispose humans and pigs to pathogens common to other species, or may allow for the adaptation of these organisms to humans or swine. Although pigs are one of the major sources of animal protein globally, and the industry represents a large portion of the economy for many countries, steps should be taken to minimize swine-associated zoonoses of public health concern. A solution to this requires uniform understanding and consensus between the swine industry, farmers, veterinarians, clinicians, public health professionals, and other stakeholders. Addressing these complex issues requires integrative and cross-disciplinary efforts to achieve optimum health for people, pigs and their environment through the ‘‘One Health’’ approach.

Such an interdisciplinary, and inter-institutional collaborative approach provides a united platform upon which stakeholders can come together as collaborators, develop a more complete understanding regarding a complex problem, and tackle these problems with carefully designed, multiple interventions. Such a collaborative strategy has potential to gain much wider acceptability among swine farmers, the swine industry, as well as among public health professionals. Embracing the principles of ‘‘One Health’’ will improve swine zoonoses surveillance, raise stakeholders’ awareness on swine-associated zoonoses, help reduce risky behaviors associated with swine production and pork consumption, encourage improved personal hygiene, and demonstrate the need for cost-benefit analyses of swine pathogen control efforts.

In addition to a shift in scientific perspective, veterinarians need to strengthen their knowledge and management skills and develop new innovation or methods for working on interdisciplinary team or “One Health” approach. With a more ecosystem-oriented scientific base and better knowledge of communications, veterinarians will have to understand and affect global issues related to controlling epidemics, herd health and food safety and security. The consumers will want pathogen-free, residue-free, and antimicrobial resistance-free meat. The modern animal production industry has been a major force for innovation and the adoption of new technology, and increasingly working in collaboration with other stakeholders. Nevertheless, even when there is a clear and major public goods to be achieved, it is not always obvious what incentives might encourage the industry to become involved. As a result, veterinary professions, scientists, and economists should be capable of addressing global issues associated with increased livestock production in this dynamic world. Sustainable food systems including pig industry that consider the environment, food safety, animal welfare and natural resources will become standard. The veterinarian has an opportunity to be a key player in driving these important changes for building better the future health and welfare of livestock and humanity.

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SWINE PRODUCTION AND HEALTH IN VIETNAM

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In Vietnam, pig production has a very important role because of their contribution to protein sources for human consumption, to agriculture production systems and to economic systems. Pig production is largest in terms of gross output of livestock, as it accounts for more than 70% of protein sources for human consumption in daily meal. In the period of 10 years from 2001 to 2010, pig production in Vietnam has grown up nearly twice times and reaches 27.37 million heads. In the year 2011, pig population has down to 26.3 million heads due to the outbreaks of Foot and Mouth disease and Blue Ear disease. And in the last four years, the pig production has an increased rate from 1.5 to 2% each year and reaches at 26.76 million heads, which contributed 3.29 million ton of port in 2014. According to a report of Vietnam National Institute of Animal Science, pig production in Vietnam is mainly included of three systems: (1) small-scale householders with a low level of hygiene; (2) small-scale commercial pig producers with minimum hygiene standards; and (3) large-scale commercial pig producers with high hygiene standards. At the present, about 70% of pig population and 60% of pork are produced by the small-scale householders. The large-scale commercial pig producers with high hygiene standards supplied only about 15% of the total pig products in the market. In Vietnam, pig production activities are often run at the dense level, with most of the pig farms managed by small-scale farmers and control of disease is facing many difficulties. Most of the pig farms are opened style with a low bio-security level. Besides the common animal diseases, there are Classical Swine Fever disease, Foot and Mouth disease, Porcine Reproductive and Respiratory Syndrome disease and Porcine Epidemic Diarrhea disease, which are often occurred in recent years. In 2014, FMD was occurred in 14 provinces with 2978 cases and death 172 pigs. At the present, there are five provinces have occurred FMD outbreak type O according to Department of Animal Health of Vietnam. For PRRS disease, no outbreak was reported from July of 2013 in Vietnam. In conclusion, pig production scale in Vietnam is small and low bio-security level, so the epidemic such as FMD is often occurred in recent years.

Pig production and pig diseases in Taiwan

Dr. Shih-Ping Chen

Taiwan Board of Swine Medicine Specialists

The pig industry in Taiwan comprises 8,137 pig farms with 592,000 sows. These figures are from the latest pig survey conducted in October 2014. Results from these surveys show that the number of pig farms and the pig inventory has gradually declined year by year, especially for small-scale pig farms. The rate of pork self-sufficiency is about 90% in Taiwan and pork imports come mainly from the USA and Canada.

Challenges in the Pig Industry

Major challenges in the pig industry in Taiwan include international free trade, generational change, a shortage of farm labor and a shortage of young veterinarians to provide services to pig farms.

In order to provide some solutions for the pig industry, several projects have been funded by government to train swine veterinary specialists in the veterinary schools in which Master's Degree courses and specialist pig veterinary training courses have been established. Hands-on practical farm management training has been introduced to train the younger generation of staff on farms, about the batch production system including and adjust pig flow to maximize farm productivity. Some demonstration farms have been set up to introduce this concept to farmers and to show farmers how to implement these programs. An innovation for training young swine veterinarians is the use of training farms where they can participate in daily farm activities and learn to plan operations such as pig flows on farms that they consult to.

A website is provided for swine producers and swine veterinarians to access information aimed at improving their knowledge of pig production and health management. The website can be accessed at: http://pmtw.atri.org.tw/. In the website, are provided videos of our training courses and photos of various common swine diseases.

Pig diseases

Classical swine fever (CSF) and Foot and Mouth Disease (FMD) are targeted diseases for eradication with first control being by compulsory vaccination. In 2014 Porcine Epidemic Diarrhea (PED) was introduced in the farrowing units and caused severe losses in new-born piglets. Recently in 2015, an outbreak of FMD was found in Kinmen Island associated with serotype A infection which had not been previously reported. This outbreak was eradicated through humane destruction of animals on the index farms and surrounding farms.

Currently, the important diseases on pig farms in Taiwan are those caused by Porcine Reproduction and Respiratory Syndrome virus (PRRSV), Porcine circovirus type 2(PCV2), Swine influenza virus (SIV) and coinfection with other pathogens such as Mycoplasma, E. Coli, Salmonella and Streptococcus causing a post-weaning respiratory syndrome which results in severe losses in the nursery piglets.

Control and management

The strategies for controlling the problems are mainly through good husbandry and sound production management aimed at maintaining pig flow using batch production, all in/all out systems and vaccination programs against Hog cholera/Swine fever (HC), FMD and PR. Antibacterial treatment of major diseases, such as those caused by E coli, Salmonella, and Streptococcus is carried out where indicated.

In order to provide records on the farms, the white board recording system has been introduced to monitoring the number of pigs per batch. With the “sow board’ (fig 2), we are able to monitor the pregnant sows in the individual batch to guarantee and prepare enough sows for breeding in the next cycle. The “finishing board” provides a visible record of the losses occurring in each fattening pig batch every week. It is easy to observe the drop of pig numbers in every batch by looking at the white board and then to provide some timely advice on what intervention is needed if there are severe losses in a batch.

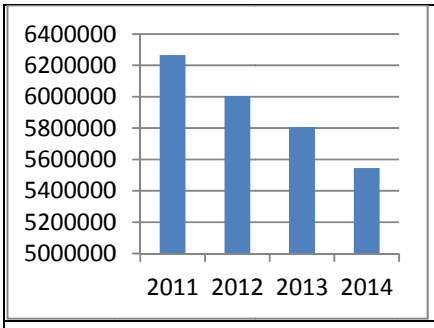

Fig 1. The pigs inventory in past four years in the pig inventory surveys.

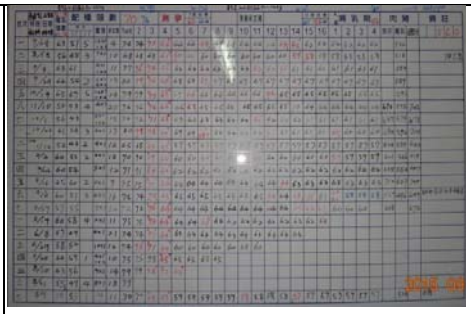

Fig 2. white board recording system has been introduced for monitoring the number of pigs per batch

Enhancing Herd Productivity by Veterinary Supportive Measures

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To enhance herd productivity the whole farm team must understand what are the key factors that influence productivity. Too many farms concentrate on vague averages rather than absolutes. For example farm parameters are set by obsession on bragging rights: pigs per sow per year, the farrowing rate, pre-weaning mortality.
However many of these "production parameters" have little real impact on profit.
Pig farming is the art of repetition. Pig farmers and their advisors should become specialists in variation control.

Variation control
Variation results in loss of control over costs and thus eats into profits. You cannot take costs down to nothing as this also affects profits, but an appreciation of the main sources of variation helps to control costs and maximize profits.

Boar selection
Current boar selection on farms is generally poor. AI is selected on price and a desire to achieve a pregnant sow. AI decisions should be made on real cost indicators which are food conversion ratio and killing out percentages (if the market pays for quality of carcass).

Single serving and other breeding ideas
The pig industry wastes a lot of time and cost in over-breeding sows. Moving to a single serving concept reduces the variation in the finishing pool by spreading the best boar genetics over more sows. This, with a move towards deep uterine insemination will reduce the variation induced into the finishing unit.

Gilt pool management
Piglets in gilts have a more than 3x chance of dying than piglets from sows. In addition they reach weight 10 days later. Having poor control of the gilt pool resulting in a simple numerical variation in the number of gilts between different batches and can create apparent "disease" outbreaks especially related to chronic respiratory disease problems, APP, pre and post-weaning diarrhoea.
Gilts are the fuel that runs the farm, without a great fuel supply the farm will stall. Oral application of altrenogest (like Ceva's Altresyn®) prior to breeding can help taking control over the gilt flow.

Batch breeding target
The farm health team must carefully review the pig layout and plan the farm. *Plan the Farm and then Farm the Plan*. Do not get distracted by local market price changes, pig farming takes over a year to plan out and farms are better managing variation in flow than trying to profiteer. The batch breeding target is the number one determinate of achieving and stabilizing herd productivity.
In order to capture the batch farrowing place it is advised to practice managed over-breeding.
With herd less 50 sows a batch – 10% overbreeding. Herds between 50 and 100 sows a batch – 7% over-breeding. Herd over 100 sows a batch 5% overbreeding.

Cull sow management
A sows should only be culled when there is a pregnant gilt to replace her or her welfare is compromised. Sows should never be culled at weaning. The sow should have been culled at farrowing or at pregnancy check.

Batch weaning target
The farm team must realize the value of the batch farrowing place. An empty farrowing place results in profit loss of the missing finishing weight, but the real loss is the fixed costs associated with the missing weight. Around the world an individual batch farrowing places can account for 500-2000$US of loss. All batch farrowing places must

be full. Pig production also demands that the batch farrowing places produces 100kg of weaner – that is 12x8 kg weaners at 27 days of age.

Finishing targets

The farm makes money selling weaners or finishing weight (dead of alive). The whole farm team must appreciate the true economic value of their decisions. The finishing herd environment should be optimised.

Variation targets to aim for:
The farm should aim for less than a 10% variation batch on batch; 50% is currently normal!

A Small Group Approach to Improving Farm Productivity and Herd Health in Taiwan - Dr. Shih-Ping Chen

Responsible Use of Antimicrobials in Veterinary Medicine

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Antimicrobial use in veterinary medicine has become an important political issue, especially in relation to the contribution that antimicrobial resistance might play a significant role in human medicine and their struggles to contain their own antimicrobial problems in health care situations such as in hospitals and care homes, leading to calls at a political level for national action plans to be developed. The WHO and OIE have created critically important antibiotic list for human medicine and veterinary medicine, respectively. With respect to veterinary medicine it can be agreed that antibiotics are an essential tool to maintain the health of animals and more importantly are needed to maintain production of safe food for human consumption.

Antibiotics are typically used in veterinary medicine either for a therapeutic indication of diseases i.e. for treatment, control and prevention or as a growth enhancer, the so called AGP use. There has been much debate over the AGP use of antibiotics in veterinary medicine and the EU banned AGP use as of 1st January 2006. This decision in the EU was based on the precautionary principle rather than on scientific data. The US FDA took a more pragmatic approach in dealing with the AGP issue based on scientific evidence and also on learning from the consequences of the EU AGP ban i.e. increased therapeutic usage resulting in increased resistance in food borne bacteria especially Salmonella.

The US FDA has, in their guideline 213 for industry, divided antibiotics into three classes. Human use only i.e. classes of antibiotics only used in human medicine, veterinary use only i.e. classes of antibiotics only used in veterinary medicine and shared class i.e. classes of antibiotics used in both human and veterinary medicine. This guideline is requesting veterinary pharmaceutical companies to voluntarily remove AGP label claims of all shared class antibiotics while allowing the AGP claim to remain for those antibiotic classes that are veterinary use only.
As we look at addressing the issues of antibiotic resistance in the Philippines, under the umbrella of responsible use a number of actions could be implemented including but not limited to (1) Antibiotic resistance monitoring (2) Antibiotic Usage Monitoring (3) Antibiotic Availability by Prescription Only (4) National Formularies and Prescriber Guidelines (5) Consideration of the distribution channel and the promotion of prescription only antibiotics

With respect to antibiotic resistance monitoring, information on the change in minimum inhibitory concentrations over time to antimicrobials is needed at the local, national, and international levels to guide policy and detect changes that require intervention strategies. These monitoring programs should not be a one-time occurrence but rather should be continuous and standardized, enabling comparison between countries as well as over time. Monitoring programs require dedicated staff and ideally a national reference laboratory. The main aspects to be considered in establishing a monitoring system

include animal or food groups to be sampled, the number of samples to take, the strategy for collection, bacterial species to be included, methods for susceptibility testing, antimicrobials to test, interpretive criteria (break points and/or epidemiological cut-off values) to use, quality control, data to be reported, analysis and interpretation of data, and reporting. The Danish Integrated Antimicrobial Resistance Monitoring Programme (DANMAP) established in 1995 was the first integrated program in Europe and subsequently a number of European member states have initiated national monitoring programs. However, there remains a great deal of conflict between the national programs and recently a proposal for a common protocol for antimicrobial resistance monitoring was proposed for Europe.

This talk will discuss the consequences of the EU AGP ban and the US FDA position with respect to AGPs and the urgent need for interpreting antibiotic resistance monitoring data using harmonised interpretive criteria.

PRDC math does not add up: 1 + 1 = 4

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Introduction

It is well recognized that porcine respiratory illnesses play a significant impact in the health and wellbeing of growing pigs worldwide. It contributes significantly to the morbidity, mortality, and overall performance of growing pigs all which have a great financial impact for the farm.

The term porcine respiratory disease complex (PRDC) is regularly used today with the recognition that most respiratory infections in swine herds involve multiple etiologies. A study by Choi et al. in 2003 reported that of 2,872 respiratory cases examined by the Minnesota Veterinary Diagnostic Laboratory, only 11.8% (338) of them involved a single pathogen. It is also critical to remember that many swine respiratory agents have been demonstrated to increased dieses in co-infection models. This is critical to our thinking as veterinarians to move away from the one agent, one cause, and one treatment mentality to a more holistic approach to works to mitigate PRDC and its consequences.

Basics of respiratory system immunology

The respiratory system is a highly vulnerable system because it bring environmental air which contains many compounds and organisms in close contact with body tissues and blood. In humans and large dogs it is estimated that it contains some 300 x 10^6 alveoli allowing a surface area over 100 m^2. This creates a great opportunity for pathogens to become localized in the lung and challenge the pig's immune system. The innate immune system relies on filtering done by the nose which also slightly warms the air and is moistened by mucous. The mucociliary apparatus helps create a continuous flow of mucous (estimated at 4-15mm/min) containing "contaminates" away from the lungs and towards pharynx where it can then be swallowed for permanent removal. In addition to the critical mucociliary apparatus, macrophages (alveolar and intravascular), lymphocytes, and neutrophils all work to help counteract invaders. From the adaptive immunity, IgA and some IgG will also be secreted into this mucous blanket helping opsonize and/or neutralize pathogens. Cell mediated immunity along with cytokine production will help regulate the inflammatory response to occur in the lung. Too little inflammation can allow pathogens to replicate, while too much inflammation can significantly damage the host's lung and its ability for effective air exchange (O_2 and CO_2). A strong immune response in NOT always the desired outcome.

Pathogens of concern

The following table has been modified from Opriessnig et al. (2010) and it list most common swine agents which are primary pathogens (cause pneumonia on their own) as well as secondary pathogens (usually only cause pneumonia with other agents).

	Primary	Secondary	Macrophage	Mucociliary
VIRAL				
Aujeszky's disease virus	**X**		**X**	**X**
Classical swine fever		**X**	**X**	
Influenza A virus	**X**		**X**	**X**
Porcine circovirus Type 2		**X**	**??**	
Porcine cytomegalovirus		**X**		**X**
Porcine reproductive and respiratory syndrome virus	**X**		**X**	**X**
Porcine respiratory coronavirus		**X**	**X**	**X**
Torque teno sus virus		**X**		
BACTERIAL				
Actinobacillus pleuropneumoniae	**X**			
Actinobacillus suis	**X**			
Bordetella bronchiseptica		**X**	**??**	**X**
Haemophilus parasuis		**X**		
Mycoplasma hyopneumoniae	**X**		**X**	**X**
Mycoplasma hyorhinis		**X**		
Pasteurella multocida		**X**		
Salmonella spp	**X**			
Streptococcus suis		**X**		
Trueperella pyogenes		**X**		
PARASITIC				
Ascaris suum	**X**			
Metastrongylus spp	**X**			
Paragonimus spp	**X**			

Chart identifies agents which negatively impact macrophage function (directly or indirectly) or mucociliary apparatus as part of their respiratory pathogenesis. Damage to either of these two systems creates a lung that becomes quite vulnerable to other infections.

Non-infectious factors

Although many times we focus on infectious causes for pneumonia, it is important to remember that many other environmental and pig factors significantly contribute to respiratory disease. Environmental factors not only contribute to the severity of respiratory disease, but also play an important role in facilitating the transmission and spread of infectious organisms. High humidity (especially >70%) allows larger particles to travel through the air as well as prolongs the survivability of most infectious organism. Dusty environments can challenge the innate mucociliary mechanism of the lungs limiting its ability to clear pathogens. High ammonia levels irritate the respiratory tract as well as cause paralysis of the mucociliary apparatus. In poultry 25 ppm of ammonia contributes to ciliary paralysis while 40 ppm caused cilia cell death.

From the host side, genetics, age, nutrition, and immunological status influence the severity and outcome of disease. Currently the slight differences in genetic susceptibility to common respiratory pathogens do not play a significant role in disease prevention. Science and technology are moving towards a greater ability to predict and select disease resistance in the future. On the other hand, through managements we are able to better control the nutrition and immunological status of different pig populations.

Doing the math: Severity of co-infections

It has been well established, both under research conditions and in the field, that many times co-infections potentiate PRDC when compared to the individual agent diseases. Opriessnig et al. (2011) summarize examples of 23 different swine pathogen-pathogen interactions that have been studies under research conditions. These include 5 different bacterial-bacterial interactions, 6 viral-viral interactions, and 12 viral-bacterial interactions. Mechanisms of pathogen interactions involve damaging of the mucociliary apparatus, affecting macrophage function, altering cytokine response, or inducing immunosuppression.

Some examples of these interactions involve *Mycoplasma hyopneumoniae* and porcine circovirus type 2 (PCV2). In a study by Opriessnig et al., (2004) it was clearly demonstrated that there were more pigs with inflamed lymph node lesions (0/9 + 6/8 = 8/9) and their lesions were more severe (0 + 1.0 = 1.4) in co-infected pigs than the respective single inoculated pigs. The overall percentage of lung with pneumonia was also significantly increased both at 21 days (0.63% + 16.55% = 33.22%) and 35 days (1% + 10.5% = 23.88%) post infection in the co-infected pigs.

In another study by Brockmeier et al., (2000), pigs infected with both *Bordetella bronchiseptica* and porcine reproductive and respiratory syndrome virus (PRRS) had 10 times more sneezing and 4 times as many coughs as those pigs with either agent alone. These confected pigs had a fever (>40^{o}C) for 8.2 days compared to 2.6 and 4.2 days for the single agent inoculated pigs.

This amplified disease due to pathogen interactions can also be seen in the field. In a study by Haden et al., (2012) they retrospectively collected production data and diagnostic reports for a large commercial production system. They calculated the financial cost associated with percentage of mortalities, culls, tailenders, and average daily gain in different groups in relation to diagnostic report findings. They showed that in their particular system, they were attributing losses of $0.63, $5.57, and $3.23 per pig marketed associated with *M. hyopneumoniae*, PRRS and Influenza A virus (IAV) respectfully. Losses due to combining pathogens were much higher: PRRS and *M. hyopneumoniae* ($0.63 + %5.57 = $9.69); PRRS and IAV ($5.57 + $3.23 = $10.41); and IAV and *M. hyopneumoniae* ($3.23 + $0.63 = $10.12).

These previous examples are just three of many documented cases. It is also important to remember that many times diseases are sub-clinical and thus opportunity for better pig health and more profit has been lost. A great example of this was seen when PCV2 vaccines became available. Herds with clinical disease saw a dramatic decrease in mortality once vaccination was implemented. Herds with no apparent PCV2 clinical sign that implemented PCV2 vaccination also saw a significant change in their "normal" mortality as well as improvements in their pig's productivity. This strongly suggest that in fact, PCV2 was causing some problems in their herds, they were just not measurable and thus "sub-clinical" until vaccination was implemented.

Prioritizing mitigation approaches

It is clear that co-infections significantly alter many pathogen-pathogen interactions. As such interventions must be implemented to mitigate the different pathogens of concerns. From the respiratory disease perspective this is not a complex process.

The first step in any process is to identify the goals of the client. As with any client the goals determine the necessary interventions. Once the goals are clear the next step involves determining the current pathogens affecting that particular site or system as well as determining limitations or constraints that must be worked around. The veterinarian can now work together with the client to establish interventions which can help improve the herd's health status. This includes ensuring the proper nutrition and environment is available for the pig so that the pig's immunity can be maximized to better fight disease. Proper selection and timing of vaccines is critical in helping maximize immunity. Focus should be on vaccines which help protect against primary respiratory pathogens as well as PCV2 (due to its proven sub-clinical effects). Finally a plan needs to be in place to monitor progress to help refine any of the interventions implemented. Ultimately the goal is to minimize pathogen-pathogen interactions and therefore minimize respiratory disease and maximize health.

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Major Endemic Swine Diseases in SouthEast Asia - Dr. Rungroje Thanawongnuwech,DVM, PhD, TBVP

Transboundary Disease Transmission and Regional Cooperation - Dr. Satoshi Otake

African Swine Fever

The development of rapid cross-priming amplification for the direct detection of African Swine Fever in swine and wild boar blood and sera

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Introduction

African Swine Fever (ASF) is a contagious viral disease affecting swine, wild boar, warthogs and other hosts belonging to *Suidae* family [2]. The role of National Reference Laboratory (NRL) for diagnosis of ASF is essential to cope with the current situation caused by this devastating disease. The methods applied by NRL include real-time PCR, enzyme-linked immunosorbent assay (ELISA) and immunoperoxidase test (IPT) [1,2]. However, there is an urgent need of portable and sensitive method for the preliminary detection of ASFV. These requirements are fulfilled by cross-priming amplification method (CPA) [3]. The aim of this study was to develop CPA for the direct detection of ASFV in blood and sera from swine and hunted wild boars.

Materials and methods

Blood and sera samples were collected from 10 pigs and 55 wild boars originating from the confirmed ASFV cases and outbreaks in Poland during 2014 and 2015. About 10 µL of each blood sample was diluted in 90 µL of APO buffer (Novazym, Poznan, Poland) and incubated for 10 min. The CPA temperature was optimized in a water bath, at various temperatures, from 55.4°C to 66.9°C in time from 30 to 120 min. The assay volume was 15 µL of Isothermal Mastermix (OptiGene, Horsham, West Sussex, United Kingdom) and 5 specific CPA primers.

Results

The conducted CPA optimization showed the most efficient amplification underwent at 56.2°C starting from the 45 min. The final results were observed as the fluorescence of positive samples. The CPA detection limit was 10^{-6} dilution of DNA extracted from the standard ASFV strain and was equal with the UPL real-time PCR method. The CPA successfully detected the presence of ASFV DNA in diluted blood and sera samples without DNA extraction (Figure 1). These results were consistent with UPL real-time PCR.

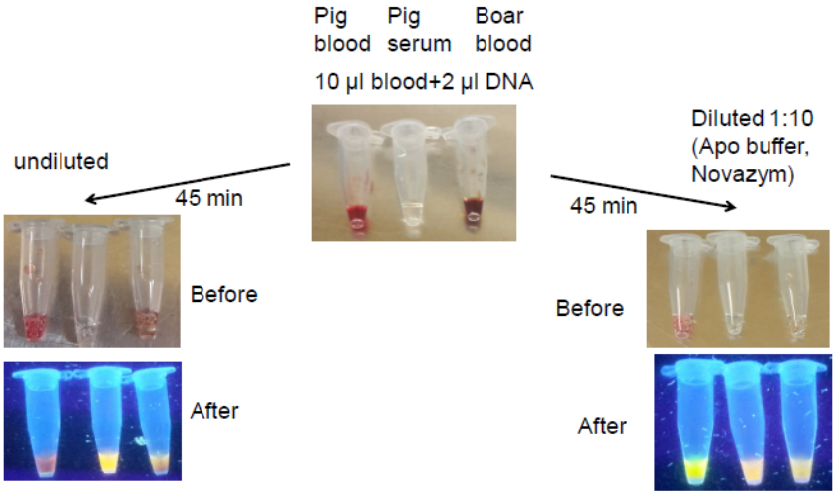

Figure 1. Direct detection of ASFV in blood, diluted blood and sera using cross-priming amplification (CPA).

Discussion

The effective and reliable detection of ASFV has an important epidemiological and economical aspect. The detection methods recommended by the OIE include virus isolation, PCR, ELISA and IPT assays. The presented CPA does not require DNA extraction except 10-fold dilution in APO buffer. The CPA was highly sensitive and may be conducted in a water bath without application of thermocyclers. The developed CPA was capable to specifically detect ASFV DNA in the blood and sera directly collected from swine and wild boar.

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Assessing biosecurity practices in 290 Korean pig farms: preliminary results

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Introduction

Biosecurity is becoming increasingly important in the swine industry as a means of controlling the introduction, persistence, and spread of pathogens [1]. In spite of the importance of biosecurity measures to avoid the introduction of swine diseases into farms and to contain the persistence and spread of infections already present, there is little information available in the literature on the biosecurity status of Korean pig farms. To the author's best knowledge this is the first report tried to classify pig farms according to their biosecurity practices in Korea.

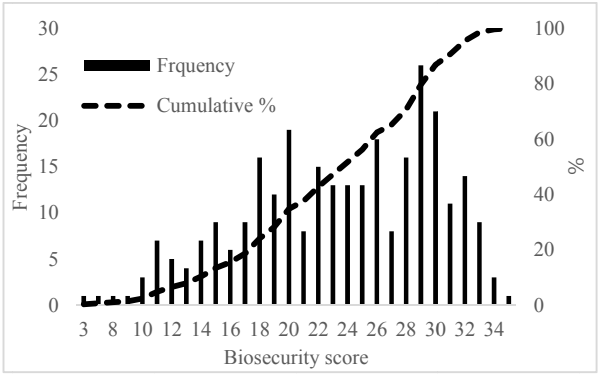
Materials and methods

Data were from the 2014 Nationwide Pig Farm Disease Survey (April to December 2014), which was financially supported by the Ministry of Agriculture, Food and Rural Affairs (MAFRA) and Korean Pork Producers Association (KPPA). The target population comprised of all such pig farms, and a sample size of 345 farms was specified due mainly to financial limitations. This figure accounts for 5.6% of a total of 6,130 farms in Korea, as of December 2013. The pig farms were randomly selected from the farm lists registered to each of the 9 local governments. The unit of interest in this study was the individual farm, defined as any premise where at least one pig was reared, and artificial insemination centers and breeder farms were excluded in the analysis purposes. A structured questionnaire was divided into 9 parts with a combination of open, closed, and open questions was used to elicit data on the following categories: demographics, housing, feeding, animal health, reproduction practices, serological testing, disposal of dead stocks, vaccination, and biosecurity measures. The questionnaire was administered by trained veterinarians who participating for the project. In our analyses, a total of 40 variables were selected to produce a biosecurity score. To this end, all variables were coded using value of 1 (biosecurity measure present) or 0 (absent), and total biosecurity scores were categorized into 4 classes: 1-10 (very low biosecurity standard), 11-20 (low), 21-30 (moderate), and 31-40 (high). Data (n=290) were analyzed using SAS software (version 9.3).

Result

Of the 290 farms analyzed, 13.1% of farms were classified into low risk group (high biosecurity standard), 52.1% in moderate risk group, and 34.8% in high risk group (low and very low biosecurity standard) (Figure 1).

Figure 1. Distribution of biosecurity scores of Korean pig farms (n=290), based on 2014 national survey



Discussion

Farms with higher biosecurity level were more likely associated with: restrictions on feed-delivery vehicles for farm entrance (51.9%), off-site supply room for feeds (50.0%), off-site pick-up location for finishers (44.4%), driver restrictions on farm entrance for market pig movement (42.2%), restriction on manure disposal trucks entering the farm (30.7%), off-site removal of dead stocks (29.4%), and endorse HACCP accreditation (27.3%).

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The effect of antimicrobial substances on the outer membrane of gram-negative bacteria and their efficacy in weaning pigs

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Introduction

The outer membrane (OM) of gram-negative bacteria protects cells from external agents. Permeabilizer (PS) (Biomin® Permeabilizing Complex, BIOMIN, Austria) destabilize the OM and increase the permeability of the OM to other antimicrobials (Soto *et al.*, 2015)

The objective of the current trials were to study the potential of PS to weaken the gram negative bacterial outer membrane and the effects of a blend of organic acids, cinamaldehyde and PS (Biotronic® TOP3; ACPS) on growth and intestinal parameters in pigs.

Materials and methods

In-vitro trial: Uptake of 1-N-phenylnaphthylamine (NPN) by bacterial membranes indicates damage of Gram-negative bacteria. NPN and culture suspension of *E.coli* and Salmonella *typhimurium* were mixed. PS in different concentrations or Ethylenediaminetetraacetic acid (EDTA) were added and fluorescence was monitored with fluorometer.

In-vivo trial: Ninety-six weaning pigs at 35days old were assigned to three treatment groups (3 replicates /group) and fed commercial diets.

Negative control group (NC): non-growth promoters

Positive control group (PC): Colistin 100g/MT + Chlortetracycline 100g/MT

Treatment group: ACPS 1kg/MT

Growth performance, the pH in the gastro-intestinal tract (GIT), microbial population in the ileum and villus height in the jejunum was determined at the end of the trial (day 56).

Results

The PS was shown to effectively destabilize the OM of Salmonella *typhimurium* and E.*coli.* Results showed that at the 56th day of trial, body weight, average daily gain and feed intake were higher in the trial group compared with the two control groups. The pH of digesta collected from the stomach was lower in the group fed ACPS in comparison with the control groups. Microbial analysis showed that the number of E. *coli* and Salmonella *spp.* in the ileum of pigs were reduced in the groups fed ACPS and antibiotics in comparison with the negative control. Counts of Lactobacilli and Bifidobacteria in the ileum were higher in the trial group than in the other two groups. The villus height in the jejunum was greater in the positive control group and in the trial group in comparison with the negative control.

Figure 1. Results of NPN assay

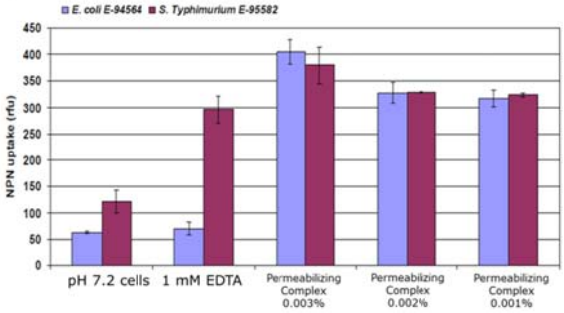

Table 1. Growth performance of pigs

	NC	PC	ACPS
No. animals	32	32	32
Initial BW d 35, (kg)	10.0	10.9	10.7
Final BW d 91, (kg)	42.5[a]	43.2[a]	48.1[b]
FI (g/pig/day)	1092[a]	1112[a]	1269[b]
Daily weight gain(g)	580[a]	578[ab]	668[b]
FCR	1.88	1.92	1.90
Mortality, no. of pigs	1	2	-

a,b means with different superscripts within a row differ significantly

Table 2. Microbiology, histology, and pH-value in GIT of pigs

	NC	PC	ACPS
Bacterial count in ileum, Log cfu/g			
E. coli	6.302[a]	5.970[b]	5.873[b]
Coliforms	8.277[a]	7.977[b]	8.151[b]
S. *typhimurium*	8.220[a]	7.941[b]	8.053[ab]
Lactobacillus spp	6.295[a]	6.172[a]	6.515[b]
Bfidobacteria	6.891[a]	6.878[a]	7.130[b]
Histology of jejunum			
Villi length, µm	418.33[a]	448.63[ab]	456.18[b]
Crypt depth, µm	192.37	188.77	187.15
pH in stomach			
pH in stomach	4.28[a]	4.30[a]	3.67[b]

a,b means with different superscripts within a row differ significantly

Conclusions and Discussion

In conclusion, PS effectively destabilized the OM of E.*coli* and S. *typhymurium,* and ACPS positively influenced on the intestinal microbiota and growth of weaned pigs.

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PCV2 expression in the porcine ovary

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Introduction

Porcine circovirus type 2 (PCV2) is a small circular single stranded DNA virus. PCV2 is associated with many disease manifestation in all ages of pigs [1,2]. Although study on the influence of PCV2 is well established in nursery and fattening pigs, additional knowledge on PCV2 associated reproductive failure is still required. To our knowledge, it is still not fully understood on the mechanism of PCV2 infection on reproductive apparatus in gilts and sows. The objective of the present study is to determine the expression of PCV2 antigen in the ovarian tissue of naturally infected gilts.

Materials and Methods

Ovarian tissue sections were obtained from 11 culled gilts. The age and body weight of the gilts were 278 days and 152 kg, respectively. Immuno-histochemical technique was applied to all tissues section to determine the expression of PCV2 antigen [3]. The tissues was evaluated under a light microscope. The PCV2 antigens were localized by the brown intranuclear staining in the tissue sections. A total of 2,131 ovarian follicles (1,437 primordial, 133 primary, 353 secondary and 208 antral follicles), 131 corpora lutea and 66 atretic follicles were evaluated. The follicles were interpreted as positive if they contained at least one positive cell. The PCV2 expression in different compartment of the ovarian tissues were compared within the ovary by using paired *t* test. $P < 0.05$ was considered statistically significant.

Results

PCV2 antigen was detected in the ovarian tissues in all of the culled gilts (Figure 1). In each ovarian tissue, PCV2 antigen was detected in 13.5% of normal follicles, 1.8% of atretic follicles and 3.8% of corpora lutea ($P < 0.05$). PCV2 antigen was found in 22.2% of primordial follicles, 10.2% of primary follicles, 3.2% of secondary follicles and 8.8% of antral follicles. PCV2 antigen was detected in primordial follicles more than secondary follicles, corpora lutea and atretic follicles ($P < 0.05$).

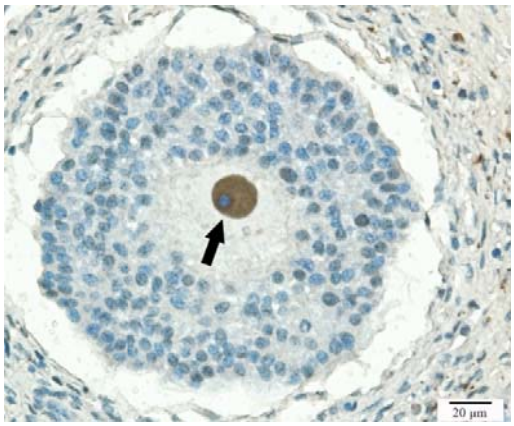

Figure 1 PCV2 antigen expression in the oocytes of the porcine ovary (black arrow)

Conclusions and Discussion

The present study is the first report demonstrated the expression of PCV2 antigen in the oocytes of gilt. This indicates that oocytes is one of the target cells of PCV2 infection. In our previous study, PCV2 DNA was detected in 30% of the ovarian tissues and in 45% of the uterine tissue in naturally PCV2 infected gilts [3]. Nevertheless, no pathological lesion in relation to PCV2 DNA detection has been observed in both the ovarian and the uterine tissues [3]. In conclusion, PCV2 antigen expressed in all types of the ovarian follicles and corpora lutea.

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Swine enteric coronavirus disease (SECD) elimination and prevention in a genetic multiplication system in North America

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Introduction

PEDV, PDCoV and TGEV are causal agents of SECD. Diarrhea, vomiting and 100% mortality for 3-5 weeks are observed in suckling pigs infected with PEDV in NA. It has been estimated that about 60% of the USA breeding herd has been impacted by PEDV since its detection in May 2013 causing a shortfall of 12.500.000 market hogs (11%) for 2014. PDCoV was also recently reported in NA with a similar but milder clinical presentation. The route of introduction to the USA has not been confirmed but genetic analyses indicate relationship with isolates previously detected in Asia. This abstract describes the elimination experience and prevention program in a 92.000 sow genetic multiplication system in NA.

Materials and Methods

Between November 2013 and April 2014, 47,4% of the breeding herds in the system became infected. Specifically, 26,4% were infected with PEDV only, 10,5% with PDCoV only and 10,5% with both viruses. Likely because their remote location and intensive biosecurity none of the genetic nucleus farms were affected. The system has accumulated a record of only one or no PRRS or *M. hyopneumoniae* outbreaks per year in the past several years. As soon as the presence of PEDV is confirmed, piglets are weaned early and moved to an offsite nursery for better survival, the gilt development unit is loaded and controlled oral live virus exposure is initiated to all sows and gilts aiming to homogenize immunity to minimize the duration of shedding. In order to interrupt the introduction of susceptible individuals, every piglet is weaned off site and the herd is closed to replacement pigs until the third consecutive PCR-negative biweekly test. Negative sentinels are brought in at this time, and if no clinical or diagnostic evidence of infection is detected after five weeks, negative replacements can enter the herd. Keeping litter integrity, minimizing piglet handling and intensifying cleaning and disinfection in the farrowing rooms are key for the success of the project.

Results

By August of 2014 all breeding herds were consistently weaning negative pigs. By the end of October 2014 the lack of shedding had been verified through the use of sentinel pigs in all herds. It took 20,1 (7,1 – 28,1) weeks for the herds infected with PEDV and 14,6 (11,9 – 17) weeks for the herds infected with PDCoV to consistently wean PCR-negative pigs. No new or "reactivated" infections have been detected and 100% of the growing sites are negative at this time. Likely as the result of the surveillance program, the transportation biosecurity protocols and the quarantine at destination, no SECD has been transmitted through pigs or semen.

Conclusions

The successful elimination of PEDV and PDCoV from all herds is encouraging but reconstituting a susceptible population is concerning. Therefore, a SECD prevention initiative has been initiated across the system focused on five main risk areas: (1) feed ingredients, reception, manufacturing and delivery, (2) transportation decontamination and inspections, (3) people training and engagement, (4) manure management and (5) mortality disposal.

Bacteriospermia of boar semen, antibioterapia and efficiency of Dicol®

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Introduction. Bacterial contamination in extended porcine semen occurs frequently in artificial insemination centers. The choice of the appropriate antibiotic treatment included in semen extender is very important. Furthermore, it is necessary to use extenders with an effective antibiotic combination. The aim of this study is to check the main bacterial species isolated from seminal doses, to assess the activity of antibiotics commonly used in veterinary and to verify possible resistances of bacteria. In parallel, the objective was also to check the appropriate combination of antibiotics to control bacteria and demonstrate the effect of Dicol® on controlling *in vitro* semen contamination.

Materials and methods. The study was carried out with commercial extended semen coming from more than 100 Boar studs located throughout the Spanish geography. Bacterial cultures from semen samples, isolation and identification were performed. Antibiograms for all isolated bacteria were carried out using 29 antibiotics. Semen samples collected into extender free of antibiotics and divided in aliquots were infected with 10^6 ufc/ml of two strains: *Serratia marcescens (gram-negative), and Micrococcus spp. (gram-positive)*. Infected semen samples were diluted to reach 30 millions sperm/ml and incubated with 4 increased concentrations of 10 antibiotics (A1 to A10), a multiple of the minimal inhibitory concentration (MIC) of each antibiotic (according to CLSI): 1x, 5x, 25x and 125x µg/ml. All samples were incubated at room temperature and cultivated for bacteria content assessment after 50 min and 24 hours of treatment. Finally, five ejaculates from five different boars were collected and divided into 3 groups which were initially diluted (1:1) with Dicol, Vitasem or Duragen extender. Subsequently, all groups were divided into 10 aliquots, and infected with 10^6 cfu/ml of final concentration from 10 pure isolated multi-resistant strains. After 25 or 50 min, final dilution was carried out with Duragen, Vitasem or antibiotics free extender to reach a $3x10^7$ spermatozoa/ml. All samples were stored at 16ºC and bacterial load determined at 24 hours. **Results.** Semen culture showed that 26.24% of examined samples were infected (more than 300 UFC/ml). In total 113 species of bacteria were isolated and cloned. The most commonly found in extended semen samples were: *Proteus vulgaris* (3.5%), *Serratia marcescens* (6.19%), *Serratia liquefaciens* (12.39%), *Stenotrophomonas maltophilia* (7,96%), *Staphylococcu spp* (9.4%), *Cedea* (4.4%), *Micrococcus spp* (5.3%), *Morganella mornanii* (4.4%) and other species (*E. coli, Bordetella, Enterococcus, Klebsiella, Kurthia, Pseudomonas etc.)*. Analysis of antibiograms of all isolated bacteria showed a higher sensitivity profile of gram-positive bacteria to antibiotics, and lower of gram-negative. The results of the controlled infections showed a significant reduction in both bacteria content after 50 min of incubation with some antibiotic concentrations. Interestingly, *Serratia marcescens* and *Micrococcus spp* content in culture after 50 min of treatment was <1ufc/ml with 25x MICs concentration of A1, A3 and A10 and 125x MIC concentration of A2, which allowed to antibiotic combination and Dicol design for bacteriospermia treatment. The results of Dicol efficiency showed almost no growth (<1cfu/ml) of bacteria in samples of Dicol group even in the case of final dilution with antibiotics-free extender. In parallel, samples of Duragen group showed small growth of *Serratia marcescens* up to 100 ufc/ml. However, Vitasem group was more sensitive to bacterial growth such as *Serratia marcescens* and *Achromobacter xylosoxidans*.

Discussion and conclusion. The analyses of semen contamination and antibiograms of the studied antibiotics showed surprisingly that sensitivity of gram-negative bacteria exactly to 9 antibiotics is similar in total isolated bacteria. This finding implies an important tool to select the best antibiotic for an effective prevention treatment of semen or biotherapy, against large spectrum of bacteria. Therefore, the controlled infection by *Serratia marcescens* (gram-negative), and *Micrococcus spp.* (gram-positive) and the results of antibiotics concentrations effects permitted to develop effective combination of antibiotics and Dicol Design. Finally, the efficacy study of Dicol, concluded that it is a suitable tool for contamination control in ejaculates, and final dilution is also effective with free antibiotics extender.

Case study : Accidentally use of antibiotics in Enterisol Ileitis vaccinated piglets

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Introduction

Lawsonia intracellularis is the cause of enteric diseases like porcine proliferative enteropathy (PPE), proliferative hemorrhagic enteropathy (PHE) and porcine intestinal adenomatosis (PIA), normally are known as ileitis. Ileitis is commonly occurring in fattening pig in major pork production countries including Thailand causing relevant economic losses e.g.by reducing ADWG and increasing FCR.. Tiamulin, Tylosin or Lincomycin are antibiotics used to treat Ileitis. Vaccination with an oral attenuated live vaccine (Enterisol Ileitis®, Boehringer Ingelheim) is an alternative to antibiotics to control the disease effectively. To ensure efficacy of the live vaccine no antibiotics effective against Lawsonia should be used for at least 7 days around vaccination (3 days before through 3 days after vaccination).
This case report evaluates the effect of antibiotic treatment on the efficacy of the vaccine, by comparing performance of pigs receiving medicated feed during vaccination to pigs receiving non-medicated feed.

Material and Methods

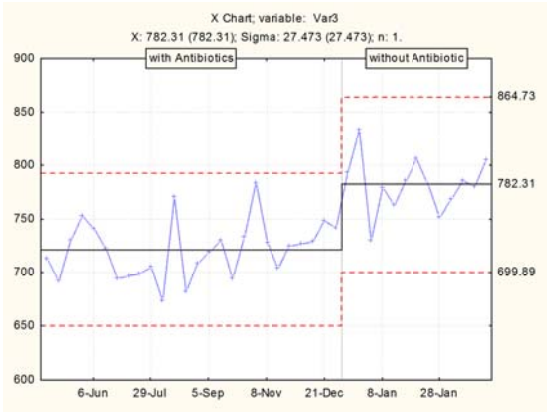
The retrospective field observation was conducted in a 2-site production farm with 2,000 sows in Thailand. The sow herd was stable for PRRSV, piglets were weaned at 24 days of age and moved from the nursery to the grow-finisher site at the age of 8 weeks. Average fattening period was 118-120 days from end of nursery. Enterisol Ileitis® was given to piglets at 3 weeks of age to control Ileitis routinely. However during Jan - Jun 2013 the growers performance was found lower than farm standard, after investigation the owner found that workers forgot to withdraw antibiotics in creep feed at the time of vaccination. Therefore the owner corrected this problem by withdrawing antibiotics from creep feed starting in July 2013.

In total, 39 batches were evaluated. The 26 batches of 11,755 pigs reported during May – Dec 2013 were vaccinated and accidentally received antibiotics (Amoxycillin 200 ppm + Tiamulin 180 ppm + Colistin 120 ppm) in creep feed during Ileitis vaccination. The 13 batches of 5,797 pigs reported during Jan-Feb 2014 were vaccinated without antibiotics in creep feed.
The fattening performance such as average daily weight gain (ADWG), feed conversion rate (FCR) and slaughter weight are summarized in Table 1, the t-test was used for statistical analysis. Figure 1 shows a statistical process control (SPC) chart of the ADWG (Statisca version 10).

Table 1 Fattening pig performance in observed groups.

	Group A (with antibiotics during vaccination)	Group B (without antibiotics during vaccination)	Diff	P-value
ADG (g/d)	724.14	786.19	62	0
FCR	2.38	2.32	-0.06	0.114
Weight (kg)	108.94	116.65	7.71	0.003

Figure 1 SPC chart of ADWG (g/d)



The ADWG in Group B, which was vaccinated without antibiotics in creep feed, was better than in Group A, in which antibiotics were present in creep feed during vaccination time (782.31 and 721.27 respectively), resulting in an average slaughter weight 7.71 kg higher in group B than in group A. The difference in FCR between both groups (2.38 vs 2.32) was statistically not significant.

Discussion

The results of this case report demonstrate the positive impact that Ileitis vaccination can have on pig performance and underlines the importance that antibiotics effective against Lawsonia are withdrawn from the feed around and during vaccination.

THE EFFICACY OF INGELVAC AUJESZKY'S MLV ADMINISTERED BY INTRANASAL ROUTE IN A 300 SOW LEVEL MALAYSIAN FARM

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INTRODUCTION

Aujeszky's disease is a herpes virus infection of pigs characterised by nervous and respiratory signs. In young pigs it is often leading to death with a rise of temperature. In adults infections, it may be inapparent or associated with still birth or abortion(1).

Despite Aujeszky's vaccination has been implemented in the swine farm since a long time ago, the prevalence of Aujeszky's disease in Malaysian farm is 46.15%(2). The objective of this study was to determine the efficacy of Ingelvac Aujeszky MLV on reducing the field exposure (gE) via intranasal route in piglets.

MATERIALS AND METHODS

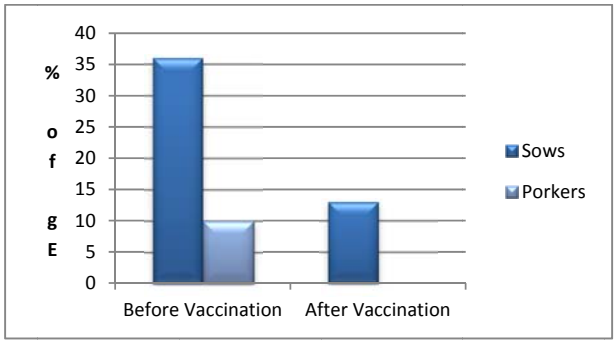
The farm was located in Central region of Malaysia, the most pig-dense areas in the country with more 120 farms in 100km^2 . It is a 300 sow level farm, single-site, farrow-to-finish operation. Since many years ago, most of the farm owners were using PR-vaccine on breeding herd only. From the serology results (IDEXX PRV gE test kit) pigs showed high percentage of gE antibody presence despite vaccinating Aujeszky's vaccine for a long time. In the month of September 2014 the farm started to use sow and piglet vaccination of Ingelvac® Aujeszky MLV every 3 months for sow via intramuscular route and day 1 to 3 of age for piglet via intranasal route. Parameters on the difference in percentage of gE presence in the serorogy results before and after 6 months of using Ingelvac® Aujeszky MLV.

Table 1: Percentage of gE seroconversion before and after vaccination with Ingelvac® Aujeszky MLV.

Group	gE (%)	
	Sows	Porkers
Before vaccination (Sept 2014)	4/11 (36%)	1/10 (10%)
Ingelvac Aujeszky MLV (March 2015)	2/15 (13%)	0/15 (0%)

There was an improvement in terms of percentage of gE seroconversion before and after vaccination with Ingelvac Aujeszky MLV, with sows reduced from 36% (4/11) to 13% (2/15) and porkers from 10% (1/10) to 0% (0/15). The reduction percentage of gE seroconversion in sows was up to 64% while 100% in porkers.

Figure 1 : Percentage of gE seroconversion before and after vaccination with Ingelvac® Aujeszky MLV.



DISCUSSIONS

Vaccinating with of Ingelvac® Aujeszky MLV reduced field virus exposure (gE) in both sows and porkers. Intranasal vaccination has once again proven its efficacy in reducing seropositives in porkers(3).

CONCLUSION

After 6 months of vaccination with Ingelvac® Aujeszky MLV, this farm successfully reduced the percentage of gE sero-positive in both sows and porkers herd.

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Efficacy of AKIPOR® 6.3 against a novel pseudorabies virus variant affecting Bartha-K61-vaccinated herds in China

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Introduction

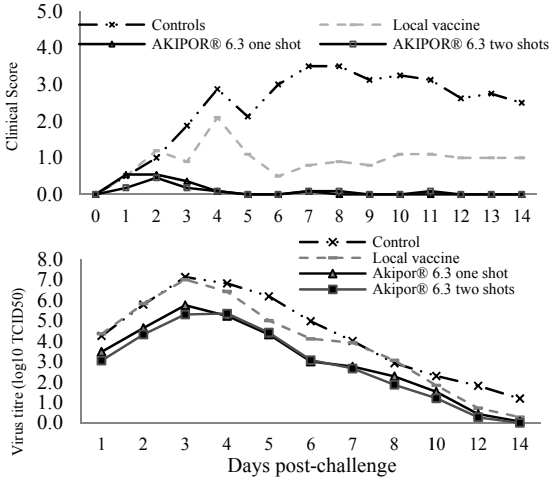
Pseudorabies (PR), caused by pseudorabies virus (PRV), is an economically important infectious disease. In China, vaccination had effectively contributed to its control during the past 30 years. However, at the end of 2011, severe PR outbreaks were reported in many PRV-vaccinated pig farms. Later on, this situation quickly spread in pig herds across China, causing heavy economic losses to the swine industry. Researchers reported that some commercial vaccine strains showed poor protection to the new epidemic strains (1-4). The aim of this study was to assess the efficacy of AKIPOR® 6.3, a Bartha strain-based, gE-deleted MLV, in pigs against a novel PRV antigenic variant, named ZJ01 (5, 6), isolated in China in 2012 and hypothetized to affect Bartha K-61 vaccinated herds.

Material and methods

The study was carried out in Nanjing University animal facilities, PRC. Forty-one PRV-free pigs aged 3-4 weeks were randomized according to bodyweight to four vaccination groups: AKIPOR 6.3 one shot (D0), AKIPOR 6.3 two shots (D0, D17), a local commercial gE-deleted Bartha K-61 vaccine one shot (D0) or saline injection (D0). On D31, all pigs were intranasally challenged with 10^5 $TCID_{50}$ under 1 mL of ZJ01 strain. The pigs were daily monitored for rectal temperature and general clinical observations for 14 days post-challenge according to (7) with slight modifications. Growth performance following challenge were assessed by calculating the relative daily weight gain. PRV-specific gE and gB antibodies were titrated using commercially available ELISA kits (IDEXX Laboratories, Westbrook, USA) on D0, D17, D31 and D45. Virus excretion for 14 days post-challenge was determined by collecting nasal swabs submitted to a qPCR technique.

Results

One pig in the local vaccine group died on D2. Death was not related to vaccination. Seventeen days post vaccination, only 4/10 pigs generated positive gB-specific antibody responses in the local vaccine group while 9/11 and 10/11 pigs generated positive gB-specific antibody responses in AKIPOR 6.3 groups. Each vaccinated pig was positive to gB-specific antibody before challenge. After infectious ZJ01 challenge, all pigs seroconverted towards gE protein thus validating the conditions of the study. All the non-vaccinated control pigs displayed steady progression of PR syndrome, from fever to respiratory and nervous signs and 4/8 pigs died before the end of the post-challenge monitoring period. Meanwhile, all pigs immunized with AKIPOR 6.3 one shot or two shots remained healthy and survived without any severe clinical signs. Two out of ten pigs exhibited serious central nervous disorders and died in the local vaccine group. Growth was significantly improved only in the AKIPOR 6.3 vaccination groups compared to the unvaccinated one.



Figures 1&2. Post-challenge clinical scores and viral excretion

During the peak period of virus excretion, the virus shedding of animals vaccinated with AKIPOR 6.3 was significantly lower than animals vaccinated with the local vaccine group ($p<0.05$) or controls ($p<0.05$). Over the 14-day post-challenge period, virus shedding was significantly reduced in AKIPOR 6.3 groups as compared to the local vaccine group.

Discussion and conclusion

In this experimental vaccination-challenge study using a PRV variant known to affect Bartha-K61-vaccinated herds, AKIPOR 6.3 provided 100% protection against fatal pseudorabies as well as a clear reduction of clinical signs and virus shedding. This underlines its possible use for PRV eradication in China.

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Application of SEBS(Site Evaluation of Biosecurity System) for PRRS ARC in Korea

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Introduction

Biosecurity is the key to prevent introduction of new virus and to intervene circulation within a herd. To inform farmers and to make the better biosecurity system, we need to score the level of biosecurity of the site. For that reason, we made the new scoring system called 'SEBS-Site Evaluation of Biosecurity System' in the level of biosecurity for a site and applied for the sites of PRRS ARC(Area Regional Control) in Korea since 2010.
We tried to show where a site placed as its PRRS status on SEBS quadrant.

Materials and Methods

Members of PRRS ARC 2013 made the SEBS with risks for introduction and circulation within a herd of PRRS virus known.

Table1. The draft structure of SEBS

Internal Biosecurity		**External Biosecurity**	
Checklist	**Value**	**Checklist**	**Value**
AIAO	40	Pig related	56
Acclimation	25	Semen	20
Hospital for sick pigs	15	Truck/Cars	10
Needle management	9	Neighbors	5
Sanitation	3	Visitors	3
Cross-fostering	3	Materials	3
Boots change	2	Others	3
Carcass	1		
Regular monitoring of SEBS	1		
Vermin / Insect	1		
Total	**100**	**Total**	**100**

We applied SEBS to the sites in three PRRS ARC areas.

Fig1. Three area of PRRS ARC project in 2014.

Results

All farms didn't received good score both internal and external biosecurity checklist.

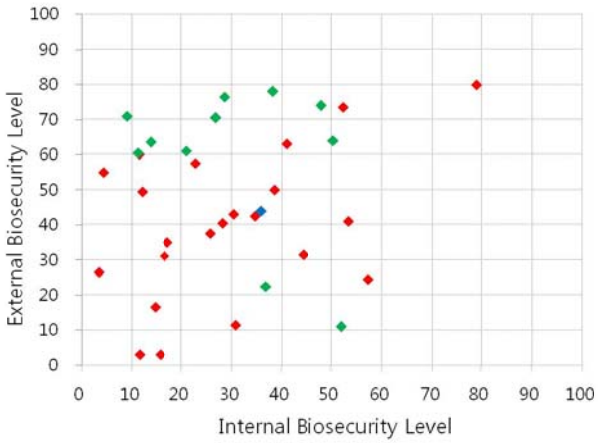

Fig2. Results of SEBS (red=PRRS unstable, green= PRRS stable, blue=PRRS negative)

Discussion

There are some aspect are different from farm in US, so we need our own tool for biosecurity scoring. SEBS which we made is useful tool to scoring the biosecurity level of the site and it also motivated some the farmers to do something better for their own biosecurity.

Most of PRRS stable herds were placed on higher external biosecurity level than those of PRRS unstable. There are two stable herds were placed on lower external biosecurity level.

One of two herds has maintained as a closed herd since 2009 and the PED outbreak was in the other herd in this winter.

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PRRS ARC Program in Yaro Danji, Korea: a case study

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Introduction

Danji is a collective geographical term, representing high pig density site of Korea. It consists of many small-scale farms with different biosecurity levels, and farms within a Danji are located geographically very closely. Since 2012, 'PRRS ARC (Area Regional Control) program, funded by KPPA (Korea Pork Producers Association), has been implemented in Yaro Danji consisting of twenty farms within one kilometer radius. These efforts identified some key challenges related to PRRS virus elimination, included continuation and expansion of ARC, participation of producers, and enhancement of biosecurity level. Based on our preliminary findings, we have modified the role of each players to optimize the program, taking into account demographics and locations of swine populations in Yaro Danji.

Process

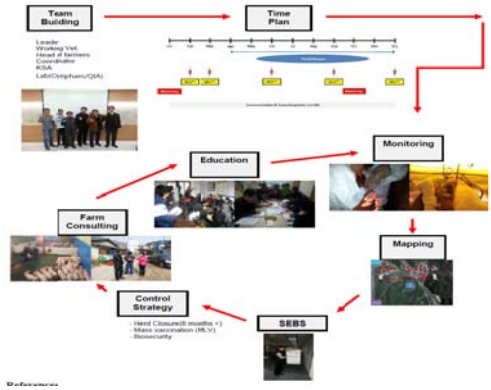

Table1. The role of each player of PRRS ARC project in Yaro Danji

	Role of each player (2012~2014)	Role of each player (2015~)
KPPA	Financial support and managing the program	Managing the program
Leader (Farmer)	Communication at the area	Same as 2012
Advisory (Vet)	Cooperate and advise to make PRRS control strategy, planning the schedule, monitoring PRRS status and on-site education	Providing workshop program for working vets
Working vets	Perform the program, checking biosecurity status, sample collection for serological testing, data analysis. Problem solving of client farm : Problem solving of client farm : - other bacterial/viral diseases - ventilation - management	Education for farmers, perform the program, checking biosecurity status, sample collection for serological testing, data analysis.
Farmers	Cooperate with their working vets	Same as 2012
Coordinator	Communication	Same as 2012
Lab	Laboratory testing (PCR, Sequencing, ELISA)	Same as 2012
Other vets	None	Periodic blood collection.

References 1. HoChul Kong, PRRS ARC Process in Hapchun (DanJi: High Pig Dense Area). APVS Proceeding. Vietnam. 2013.

Effect of Ingelvac® PRRS MLV pig vaccination in a wean-to-finish farm in Taiwan

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Introduction

Porcine reproductive and respiratory syndrome (PRRS) is the major viral disease in swine and estimated to cost $5.6-7.6 per marketed pig. Modified-live vaccine is one of the control tools which show consistent efficacy in field. The objective of this study is to evaluate the effect of Ingelvac® PRRS MLV vaccination in pigs in Taiwan.

Materials and methods

This study was conducted in a wean-to-finish farm located in Taiwan. Eight hundred fifty-nine (859) piglets weaned from a PRRS-vaccinated sow herd were assigned into 2 groups: Control group (C, n=460) follow their regular vaccination program; Vaccinated group (V, n=399) with an additional vaccination of Ingelvac® PRRS MLV (Boehringer Ingelheim Vetmedica, Inc., St. Joseph, MO) at weaning (21 days). Then these pigs were transported to second site and kept in different houses by group. Mortality, market weight (MW), and days to market (DTM) were reported from the farm. Serum samples were collected from 15 pigs per group at 6, 9, 12, 15 weeks of age for ELISA and RT-PCR (pooled of 5) test to confirm the challenge of PRRS virus from field. Boxplot analysis of ELISA titers was done using Minitab 17.

Result

Primary parameters were shown in Table.1 The vaccinated group had a 44% less mortality compared to the control group. Vaccinated pigs were also marketed 8 days earlier than controls with 3 kgs heavier average weight . ELISA and RT-PCR results were shown in Table. 2. Seroconversion was the hallmark difference of vaccinates over controls. Titers thru time were illustrated by Boxplot chart in Figure 1. Vaccinates show a higher average S/P ratio compared to controls Even at 6 weeks of age (3 weeks post-vaccination), the vaccinates already showed higher average S/P ratio compared to controls.. The higher S/P ratios in the control group at the end confirms the field challenge. Sequences of the isolates distinguished field from vaccine strain

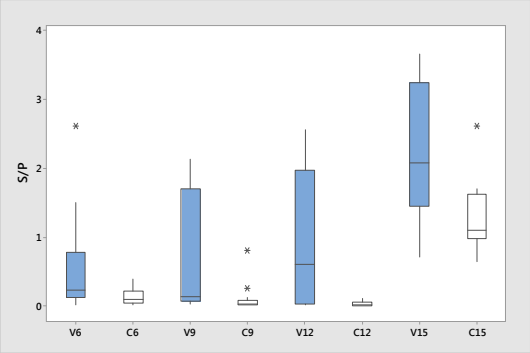
Table.1. Primary parameters of V and C group

Group	Morttality(%)	MW(kg)	DTM(day)	ADG(g)
V	7.02	116.5	182.8	637
C	12.61	113.3	190.7	594
Diff	-5.59	+3.2	-7.9	+43

Table.2. PRRS ELISA positive rate and PCR results (positive number/ 3 tests)

Group	weeks of age			
	6	9	12	15
V	40(0/3)	40(1/3)	66.7(0/3)	100(0/3)
C	0(0/3)	7(0/3)	0(0/3)	100(2/3)

Figure 1. Boxplot chart of overtime ELISA s/p value in V (blue box) & C (white box) groups



Discussion

The seroconversion of pigs after vaccination were consistent with previous findings[1] Vaccination of Ingelvac PRRS MLV in growing pigs is effective to protect against the negative effect on performance from field challenge [2,3].

Reference

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Pseudorabies in Nursery Pigs

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Introduction

Pseudorabies is endemic in swine in most parts of swine production countries. It is still one of the economically important viral diseases of swine, causing multimillion dollar losses each year in countries where it is found. Control and eradication of Pseudorabies has been a challenge for Taiwan swine farms, especially those herds situated in the mid-South pig-dense regions. This abstract reports the diagnosis of Pseudorabies in a Taiwan wean-to-finish pig herd and its response to an intervention program.

Materials and Methods

Pigs came from a wean to finish swine farm at central Taiwan with an inventory of 2300 pigs. In the sow herd, suckling pigs were weaned at around 3-week-old, then shipped to the finishing farm. Before weaning, these pigs were immunized against *Mycoplasma hyopneumiae* and Porcine Circovirus type 2 (PVC2). Around the end of March 2014, some 8-week-old pigs showed clinical signs of rough hair, swollen joint, cripple, tremor, hindquarter paralysis. tDyspnea and conjunctivitis were also noted. Some affected pigs showed severe central nervous syndrome. Many pigs had dark round patches in the skin. Out of 600 pigs in the nursery house, the morbidity was 25% (150/600) and the mortality was 4% (24/600). Weaners were raised at the concrete floor with partial stainless wire mesh. There were double curtains for ventilation in the open nursery house with two exhaust 24 inchfans. Sows were immunized against classical swine fever and pseudorabies vaccine. Pseudorabies vaccine were immunized three times a year. Four eight-week-old pigs were submitted to the Animal Disease Diagnostic Center, NCHU for pathological diagnosis on April 7, 2014.

Results:

External examination revealed rough hair coat with raised, round black skin lesions on hind limbs, shoulders, and facial skin around lower eyes. At necropsy, antero-lateral firm pneumonic meat like lesions were present on both cardiac and diaphragmatic lobe of the lungs, involving 30% of total lungs. On a right stifle joint, increased synovial fluid was noted. Only small amount of ingesta was found in the stomach. Histopathological examination of skin revealed hyperkeratosis with cell debris and infiltrated neutrophils in the epidermis, there were aggregations of moderate amount of lymphocytes and some macrophages in the edematous dermis. The lung showed mild interstitial bronchopneurnonia, while non-supurative meningitis in cerebrum and lymphocytic depletion in lymph node were also noted. No bacteria were isolated in lung, brain and joint fluid during microbial examination. Molecular biological test of PCR (Polymerase Chain Reaction) for pseudorabies virus (PRV), porcine circovirus type 2 (PCV2) from skin resulted PRV and PCV2 nuclear acid positive.RT-PCR Reverse Transcription-Polymerase Chain Reaction) for porcine reproductive and respiratory syndrome virus (PRRSV), classical swine fever virus (CSFV) nuclear acid from lymphoid organs, brains and lungs of piglets resulted PRRSV positive, while CSFV was negative. From the above mentioned analyses (history, clinical signs, lesions, histopathology, molecular biological test) a final diagnosis of pseudorabies of nursery pigs was made.

Conclusions and Discussion:

The clinical observation of affected 8-week-old weaning piglets displayed nervous signs of convulsion with hindlimb paralysis and experienced many dark round plaque skin lesions, histo- pathological examination of lymphocytic dermatitis and non-supurative meningitis, the positive PCR test of Pseudorabies virus nuclear acid in the affected skin and tissue strongly suggest that the piglets were infected in the finishing farm with field pseudorabies virus. While PCV2 was also positive in PCR test for skin and tissue, but there was no evidence of PCV cytoplasmic inclusions in histopathology, Porcine Circovirus Disease (PCVD) was excluded from the differential diagnosis. Although the sows in the sow herd were immunized with PR vaccine every 4 months, we recommended the piglets shall immunize against PR two weeks prior to the outbreak of this episode. There are no known treatments for PRV infections. Control measures of the condition depend on elimination of the causative virus through disease control. Weaner pigs severely affected with skin disease and central nervous sign compatible with Pseudorabies should be disposed off. Four months after the implementation of the intervention program, no further clinical case has been observed. The morbidity rate of nursery pigs decreased. In conclusion, a skin form of Pseudorabies virus infection was diagnosed as the main cause of post-weaning loss in the nursery pigs.

Acknowledgements: We sincerely thank Boehringer Ingelheim Taiwan Ltd. for supporting fund.

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The analysis results of PRRS vaccination for growing pigs

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Introduction

A characteristic of PRRSV infection is a relatively slow development of immunity to other pathogens and A PRRSV infection is clinically characterized by respiratory disease in growing pigs of all ages, causing huge economic losses (Zimmerman et al., 2012). In spite of current status, PRRS vaccination rate is very low for growing pigs in Korea. The objective of this study was to evaluate the efficacy of a new type II PRRSV vaccine against type II infected pigs in growing pigs in terms of respiratory disease based on clinical, immunological, virological, and pathological results.

Materials and Methods

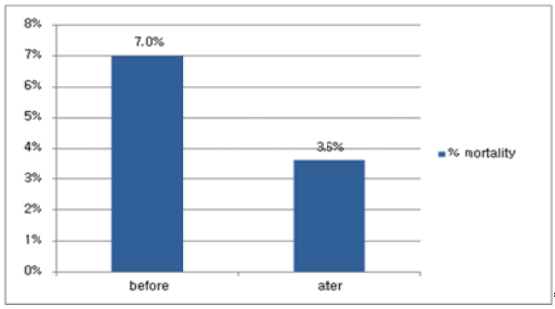
We selected the PRRS unstable farm which has 600 sows. We applied PRRS vaccine for piglets during 6 consecutive weeks. We selected newly introduced Type II PRRS vaccine, Fostera PRRS (Zoetis; Lot No. A405013B/A40691). We identified this farm with Type II PRRS 6 months earlier through certified lab service.
The pigs in group were immunized with Fostera PRRS administered as a 2.0ml dose at 21 days of age based on the manufacturer's recommendations. At 70 days of age, the body weights of vaccinated pigs were evaluated and at 91 days of age, the mortality rates were identified as well.

Results

The performance data were as below.
Table1. The performance data before and after PRRS vaccination

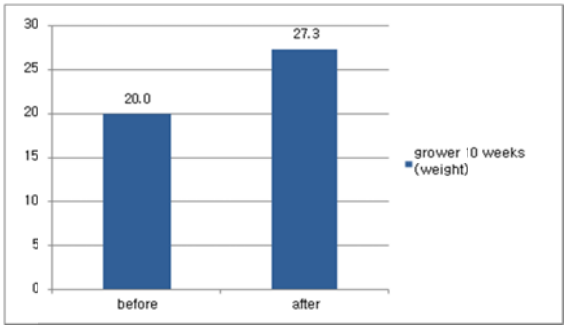
	before (6 months) *	after (6 batches) **	Δ
Mortality % (wean to 10 weeks)	7.0	3.6	-3.4
Body weight (10 weeks)	20.0	27.3	7.3

* Sep, 2014~ Feb, 2015



** 7th Mar ~ 21st Apr, 2015

Fig1. Mortality before and after PRRS vaccination



(wean to 10 weeks old)

Fig2. Body weight before and after PRRS vaccination (wean to 10 weeks old)

Discussion

The results can confirm that the pigs administered with Fostera PRRS showed significant figures and may have fundamentally different characteristics from non-vaccinated group in growing pigs.
PRRS vaccination for growing pigs per batch is worth to this farm as below.
[In-body weight]
250 weaned pigs per batch x 3.4% = 8.5 grower
8.5 growers x 27.3kg = 232.05kg
232.05kg x 3.5USD/kg = **812.175 USD/batch**
[Out-vaccine cost]
250 weaned pigs per batch x 1.5 USD = **375 USD/batch**
We thought PRRS vaccination for piglets is valuable to this farm.

Reference

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Genetic Characterization of ORF5 and ORF7 gene of Porcine Reproductive & Respiratory Syndrome Virus found in Malaysia.

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[3] *Rhone Ma (M) Sdn. Bhd., Petaling Jaya, Selangor, Malaysia.*
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Introduction

Porcine reproductive and respiratory syndrome (PRRS) is one of the most important infectious diseases of swine [1] worldwide and has caused great economic losses in the swine industry. In this study we compare the ORF5 and ORF7 gene sequence from Malaysia with gene isolates from other Asian countries to study the diversity of PRRSV in Malaysia and its genetic relatedness to vaccine virus strains which may help shed some light on the potential origin of PRRSVs in Malaysia.

Materials and methods

Sampling

Pooled organs (brains and lymph nodes) were collected from an atypical PRRSV outbreak in Malaysia for diagnosis and genetic characterization.

Phylogenetic analysis of the ORF7 and ORF5

Sequencing of the ORF5 and ORF7 gene of PRRSV was done using the BigDye Terminator v3.1 cycle sequencing kit chemistry. The phylogenetic tree was constructed by using the distance-based neighbor joining method and generated by using Mega 5® (Biodesign Institute, Tempe, Arizona).

Result

The nucleotide sequence identity matrix of the ORF5 gene derived from this study showed 100% nucleotide sequence identity match with JN-HS from Shandong, China, BH58/10 from Laos, 112HCM from Ho Chi Minh, Vietnam, HCMC-3867 from Tay Ninh, South Vietnam, Hau Giang from Vietnam and JilinTNI from China. The nucleotide sequence identity matrix of the ORF7 gene derived from this study showed that the nucleotide sequence of ORF7 gene derived from this study is 99.4% similar to JN-HS from Shandong, China, JX-A1 from China, BH58/10 from Laos, XL from China, YD from China, DC from China, BB0907-F44 from China, BB0907-S34 from China, DT7 from Dong Thap, Vietnam, DN1107 from Dong Nai, Vietnam, DN694 from Dong Nai, Vietnam, DN 444 from Dong Nai, Vietnam and HCM.CC3 from Ho Chi Minh, Vietnam.

Discussion

The genes characterized in this study and the neighboring countries; Vietnam, Cambodia, Laos, and Thailand share the same ancestor from Shandong, China; a US-type PRRSV strain whose common ancestors are VR-2332-USA and RespPRRS-USA. It has been documented that PRRSV strains differ in virulence and vary genetically. Concerns that vaccine strains or derivatives of the vaccine strains may induce disease continue to be discussed [2] because vaccine viruses have been demonstrated to persist in vaccinated pigs and to spread to non-vaccinated pigs, indicating their ability to circulate in the field [3]. Our study suggests that recombination events between vaccine strains and field isolates may contribute to PRRSV virulence in the field.

Acknowledgement

The authors would like to thank Prof. Dr. Henry Too for his invaluable advice & contribution.

Reference

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COMPARISON OF ANTIBODY TITER OF PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME (PRRS) VIA ORAL FLUID AND SEROLOGY DETECTION METHOD IN MALAYSIA

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Introduction

Porcine reproductive and respiratory syndrome virus (PRRSv) is a major threat to pig industry. Malaysia is a PRRS endemic country, with 89.2% seroprevalence and predominantly North American Strain in 2012[1]. Therefore, reliable and improved diagnostic methods are needed to help disease surveillance. The objective of this study was to evaluate the use of the oral fluid samples instead of serum samples to detect PRRS by using IDEXX ELISA test kit.

Material and Methods

2 swine farms from Peninsular Malaysia were selected. The pig herds in each farm were divided into 7 categories: gilts, young sows (2nd to 5th parities), old sows (6th parities and above), grower-finisher at 10, 15, 20, 25 weeks old. 5 individual pigs were randomly selected within each category each farm for oral fluid sampling and serum sampling. Total of 35 individual oral fluid samples and 35 individual serum samples were collected from 35 individual pigs each farm.

The oral fluid and serum samples were tested with IDEXX PRRS Oral Fluid Antibody Test Kit and IDEXX PRRS X3 Antibody test Kit respectively. The data was analyzed by using IBM statistical Package for the Social Sciences (SPSS). Pearson's product-moment correlation test was used to determine the correlation between oral fluid and serum samples.

Results

In general the S/P ratio for the oral fluid samples was higher than the serum samples. However, the values of S/P ratio of the oral fluid and serum samples showed similar pattern and did not deviate much for breeder herd and grower-finisher herd (Figure 1 & 2). The oral fluid and serum samples results were found statistically correlated with each other (p=0.0001, r=0.638) (Figure 3).

Figure 1. Average S/P ratio for oral fluid and serum samples of breeder herds from both farms

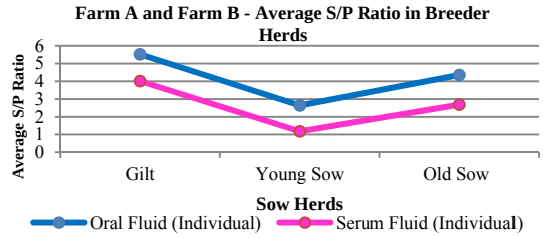


Figure 2. Average S/P ratio for oral fluid and serum samples of grower-finisher pigs from both farms

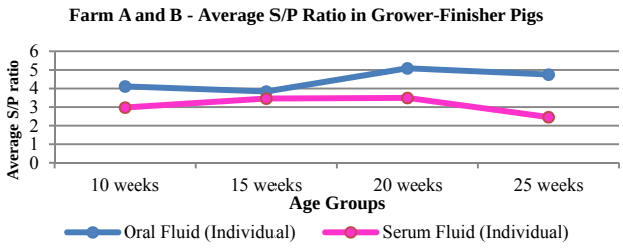
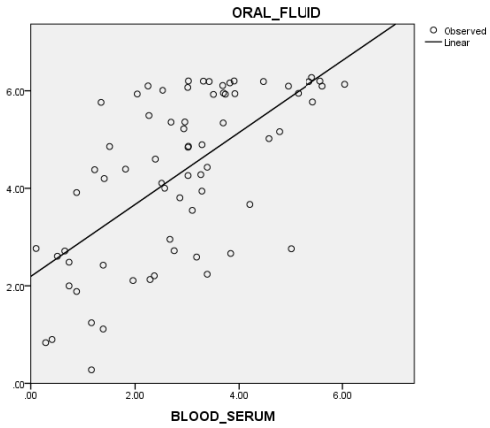


Figure 3. Correlation between S/P ratios for oral fluid and serum samples from individual pigs in both farms (Pearson's correlation coefficient, r =0.638)



Discussion and Conclusion

Oral fluid sampling method is non-invasive and causes less handling stress to the animal as compared to serum sampling method. With the data showing that the results of the oral fluid samples had a similar pattern as the serum samples and statistically correlated with each other, hence, the oral fluid could be a useful and reliable sample to replace serum as in PRRS surveillance in the farm.

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Genetic characterization of type I porcine reproductive and respiratory syndrome virus in South Korea

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Introduction

Porcine reproductive and respiratory syndrome (PRRS) is a major problem in swine industry worldwide. [1]

Although type I PRRS vaccine was imported to Korea recently, genetic variation of European strain is major concern because of alteration in antigenic site. Among the structural proteins of PRRSV, the GP5 and M proteins of PRRSV constructs a disulphide-linked heterodimer and acts as epitope for neutralizing antibody. [2] It can be a good tool for expectation of immunological changes in PRRSV. This study performed to compare these genes of type I PRRSV strains in Korea.

Materials and methods

Serum samples identified as PRRSV (type I) positive and one of cell culture adapted type I PRRSV isolate were used in this study. Two sets of primers targeting ORF5 and ORF6 gene were designed according to the nucleotide sequences of type I PRRSV previously published. The amplified DNA was run on a 1.2% agarose gel and the target DNA band was extracted via gel elution for sequence analysis. Sequence alignments were performed with Clustal W alignment program and phylogenic tree was constructed with MEGA 6 program in neighbor-joining method.

Result

Comparison of the ORF5 nucleotide sequences showed 85-95% identity with the KNU-07 strain and 88-89% identity with the Lelystad strain, respectively. The ORF 6 sequences shared 90-96% homology with KNU-07 strain and 89-92% with Lelystad strain. The genetic difference of nucleotide sequences of ORF5, 6 between Korean field strains and Amervac vaccine strains were 84%-88%, 90%-91%, respectively. Phylogenic tree showed that ORF 5 and 6 sequences of Korean strains formed a distinct cluster with other strains of European PRRSV including type I vaccine strain.

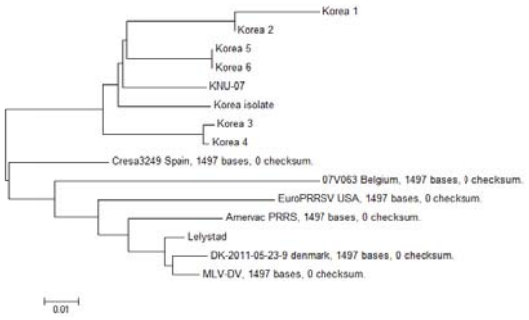

Figure 1. Phylogenic analysis of ORF5 sequence of Type I PRRSV strains.

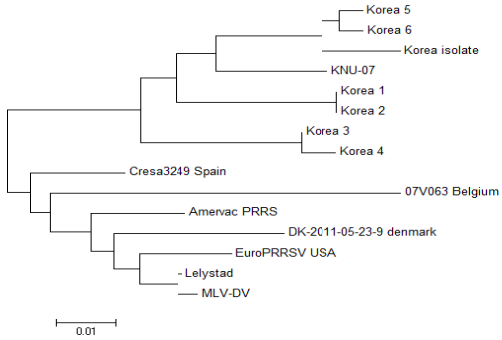

Figure 2. Phylogenic analysis of ORF6 sequence of Type I PRRSV strains.

Discussion

The result of this study suggests that genetically diverse strains of type I PRRSV are exist in Korea, forming a different cluster with currently circulating type I PRRSV in other country. Therefore, there is considerable variation in immunologically important proteins, which suggests the necessity for the efficacy analysis of currently available vaccines.

Reference

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Comparison of two PCV2 vaccines in a commercial farm in the Philippines

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Introduction

In this study, we evaluated the production data and serological profile of two PCV2 vaccines in a farrow to finish commercial farm unit that vaccinated both sows and piglets. The vaccination in sows was off label at 4 weeks pre-farrow. In consideration to possible maternally derived antibody interference, the piglet vaccination was scheduled at 5 weeks of age in the nursery. Porcilis®PCV (MSD Animal Health) vaccine was administered as a comparative vaccine at 5 weeks of age and production data of the finishers were measured.

Materials and Methods

The farm was using Product F for more than 2 years already. Although production data was significantly better as compared to no PCV2 vaccination, they were interested in comparing the current performance against a new PCV2 vaccine in the market. Only the finisher data was evaluated and all data was compared at the end of the production phase. A total of 180 pigs were entered in the study; 90 piglets were vaccinated with Product F and 90 piglets were vaccinated with Porcilis PCV. The overall average values for average daily gain (ADG), mortality rate and PCV2 ELISA serological profile (Biochek PCV) were analyzed by the number of pigs placed in each group. The data were analyzed using Mann-Whitney Test for comparison on a group basis.

Results

The mean body weights collected throughout the study are summarized in Table 1. The Porcilis PCV vaccinated group had a higher harvest weight. The analysis of the overall average weight gain and average daily gain are in Table 2. The group vaccinated with Porcilis PCV has significantly higher weight gain with an average daily gain of 737 grams, which was 42 grams higher than Product F vaccinated group.

Figure 1 shows the serological profile of serum samples collected at 5 time points. The serum was tested using the Median Diagnostics VDPro PCV2 Ab ELISA Test Kit to measure the S/P ratio from the day of vaccination until 2 weeks before the animals were sold to market. The antibody level remained consistently high until 21 weeks in pigs vaccinated with Porcilis PCV. There was a consistent decrease in the antibody level in the Fostera PCV vaccinated animals until 17 weeks of age. An anamnestic response following a field infection occurred at 21 weeks, resulting in an antibody level that was even higher than the post-vaccination level.

Table 1. Summary of body weights.

Group	Pre-Vax (Kgs)	Transfer (in Kgs)	Harvest (Kgs)
	5 wks	14 wks	23 wks
Porcilis PCV	11.02	47.92[a]	98.67[a]
Product F	11.25	46.17[b]	93.92[b]

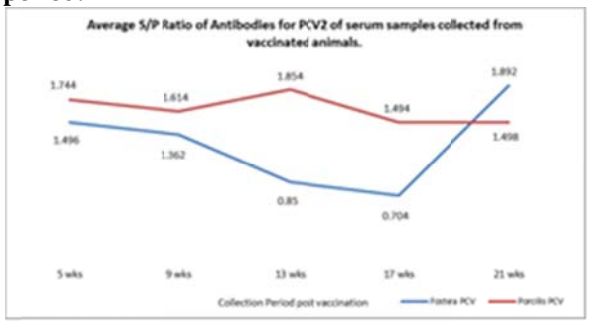
a, b: value with different superscripts in each column represent statistically significant differences ($p<0.05$)

Table 2. Summary of production data and mortality.

Group	Gain (Kgs)	ADG (Kgs)	% Mort
Porcilis PCV	87.65[a]	0.737[a]	4%[a]
Product F	82.67[b]	0.695[b]	4%[a]

a,b: value with different superscripts in each column were significantly different ($p<0.05$)

Figure 1. ELISA PCV S/P ratio at 5 collection period.



Conclusion

This study compared the performance of Porcilis PCV vaccine to Fostera PCV. Porcilis PCV vaccinated pigs had improved average daily gain and produced a consistently higher level (with the exception of 21 wks) of antibodies throughout the fattener production phase.

Field experience of whole herd approach for PRRS control in a Japanese pig farm locating in pig dense area

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Introduction

Porcine reproductive and respiratory syndrome (PRRS) is an infectious disease mainly affecting the reproductive and respiratory systems of pigs. In Japan it imposes a significant economic losses especially in swine dense area where PRRS control is more difficult than farms in isolated location. This case is an example of controlling PRRSV in a 500 sow farrow to finish farm located in pig dense area in South Kyushu in Japan.

Materials and methods

A whole herd approach was initiated including 1) Change of pig flow, separating farrowing barns and nurseries 2) Biosecurity improvements using 5 S concept 3) Whole herd double mass vaccination of PRRS MLV and quarterly mass vaccination on sows and piglet vaccination at weaning to follow and 4) Monitoring using proper diagnostics (Table 1).

	d 0	d 21	d 23	d 55	d 184
<Vaccination> Mass Vaccinate Whole Herd (sow and pigs*)	☆	☆			
<Vaccination> Regular vaccination on sows quarterly and piglet at weaning	→	→	→	→	→
<Monitoring> Suckling pig			PCR/ELISA	PCR	PCR/ELISA
<Monitoring> Pigs (cross sectional)			PCR/ELISA		PCR/ELISA

*Excluding suckling pigs and pigs to be marketed in the next 3 weeks

Table 1 Vaccination protocol & monitoring

Result

After weaning mortality has dropped significantly after this whole herd intervention program (Figure 1). Monitoring results are shown in the table 2.

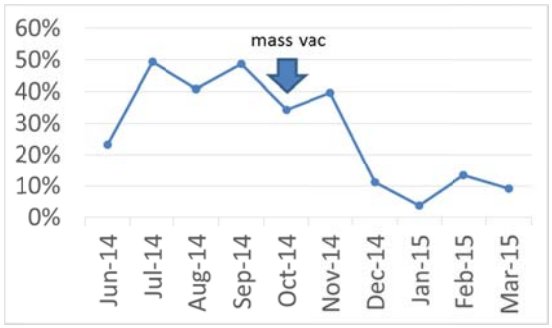

Figure 1 Post weaning mortality

	d 23 (Oct 30th , 2014)		d 55 (Dec 1st, 2014)		d 184 (Apr 9th, 2015)	
	PCR	ELISA	PCR	ELISA	PCR	ELISA
Suckling Pig PCR (n= 28～30)	+(WT)	+	—	NT	—	+
Pigs 30 days old	+(WT)	+	NT	NT	—	+
Pigs 60 days old	+(WT)	+			—	—
Pigs 90 days old	—	+			—	+
Pigs 120 days old	—	+			—	+
Pigs 150 days old	—	+			—	+
Pigs 180 days old	—	+			—	+

Table 2 Vaccination protocol & monitoring

Discussion

Holistic PRRS control approach including change of pig flow, increase of internal biosecurity using 5 S concept and strategic use of Ingelvac® PRRS MLV successfully controlled PRRSV in post wean pigs.

Uniform immunity achieved by double mass vaccination followed by regular sow and piglets vaccination results in breaking the chain of infection from nursery to farrowing and reducing the virus load entering the nursery by reduced circulation in the breeding herd.

Reference

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Pathogenicity of Vietnamese strain highly pathogenic porcine reproductive and respiratory syndrome virus to sows in late- and mid-gestation

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Introduction

In 2006, highly pathogenic PRRS (HP-PRRS) was occurred in China and posed a great concern to the global swine industry [1]. Highly incidence of reproductive failures in all stage gestations were reported in HP-PRRS field cases, although reproductive failures of typical type of PRRS are mainly characterized by late-term abortion and premature farrowing. In addition, pathogenicity of HP-PRRSV was different by each experimental study [2, 3], and capability to induce reproductive disorder is still unclear. In this study, the potential of HP-PRRSV to induce reproductive disorder in late- and mid- term pregnant gilts was investigated.

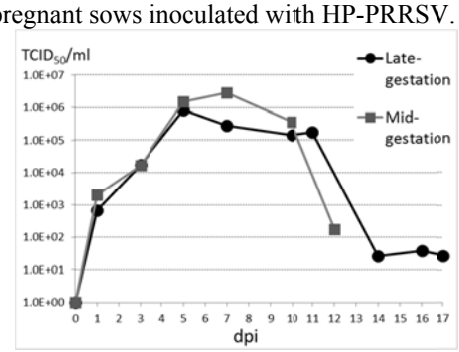
Materials and methods

Four (90 days of gestation; group 1) and three (60 days of gestation; group 2) PRRSV free SPF pregnant sows were intranasally inoculated with $1x10^5$ $TCID_{50}$ HP-PRRSV (100186-614 strain; isolated in Vietnam, 2010). Sows were monitored daily for clinical signs. Serum was collected at 0, 1, 3, 5, 7, 10, 14, and 17 days post inoculation (dpi). Sows were euthanized when they aborted, and tissue samples were collected from sows and fetuses. Viral RNA in serum samples of sows and several organs were measured by quantitative real time RT-PCR. Histopathological examination was performed on collected tissues, and immunohistochemistry was conducted for same sample with anti PRRSV monoclonal antibody (SR30, Rural Technologies Inc., SD) using paraffin embedded tissues.

Results

In both group, body temperature increased from 2 dpi, and peaked in 8 dpi (over 40 ℃) with mild respiratory distress. Groups 1 and 2 sows aborted at 11-17 dpi and 10-12 dpi, respectively. Histologically, mild interstitial pneumonia and small necrotic foci in lymph nodes were observed in all sows. Viral antigens were detected in lung and lymph nodes lesions, and uterus. In fetuses, no abnormal findings, except for autolysis, were observed by gross examination. Microscopically, only a few fetuses showed small necrotic foci in lung and mild lymphadenitis. Small necrotic foci were detected in the tip of second folds of fetal placenta in both groups. Viral antigens were also detected in some lymphoid organs and fetal placenta. Viral RNA was detected in blood samples of pregnant sows from 1 dpi, and shown approximately 10^5 to 10^6 $TCID_{50}$/ml at 5-10 dpi. In uterus of gilts and fetal organs including lung and spleen, viral RNA was also detected.

Figure 1. Viral RNA in blood samples from pregnant sows inoculated with HP-PRRSV.



Discussion

In this study, abortion in late and mid stages of gestation was reproduced in pregnant sows inoculated with HP-PRRSV. Clinical signs, pathological changes and viral dynamics were similar in both groups. Although, mechanism underlying the development of fetal placental lesion is still unclear, these lesions might be involved in abortion of HP-PRRS.

Acknowledgements

This work was supported by research project for improving food safety and animal health of the Ministry of Agriculture, Forestry and Fisheries of Japan.

Reference

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[2] Han D. et al. (2014). Vet Microbiol 169, 135-146.
[3] Metwally S. et al. (2010). Emerg Dis 57, 315-329

Oral delivery of enteric-coated TGE vaccine protects piglets from TGE by passive transfer of maternal antibodies.

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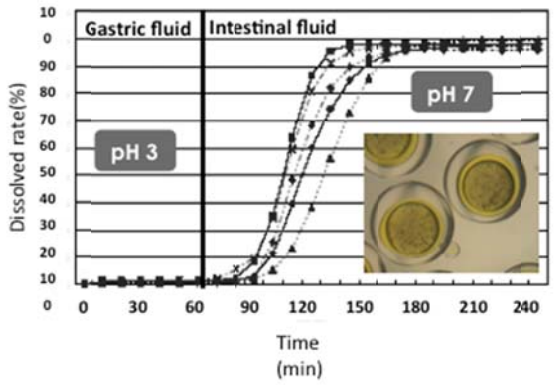
Introduction

Transmissible gastroenteritis virus (TGEV) invades intestinal epitherial cells and causes severe diarrhea in neonatal piglets. A passive transfer of TGEV-specific maternal antibodies to intestinal tracts of neonates is the major protective measure against TGEV infection. In this study, we orally administrated TGE vaccine encapsulated in enteric capsules to pregnant sows and evaluated the vaccine efficacy to protect their neonates against TGE.

Materials and methods

The enteric capsules consisted of three layers; a hydrophilic core containing live attenuated H5 strain of TGEV, lipophilic intermediate layer, and enteric outer shell to maintain its particle structure. To evaluate vaccine efficacy of the TGEV-capsules, two pregnant sows were immunized by using different prime-boost protocols; one sow (C-L) was primed orally with TGEV capsules and boosted with the intramuscular administration of the live attenuated TGEV H5 strain. The other sow (Cx5) was prime-boosted with five consecutive oral administrations of TGEV capsules.



Result

The TGEV capsule remained solid in artificial gastric fluid (pH3), and gradually dissolved in artificial intestinal fluid (pH7) *in vitro* (Figure1).

Both vaccination protocols elicited TGEV-specific IgG, IgA and neutralizing antibody responses in sera and colostrum/milk (Figure2). After farrowing neonates from the C-L and Cx5 sows were fed either with their mother's milk or with artificial milk. The neonates fed with mother's milk showed TGEV-specific antibodies in their sera, implying a passive transfer of maternal antibodies. All neonates were challenged with a virulent TGEV strain at 2 day after birth. The neonates fed with artificial milk exhibited severe TGE clinical symptoms at one day post infection (dpi) and most of them died by 4 dpi. In contrast, the onsets of TGE in the piglets fed with mother's milk were delayed, and they survived during the experimental period. The vaccine delivery system using enteric-coated capsule would be useful to protect against TGEV and other pathogens that infect their host via mucosal surfaces.

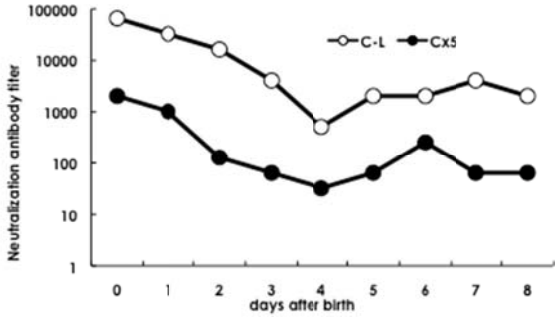


Figure 1
(Left) Solubility test of TGEV capsule in vitro
Figure 2
(upper) TGEV neutralizing antibody titers in immunized sows' milk

First results of PED control in the Philippines by means of a modified live PED vaccine

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[1]Private Swine Practitioner Philippines and Asia
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Introduction

Porcine Epidemic Diarrhea (PED) is a Coronavirus infecting pigs globally but most especially in Asia[1,2,3]. In the Philippines, the outbreaks have been causing problems in commercial farms. This field trial was conducted to confirm the efficacy of a Modified Live PED Vaccine (Enterisol® PED) in a commercial farm under field conditions.

Methodology

The trial was conducted in a 500-sow farrow to finish farm in the North part of the Philippines. The farm had historical PED-like breaks in 2006 and then again in 2008. During the second wave of the break they decided to vaccinate with an live oral PED vaccine (Enterisol PED MLV).

Despite vaccination, the farm was still having poor performance especially high mortalities (32% per month on a 12-month average) and low weaning weights. After being confirmed positive for PED by PCR in January 2013, the farm decided to evaluate a modified live PED vaccine in August 2013 given parenteral twice at 6 weeks and then again at 2 weeks pre-farrow in sows and gilts.

The results of the vaccinates were compared with historical batch performances. Both local and systemic reactions were observed. The pre-weaning mortality and weaning weight results were compared using the chi-square and using Student's t-test (SAS 9.4.) Results were considered significant, if $p \leq 0.05$.

Results

There was neither local nor systemic reaction observed in the vaccinated group following the two immunizations. A total of 86 sows (42 controls, 46 vaccinates) with a total of 968 piglets (450 controls, 518 vaccinates) were included into the trial.

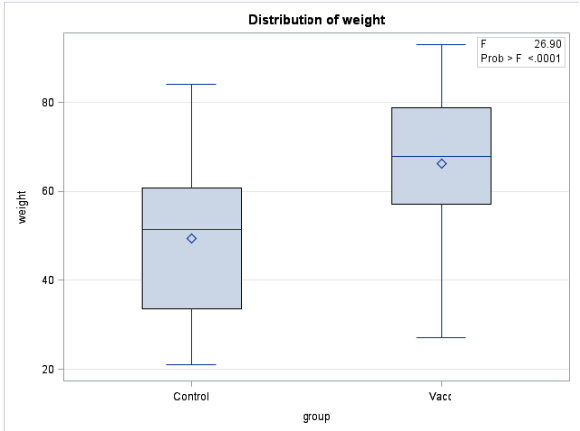
Vaccination yielded a significantly lower pre-weaning mortality as shown in table 1.

Table 1: Pre-weaning mortality between

Total no of animals	Group	Pre-weaning mortality (no)	Number of pigs survived	p-value
968	control	133 (30%)	317 (70%)	P< 0.01
	vaccinates	92 (18%)	426 (82%)	

Vaccination had also a significant effect on litter weaning weight as shown in Graph 1. Mean weaning weight of the pigs from vaccinated sows were 66.31 kg versus 49.49 kg in the non-vaccinated controls.

Graph 1: Litter weaning weights (kg)



Discussion

PED remains a challenge for the Se Asian pig industry. The modified live vaccine used in this study proved to be a valuable tool for reducing the clinical impact of a PED infection. Vaccination of sows is beneficial with regard to pre-weaning mortality and weaning weight of the litter. However, as published elsewhere, successful control of PED needs to include appropriate biosecurity measures, cleaning and disinfection and movement restrictions. Further studies are under way to confirm the efficacy of Enterisol PED MLV under different conditions.

References

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Survivability of Porcine Epidemic Diarrhea Virus in Slurry

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Introduction

Porcine Epidemic Diarrhea (PED) virus is a major enteric swine disease of economic significant in many Asia country and PED was first recognized in late April of 2013 in USA[1].

According to some research, PED virus survived in manure slurry for 28 days at 4℃ and possible longer[2].

The main purpose of this study is to investigate the time to inactivate of the PED virus in manure slurry of farm.

Materials and methods

Experimental farm : This farm is finish site having 4 barns with 1600 pigs. PED has occurred on January 23, 2014, and all pigs were removed after 7 days from this farm.

PED virus detection : We collected slurry samples from each barns from 41 days to 161 days post depopulation to verify the presence of PED virus. The samples were tested via PED virus PCR.

Inoculation in piglets : 82 days(a) and 107 days(b) post depopulation of the slurry samples were passed into PED virus naive 5days old piglets via oral-gastric tube. These pigs served as a bioassay to detect the presence of infectious PED virus. Fecal swabs were collected every 24 hours. Swabs were tested via PED virus PCR. Necropsy & IHC (Immunohistochemistry) for small intestine was performed on 48 hours and 72 hours.

Result

PED virus PCR test of slurry was positive until 161days post depopulation.

Inoculated piglet via slurry at 82 days(a) post depopulation was infected with PED virus. But inoculated piglet via slurry at 107 days(b) post depopulation was not infected with PED virus.

PED virus can present in slurry until 161 days post depopulation. But It doesn`t mean infectious virus.

And PED virus in slurry can infect pigs until 82 days post depopulation.

Table.1 PCR test result of slurry over time

days Post depop	41	55	62	76	82	107	120	161
PCR + /n	2/4	2/4	2/4	0/4	3/4	4/4	1/4	4/4

Table.2 Result of post inoculation

Post depop days(n)	Test method	0hr	24hr	48hr	72hr
82-a	fecal swab PCR	-	-	+	+
	IHC	N/T	N/T	N/T	+
107-b	fecal swab PCR	-	N/T	-	-
	IHC	N/T	N/T	-	-

Discussion

These results suggest that PED virus in slurry could be longer has infectivity than we know. Therefore, management strategy of slurry is necessary to control PED virus in the farm

Reference

[1] Steven GW, et al. 2013. **J** Vet Diagn Invest 25:649-654

[2] Sagar Goyal. NPB# 13-215 University of Minnesota.

Effects of Porcine Epidemic Diarrhoea Outbreak on Swine Productivity in Japan

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Introduction

From March to June 2014, a severe PED epidemic (5–100 cases/week) was reported among herds throughout Japan. We summarised the characteristics of this PED epidemic using data obtained from herds belonging to clients of consulting veterinarians. The authors also investigated the effect of the herd-level PED status on productivity using a data recording system (PigINFO) developed for Japanese swine producers (1).

Materials and methods

The study herds were selected from among farrow-to-finish herds that had been entered into the PigINFO system (n = 119). Data associated with PED infection in each herd were investigated by 15 veterinarians. From 1 April to 30 June 2014 (PED epidemic), any herds with clinical signs of PED and/or faeces testing positive for PED by polymerase chain reaction and/or immunohistochemical staining were defined as PED-positive (n=38). Herds that showed no clinical signs of PED or were negative for PED by the above-mentioned tests were classified as negative (n=61). PED-positive herds were further classified into those with long PED periods ≥ 30 days (L-PED-positive) (n=28) and those with short PED periods < 30 days (S-PED-positive) (n=10). Herd-level production data such as the pre-weaning mortality (%) (PRWM), post-weaning mortality (POWM) and pigs marketed per sow per year (MP) were calculated every 3 months.

Results

PED was diagnosed in 23 herds in April, 14 herds in May and 1 herd in June. During the PED epidemic, L-PED-positive herds had significantly higher PRWM levels than the PED-negative herds (Fig. 1). Similarly, L-PED-positive herds had significantly higher POWM levels than PED-negative herds (data was not shown in figure). During October-December 2014, L-PED positive herds had significantly fewer MP than PED-negative herds, (Fig.2).

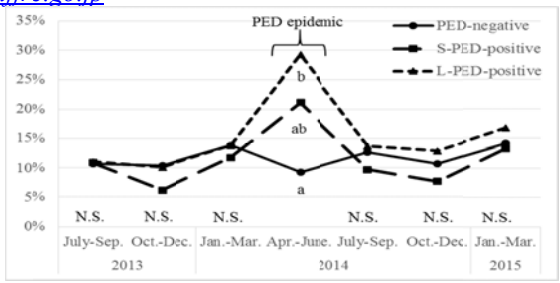

Figure 1 Average pre-weaning mortality

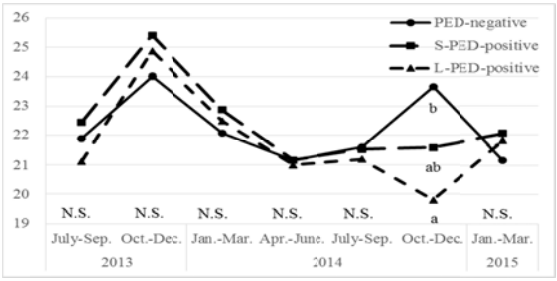

Figure 2 Average pigs marketed per sow per year

Discussion

This study demonstrated that L-PED-positive herds, had significantly reduced productivity, as characterised by higher PRWM and POWM levels during the PED epidemic and fewer MP approximately 180 days after the epidemic. Reduced productivity as characterised by higher PRWM and POWM levels was only observed during April-June 2014, which indicated that many of the PED-positive herds controlled the outbreaks within a short period. The reduced MP numbers in PED-positive herds was a direct consequent of the reduced numbers of suckling and nursing pigs during the PED epidemic. Therefore, the rapid control of an outbreak is economically important for subsequently increasing the number of pigs available for marketing.

Acknowledgements

We thank the Japanese Association of Swine Veterinarians for their supports on data collections.

Reference

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EVALUATION OF THE PED VACCINE, RNA HARRISVACCINE™

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Introduction

Porcine epidemic diarrhea (PED) is a disease of pigs endemic to Asia and is caused by a coronavirus.[1] PED has been reported to cause devastating outbreaks in the Philippines since 2006.[2] Clinical symptoms associated with PED include severe watery diarrhea and emaciation. Vaccination against PED is one of the strategies used by pig farms to control and manage the disease. PED vaccines currently available in Asia[3] have varying efficacies between herds. The objective of this study is to determine the efficacy of the USDA-approved PED Vaccine, RNA Harrisvaccine™ in two swine commercial farms in the Philippines.

Materials and Methods

Two farms in the Philippines were used in the study last October 2014 – one in Teresa, Rizal, another in San Miguel, Bulacan. A total of 4,000 sows were vaccinated using the PED Vaccine, RNA Harrisvaccine™ at 7 days pre-farrowing (one shot). Serum (at day of farrowing), colostrum (0-6 hours post-farrow), and milk samples (day 7, 14, and 21 post-farrow) were collected from 50 vaccinated sows (vaccinated group) and from 50 unvaccinated sows (control/unvaccinated group). All samples were analyzed for PED Virus Neutralization (VN) Test and PED ELISA Spike IgG and IgA.

Results

The VN titers (1/log^2) of colostrum and milk samples from vaccinated sows were higher than VN titers obtained from the unvaccinated group (Fig.1). Higher VN titers suggest higher antibody titers in the colostrum and milk samples of the vaccinated sows that can be transferred to the piglets. In Fig. 2, ELISA Spike IgG and IgA titers of the vaccinated sows were also higher than that of the unvaccinated or control group. The IgA, which is what the piglets mostly need during the suckling period for protection against the disease, were higher in the vaccinated sows as compared to the unvaccinated group. Similar to the VN titer, higher IgA and IgG ELISA titers also suggest higher antibody protection that can be transferred to the piglets. No significant difference obtained from serum samples analyzed for both VN test and ELISA Spike IgG and IgA (results not shown).

In February 2015, 4 months after vaccination, the farm located in Teresa, Rizal was unexpectedly hit by the deadly PED disease. The effect of the PED vaccination was greatly observed during the outbreak (Table 1). It was determined that there was a lower piglet pre-weaning mortality in the vaccinated sows (4.34%) as compared to that of the unvaccinated sows (16.96%).

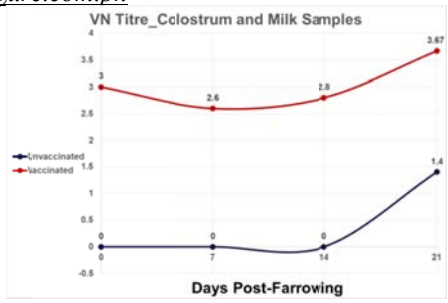

Fig.1 VN titer of colostrum and milk samples from PED vaccinated and unvaccinated sows.

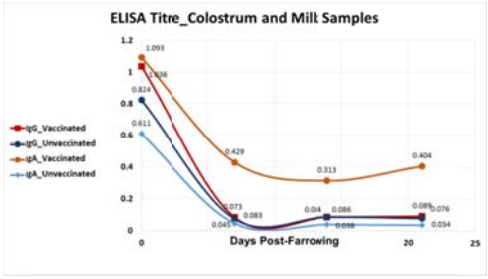

Fig.2 ELISA Spike IgG and IgA titers of colostrum and milk samples from PED vaccinated and unvaccinated sows.

FY 2015	TOTAL REARED	TOTAL SUCKLING MORTALITY	% MORTALITY
VACCINATED	19,576	850	4.34
UNVACCINATED	19,843	3,366	16.96

Table 1. Pre-weaning performance of sows accinated and unvaccinated with PED Vaccine, RNA Harrisvaccine™ during February 2015 PED outbreak.

Discussion and Conclusion

The results of the study suggested that PED vaccination using the USDA-approved PED Vaccine, RNA Harrisvaccine™ is effective in providing higher antibody protection that can be transferred to the piglets, in order to protect the piglets against the devastating effect of PED. In addition to this, effect on piglet mortality was greatly improved in sows vaccinated with the PED Vaccine, RNA in cases of PED outbreak.

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Production of recombinant chimeric swine PKR-Apaf1 proteins in *E.coli* from porcine alveolar macrophages infected with US-PRRSV

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Introduction

Currently, various viruses such as PRRS, PCV2, or CSF succeed in entering, inducing a strong anti-apoptosis (1-3) and invading a natural defenses immune cells (4) and inevitable cause the disease in infected pigs. Several mechanisms to protect pigs from viral invasion were developed. However, existing antiviral drugs are only specific certain types of diseases. Furthermore, vaccinations are also virus-specific and have to be redeveloped at great cost as a virus evolves. Recently, the recombinant human DRACO proteins for controlling the virus-infected cells were developed and showed efficacy against 15 different human viruses (5). These molecules can detect the long dsRNA helices of many viruses during transcription and replication and also induce rapid apoptosis selectively in virus-infected cells, while leaving uninfected cells unharmed. The objective of this study was to produce the recombinant chimeric swine PKR-Apaf1 (rcSPA) proteins using *E. coli* expression system in order to control PRRS virus shedding in pigs.

Materials and methods

The pQE32-PKR-Apaf1 or pET-PKR-Apaf1 expression plasmids were constructed as shown in Fig. 1. Briefly, pCR2.1-TAT-PKR-Apaf-1 plasmids using swine PKR (GenBank: AB104654), swine Apaf-1 (GenBank: XM_003481742) (5) including TAT domain (YGRKKRRQRRR) (6) was amplified from porcine alveolar macrophages infected with US-PRRSV and constructed into pCR2.1-TA vector (Invitrogen, USA). Then, these fragments were sub-cloned into pQE32 (QIAGEN, USA) or pET-His6-TEV-LIC (pET) vectors (Addgene, USA). The transformants in M15 [pREP4] or BL21 (DE3) cells were performed. Single colony of each plasmid was cultured, induced and confirmed for protein expression. The rcSPA proteins were then produced and analyzed on a 12.5 % SDS-PAGE gel staining with CBB-R250. The rcSPA proteins in bacterial cultures were purified using His-trap column (BioRad, USA) under native condition. The mouse polyclonal antibody (pAB) against this molecule was produced. The rcSPA proteins were confirmed by western blotting with anti-His mAB (Genscript, USA) and mouse anti-rcSPA pAB. The rcSPA protein concentration was measured using BCA protein Assay kit (USA).

Results

In this study, the sequences of swine PKR and Apaf-1 cDNA were reported to GenBank accession number KP729189 and KP729186; respectively. The rcSPA proteins were successfully produced and purified under native condition in both pQE32 and pET bacterial expression vectors as shown in Fig. 2. The expressed rcSPA proteins were shown at about 36 kDa and were successfully reacted with anti-His and mouse anti-rcSPA pAB using western blot technique. The purified rcSPA proteins from pET-PKR-Apaf1 and pQE32-PKR-Apaf1 expression vectors were about 12.32 mg and 4.15 mg from one liter of bacterial culture.

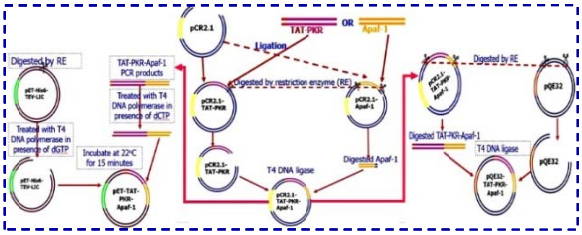

Figure 1. Construction of pQE32-PKR-Apaf1 or pET-PKR-Apaf1 expression plasmids

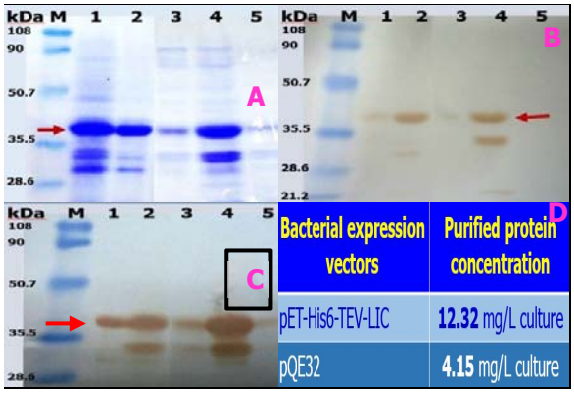

Figure 2. Protein expression of rcSPA protein analyzed using 12.5 % SDS-PAGE gel (A) western blot analysis with anti-His (B) and mouse polyclonal antibodies (C). The yield of purified rcSPA proteins (D). Protein markers kDa (M) Lane 1: pellets; 2: lysate supernatant; 3: elution 1; 4: elution 2; 5: elution 3.

Discussion

The rcSPA proteins production from pET-PKR-Apaf1 vector showed higher amount of yield than those of production from pQE32-PKR-Apaf1 vector. These rcSPA proteins had activity with mouse anti-rcSPA antibody and may be useful for further study in pigs against some infectious diseases such as PRRS virus infection (*in vitro* and *in vivo*).

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Isolation of fimbriated F18 and Shiga-toxin producing *Escherichia coli* associated with oedema disease in post-weaned pigs in Malaysia

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Introduction

Oedema disease (ED) is an enterotoxemic disorder caused by specific pathotypes of *Escherichia coli* (*E. coli*) which affects primarily rapidly-growing nursery and weaned pigs. ED in pigs is associated with the colonization and adherence of the intestine cells by host-specific highly-adapted pathogenic *E. coli* strains with F18 fimbriae. The fimbriae are encoded by *fedab*$^+$ and *fedac*$^+$ genes predominantly found in ED strains of *E. coli* and diarrhoea-causing enterotoxigenic *E. coli* (ETEC) respectively (3). ED strains in addition, possess *stx2e* genes located in plasmids that produces Shiga toxins (1, 2). On absorption of the Shiga toxins from the intestinal lumen into the blood vessels, vascular cell damage occurs leading to oedema in particular the sub-mucosa of the stomach and mesocolon, ataxia and sudden death.

Materials and Methods

A survey was conducted to identify Shiga-toxin producing *E. coli* (STEC) isolates in post-weaners in Malaysia from February to April 2013. Faecal and organ samples were collected from 19 farms with about 500 standing sow population in 6 states in Malaysia namely Penang, Perak, Selangor, Melaka, Johor and Sarawak. The targeted animals were post-weaners (3-14 days post weaning), where there is sudden death in healthy pigs with swollen eyelids and/or with ataxia. Samples such as mesenteric lymph nodes, tonsils, jejunum with content, spleen, kidney and brain stem were tested for bacterial isolation and nucleic acid extraction then followed by multiplex PCR. Samples were cultured on MacConkey and on sheep blood agar. A total of 377 representative *E. coli* strains on blood agar were purified, determined for haemolysis and identified. PCR was conducted on the haemolytic *E. coli* for the presence of STEC (*stx2e* (2)). Positive Shiga-toxin *E. coli* strains were then analyzed for the presence of the *fedab* and *fedac* genes (1).

Results

A total of 59 haemolytic *E coli* isolated from 8 farms were subjected to a singleplex PCR-based method for *stx2e*$^+$ and a multiplex PCR-based method for the detection of *fedab*$^+$ and *fedac*$^+$. 7 of the 8 farms with haemolytic *E. coli* were found to be positive for *stx2e* genes. A total of 5 farms were positive for *stx2e*, *fedab*$^+$ and *fedac*$^+$ genes (Table 1).

Table 1. Microbiological and PCR findings

Farm	Haemolytic *E. coli*	*stx2e*	*fedab*		*fedac*	
		+ve	*+ve*	*-ve*	*+ve*	*-ve*
A	0	0	0	0	0	0
B	8	1	0	1	0	1
C	0	0	0	0	0	0
D	0	0	0	0	0	0
E	5	4	2	0	2	0
F	2	2	2	0	2	0
G	0	0	0	0	0	0
H	0	0	0	0	0	0
I	0	0	0	0	0	0
J	0	0	0	0	0	0
K	9	3	1	2	1	2
L	0	0	0	0	0	0
M	26	9	7	2	7	2
N	4	3	0	0	0	2
O	0	0	0	0	0	0
P	2	0	0	0	0	0
Q	3	3	1	0	1	0
R	0	0	0	0	0	0
S	0	0	0	0	0	0
Total	**59**	**25**	**13**	**5**	**13**	**7**

Discussion

This study demonstrated that Shiga-toxin producing *E. coli* (STEC) carrying *fedab*$^{+/-}$ and *fedac*$^{+/-}$ genes were detected from haemolytic *E. coli* associated with clinical findings of oedema disease (ED) in post-weaned pigs. This finding concludes that virulence genes were present in certain pig farms in Malaysia which leads to ED.

References

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In Vitro Study of Organic Releasing Chlorine Disinfectant (Virusnip®) Contact Time for Porcine Epidemic Diarrhoea Virus (PEDV)

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Introduction

Porcine Epidemic Diarrhoea (PED) is a highly contagious coronavirus disease causing high mortality in piglets in SEA, East Asia, North and South America. Effective biosecurity on farms is the best strategy to control and handle PED outbreaks. Efficacy of disinfectant products is a key success factor for the biosecurity measures[2]. Virusnip®, an organic releasing chlorine disinfectant, provides efficacy against human coronaviruses[3]. This study is a preliminary study for providing informations on the contact time of Virusnip® against PEDV vaccine strains.

Materials and methods

Disinfectant: Virusnip® disinfectant contains Potassium Peroxymonosulphate 50% W/W and Sodium Dichlorosocyanurate 5% W/W 50 gram, Lot. No. 008528.

Virus and cell: PEDV (stock virus vaccine) from Veterinary Diagnostic Laboratory Center, Chulalongkorn University. Virus titer was $10^{4.75}$ $TCID_{50}$/ml.

Virucidal activity: Virusnip® was prepared in 4 concentrations in distil water including 1:100, 1:200, 1:400 and 1:1000 and mixed with the virus stock. The mixture was incubated at room temperature for 3 and 10 minutes, then, suddenly filtrated through Sephadex 20™ column. The filtrated solutions were inoculated into Vero cell line and the microplates were incubated at 37 °C in 5% CO_2 for 48-72 hours. The viral growth was evaluated by the observation of cytopathic effect (CPE) by Read and Muench method[1].

Results

The virus titer of all treatments and control are summarized in Table 1.

Table.1 Viral titration after contacting with agents in each concentration (Conc.) and contact time (CT)

Virusnip Conc.	Virus titer (log 10) at CT 3 min.	Virus titer (log 10) at CT 10 min.
1:100	0	0
1:200	0	0
1:400	0	0
1:1000	0	0
Control	4.05	4.05

Discussion

The results demonstrate that the disinfectant (Virusnip®) provided a virucidal effect against PEDV in 3 and 10 minutes at all tested concentrations. The lowest concentration and shortest contact time is at 1:1000 for 3 minutes. The routine spraying of the disinfectant (Virusnip®) in corresponding pig buildings is considered to be one of the effective strategic biosecurity management measures[2]. Additional field studies are recommended to confirm the effect of Virusnip® to reduce PEDV load in the pig environment.

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Reduced days to market by use of Enterisol® Ileitis under application of medicated feed

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Introduction

Porcine proliferative enteritis (PPE), caused by *Lawsonia Intracellularis* (*Li*), is clinically classified into the following types: Acute type called Porcine Hemorrhagic Enteritis (PHE), which is characterized by acute onset and high mortality with tar like diarrhea in finisher, chronic type with postweaning diarrhea and subclinical type causing economic losses by decreased feed conversion ratio or growth delay. Recently, the latter one is considered to be more important (1). Enterisol® Ileitis (Boehringer Ingelheim Vetmedica Japan Co., Ltd) is the only commercial vaccine against PPE. As it is a live vaccine no antibiotics effective against *Li* should be used for three days before and after, and on the day of vaccination to avoid interference with vaccine efficacy. Using antimicrobial feed additives in creep or pre-starter feed is common in Japan.
In this study, improvement of market age by Enterisol® Ileitis using feed with antibiotic additives during vaccination was evaluated.

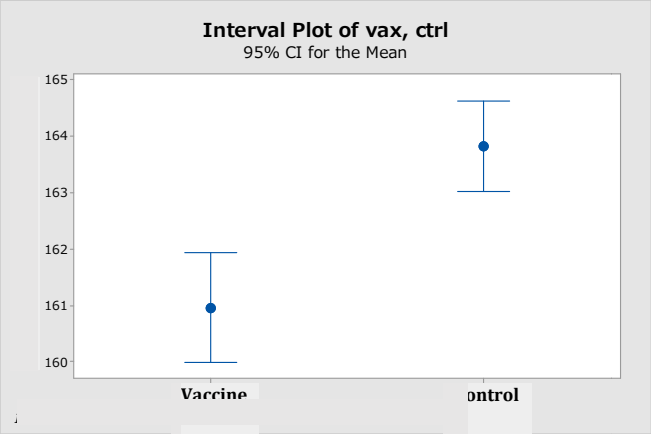
Materials and methods

The study was carried out in a 180 sow farrow-to-finish farm in Japan. Weaning age was 18-21 days old and clinical signs like hemorrhagic diarrhea and pig death occurred after 120 days of age. *Li* seroconversion was detected at 150 days old by ELISA.
Weaned pigs were randomly divided into vaccine group (n=219) and control group (n=324) in different pens. The vaccine group orally received Enterisol® Ileitis by drench; no treatment was given to the control group. Creep and pre-starter feeds were provided as usual to 10-day old to wean and wean to 40-day old in both groups, respectively. Both feeds included avilamycin 40 ppm, colistin sulfate 40 ppm and morantel 30 ppm. Individual market ages of both groups were recorded. Data was statistically analyzed by Shapiro-Wilk test and Mann-Whitney U test for comparison of groups. All statistical analyses were performed by Minitab® 17.1.0.

Results

The market age of study groups is shown in Figure 1. Average market ages were 160.99 (SD=7.28) and 164.08 days (SD=7.01) in vaccine and control group, respectively. A significant reduction of average days to market was demonstrated in the vaccine group compared to the control group (P<0.01).
No obvious clinical signs suggesting PPE -such as hemorrhagic diarrhea- were observed in both groups during the study period.

Figure 1 Differences of market age between vaccine and control group.



Discussion

In this study, average market age was significantly reduced by *Li* vaccination. According to published data colistin sulfate given concurrently with vaccination does not reduce vaccine efficacy (2). Additionally, the results of this study suggest that avilamycin and morantel do not influence vaccine efficacy. More research is needed to confirm the impact of these two antimicrobials.

Reference

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The field efficacy of PRO-VAC PED-Fc vaccine in pregnant sows on sows and piglets performance in Thai pig farms

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Introduction

Porcine epidemic diarrhea (PED) virus, a coronavirus, is an etiological enteropathogenic agent in swine (1 and 2). PED occurs in most swine-raising countries in USA, Europe, Asia as well as in Thailand. Thus, economic losses from this disease are serious loss in endemic pig farm areas. Until now, the efficacy of commercially available vaccines (Live and killed vaccines) is limited in field conditions, and the protective immunity induced is still insufficient with many field strains challenge. PRO-VAC PED-Fc vaccines (Komipharm International Co., Ltd., Korea) are the new study tools to prevent PED infection. In this investigation, we report a field effect of PRO-VAC PED-Fc vaccines with other Live or Killed vaccines in pregnant sows at 4 and 2 weeks before farrowing on the maternal immunity, the sow and piglet performance.

Materials and methods

Two pig farms located from central part of Thailand with continuous system in farrowing barns and had PED outbreak recovery more than three months were selected. Two hundred forty gilts (P0-P1) and sows (P2-P5) were equally performed. One hundred twenty gilts and sows per farm were randomly assigned into 6 groups vary with two times vaccination at 4 (Live vaccines: LV1, Korea company 1, LV2, PRO-VAC PED Live, Komipharm Inc, LV3, Korea company 2) and 2 weeks (Kill vaccines, KV1, Korea company 1, Fc, PRO-VAC PED-Fc, Komipharm International Co., Ltd., Korea) before parturition. Gilt and sow colostrum (between 3-7 hours after parturition) and piglets sera (at Day 1 and Day 21) were collected and analyzed using PED SN gold standard protocol (400$TCID_{50}$/ml of Thai PED viral isolates). Piglets' performance (Ave Born alive, % watery diarrhea, Ave weaned pig) and sows performance (% MMA sows and wean to service interval) were obtained and analyzed.

Results and discussion

This field trial (Figure 1) demonstrated that the use of PRO-VAC PED Live at 4 weeks and PRO-VAC PED-Fc vaccines at 2 weeks before parturition in gilts and sows in the group 4 showed better PED SN titer transferring in colostrum, the decrease of % watery diarrhea 0-7 days old piglets and better sows performance than the other groups. This vaccine may be useful for controlling PED disease in piglets until weaning.

Reference

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Table no. 1: PED SN titer variation, piglets and sow performance after vaccination with and without PRO-VAC PED-Fc vaccine at 2 weeks before farrowing in pregnant sows in Thai pig farms.

Group	PED Vaccination		n = (heads)	Parity	PED SN titer			Piglets' performance			Sow performance	
	4 weeks	2 weeks			Sow colostrum	Day 1 piglet sera	Day 21 piglet sera	Average Born alive	% Watery Diarrhea (0-7 days)	Average Wean (28 days)	% MMA sows (0-3 days)	Wean to service (days)
1	LV1	KV1	20	P0-P1	26.9	24.2	22.2	10.55 ± 0.12	8.1	9.35 ± 0.32	5.7	7.3
			20	P2-P5	27.2	24.7	22.5	11.34 ± 0.24	7.7	9.72 ± 0.97	5.5	7.1
2	LV1	Fc	20	P0-P1	27.2	24.5	22.5	10.69 ± 0.82	7.9	9.66 ± 0.11	5.6	7.2
			20	P2-P5	27.7	24.7	22.7	11.01 ± 0.34	6.5	9.91 ± 0.84	5.4	7
3	LV2	KV1	20	P0-P1	26.5	24.5	22.3	10.66 ± 0.11	8.5	9.24 ± 0.91	5.9	7.5
			20	P2-P5	27	24.8	22.6	11.11 ± 0.44	7.9	9.55 ± 0.29	5	7
4	LV2	Fc	20	P0-P1	28	26	23	10.79 ± 0.12	5.8	10.05 ± 0.66	4.8	7
			20	P2-P5	28.9	26.5	23.9	11.29 ± 0.32	5.2	10.19 ± 0.88	4.2	7
5	LV3	KV1	20	P0-P1	23.4	23.4	22	10.69 ± 0.45	12.4	8.69 ± 0.66	7.9	7.8
			20	P2-P5	25.5	25.5	22.1	11.21 ± 0.51	11.9	8.99 ± 0.55	7.2	7.6
6	LV3	Fc	20	P0-P1	25	23	22	10.33 ± 0.22	11.7	8.83 ± 0.92	6.9	7.4
			20	P2-P5	27	24.2	22.3	11.00 ± 0.10	10.4	8.90 ± 0.30	6.5	7.3

Effects of sows reproductive performance during 1 year before- and after-porcine epidemic diarrhea virus outbreak

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Introduction

Since US-like strain of porcine epidemic diarrhea virus (PEDV) emerged in Taiwan in late 2013, have caused a high morbidity and mortality in neonatal piglets. To our knowledge, no study on the influence during 1-year before- and after-PEDV outbreak on the subsequent sows reproductive performance in Taiwan has been documented. Therefore, the objectives of the present study were to investigate the effects during 1-year before- and after-PEDV outbreak on sow's reproductive traits in a commercial pig farm in Taiwan.

Materials and methods

The present study was conducted in a 2000-sow inventory commercial pig farm in the central region of Taiwan. On 18th January 2013, a US-like strain of PEDV was confirmed from this pig farm by Animal Disease Diagnostic Center, National Pingtung University of Science and Technology.

Data of sow reproductive traits were obtained from the computer recording systems of the herd during January 2013 to January 2015. The collected data include the sow's identities, mating date, weaning-to-service interval (WSI), mating result, number of days until the sows returned to estrus after mating, farrowing date, total number of piglets born per litter (TB), number of piglets born alive per litter (BA), number of weaning piglets (WP). Reproductive data of before- and after-PEDV outbreak were collected during a period from 19th January 2013 to 18th January 2014 and 19th January 2014 to 18th January 2015, respectively.

Results

One year before the PEDV outbreak, the farrowing rate (FR) and return rate (RR) of the herd were 90.5% and 8.1%, respectively, and TB, BA and WP were 13.7, 12.6 and 10.7 piglets/litter. In sows, the WSI, farrow-to-farrow interval (FFI) and non-productive days (NPD) were 5.4, 149.4 and 42.4 days.

One year after PEDV outbreak, the FR and RR of the herd were 80.9% and 17.9%, respectively, and TB, BA and WP were 12.1, 11.5 and 9.6 piglets/litter. In sows, the WSI, FFI and NPD were 6.2, 152.4 and 49.3 days.

Table.1 Comparison of the farrowing rate (FR), return rate (RR), the total number of piglets born per litter (TB), number of piglets born alive per litter (BA), number of weaning piglets (WP), weaning-to-service interval (WSI), farrow-to-farrow interval (FFI) and non-productive days (NPD) during 1 year before- (19th January 2013 to 18th January 2014) and after- (19th January 2014 to 18th January 2015) PEDV outbreak.

Reproductive data	Before PEDV outbreak	After PEDV outbreak	Difference	P value
Number of matings	5873	5931	+58	>0.05
FR (%)	90.5	80.9	-9.6	<0.001**
RR (%)	8.1	17.9	+9.8	<0.001**
Number of farrowing	4786	4572	-214	>0.05
TB (piglets/litter)	13.7	12.1	-1.6	<0.001**
BA (piglets/litter)	12.6	11.5	-1.1	<0.001**
WP (piglets/litter)	10.7	9.6	-1.1	0.03*
Mean gestational period (days)	116.2	116.0	-0.2	0.04*
WSI (days)	5.4	6.2	+0.7	0.02*
FFI (days)	149.4	152.4	+3	0.006*
NPD (days)	42.4	49.3	+6.9	0.01*
Replacement rate of sows (%)	48.9	48.0	-0.9	>0.05
Sow culling rate (%)	32.2	39.4	+7.2	0.03*

The Student's *t*-test was used for comparisons between 1-year before- and after-PEDV outbreak. * and ** were considered statistically significant and very highly significant, respectively.

Discussion and conclusion

This is a first report describing the effect of sow's reproductive performance during 1-year before- and after-PEDV outbreak in Taiwan. It was concluded that outbreak of PEDV in commercial pig farm caused a reduction of subsequent reproductive performance.

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Genetic characterization of porcine epidemic diarrhea virus in Korea from 1998 to 2013

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Introduction

PED has resulted in economic losses for swine farms in Korea since the reported outbreak in 1993. In 2013, PED cases were found for the first time in the USA. Korea also has explosive PED outbreaks since November 2013. Previous molecular studies of Korean PEDVs were limited to analysis of single genes or small numbers of strains collected over short periods. To determine the detailed prevalence of PEDV in Korea, we investigated the nucleotide (nt) and amino acid (aa) sequences of the full spike (S) protein, ORF3, envelope (E) protein, membrane (M) glycoprotein, and nucleocapsid (N) protein.

Materials and methods

We collected 27 samples (19 diarrhea and 8 intestinal tissue from piglets) from several provinces in Korea from 1998 to 2013 and characterized the viruses by sequencing each gene and comparing the sequences with those of previously reported Korean, other Asian, US, and European PEDVs.

Result

Based on the phylogenetic trees of the full S sequences of a total of 27 PEDV strains and 48 reference strains, including vaccine strains, the Korean strains could be divided into two groups (G1 and G2). G2 was further divided into G2-1 and G2-2. G1 consisted of vaccine strains, and European, Japanese, Korean and Chinese strains. G2-1 were grouped with only Korean field strains, with the exception of KH from Japan, and G2-2 consisted mostly of Chinese, several Korean, and US strains. Interestingly, 3 strains in G2-2 were highly similar to the US strains that spread in 2013. The S genes used in this study were not homologous, with nt and aa similarities of 89.7–99.8 %. The ORF3 and E sequences of Korean strains were divided into G1 and G2, and G2 was further divided into G2-1 and G2-2. Most Korean strains were grouped into G2-2 and showed 95.6–100 % nt and 95.9–100 % aa identity. The M sequences were also divided into two groups (G1 and G2). G1 was further divided into two subgroups (G1-1 and G1-2). Most of the 1998–2007 Korean PEDVs were grouped into G1, and those from subsequent years belonged to G2. In N genes, G1 consisted mostly of vaccine strains and CV777, and G2 including most field strains showed 95.0–99.9 % nt and 94.5–100 % aa identity.

Discussion

Korean PEDVs detected in 2013 were placed into various groups. Neighbor-joining trees constructed using S, ORF3, E, M, and N genes showed that the strains could be divided into two groups, G1 and G2. G1 consisted mostly of vaccine viruses, and G2 comprised field strains, regardless of year. In S-genes, G2-1 consisted only of field Korean strains, and was closely related to the old Korean strains Spk1 and Chinju99. G2-2 consisted mostly of Chinese strains and six of the Korean field strains that were more closely related to Chinese strains. These findings indicated that the prevalent PEDV strains in Korea are genetically diverse and can be divided into 3 groups according to their putative origin: Chinese-like (G2-2), Korean-like (G2-1), and vaccine-like (G1) viruses. Especially, Among G2-2 group, 3 strains showed high levels of sequence identity with the USA strains in 2013. This result imply that explosive outbreaks in Korea were caused by the transmission of PEDVs from the USA in some way or other. However, we cannot exclude the possibility that preexisting Korean PEDVs caused the 2013 PED outbreak.

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PEDv contamination on pig moving truck

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Introduction

PED(Porcine Epidemic Diarrhea) is a major concern of Korean pig industry. It is thought that PED problems caused 7-8% loss of P/S/Y(wean piglets/sow/year) during 2013/2014 winter[1].

Pig moving truck and slaughter house regards as the potential risk for PEDv spreading.

In this study, we monitored 'PED' virus contamination on the various site of the pig moving truck.

Material and Method

Sterilized distilled water, Sweeper paper, vinyl gloves, zipper bag and conical tube are used for PED virus sampling. The samples were sent to Optipham(Diagnotic Lab.) for PED PCR test.

1. Place 10ml of sterilized distilled water (SDW) in a bag with sweeper paper.
2. Massage the bag so that the sweeper will absorb the SDW.
3. With gloved hand remove the sweeper carepully.
4. Wipe the target area.
5. Put the sweeper into the bag.
6. Squeeze SDW from sweeper inside the bag and then pour SDW into the conical tube for submission.
7. Submit the tube in a cooler on ice to the diagnostic lab for PCR test.

Fig1. Sweeper paper

Fig2. Squeezed SDW

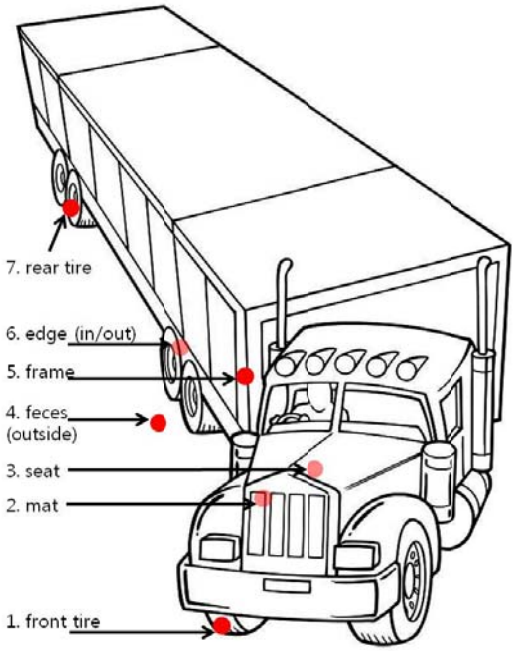

Fig3. The sites of pig moving truck for PEDv contamination

Result

PED PCR results is as below (Table1).

Table1. PED PCR results in farrowing house.

	1	2	3	4	5	6	7
PEDv	-ve	**+ve**	**+ve**	-ve	**+ve**	**+ve**	-ve

1=front tire, 2=mat, 3=seat, 4=feces(out side), 5=frame, 6=edge(in/out), 7=rear tire

Discussion

In this study, we know that driver's seat and mat, frame and edge of container are the risk site for PEDv spreading. For reducing PEDv spreading by pig moving truck, we pay more attention to wash and to disinfect these risk sites.

Reference

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RT-LAMP-BASED ASSAY: QUICK AND ECONOMICAL PED SURVEILLANCE AND DIAGNOSTIC TEST

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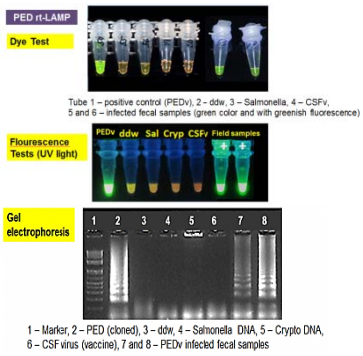
Tangonan AC

Last May-August 2010, an occurrence of Porcine Epidemic Diarrhea (PED) in the province of Batangas killed 67% (11,414 head) of 17,115 sick pigs. The economic losses due to this outbreak amounted to P9.131M (1). Assuming that 50% of the 11,414 pigs affected by PED in Batangas survived due to early detection, economic losses can be reduced by P4.56M. Hence, the study developed the RT-LAMP or reverse transcription loop-mediated isothermal amplification method for the detection of PED virus.

RT-LAMP primers were constructed based on the target sequence of the conservative regions of the target gene using the primer design software (Primer Explorer V4). Optimization of the RT-LAMP protocol was done using gradient temperatures from 60°C to 65°C and incubation time from 25 to 60 minutes. The optimized reaction (temperature and time) was based on the presence of amplified nucleic acid products as demonstrated in the dye and fluorescence tests and gel electrophoresis. Cloned cDNA of PED virus was developed as reference template from field samples that were RT-PCR positive reactors and confirmed through DNA sequencing. Analytical specificity was determined by running the cloned cDNA with a negative control (sterile double distilled water) and non-target genes (Classical Swine Fever virus from modified live vaccine, Salmonella Cholerasuis and *Cryptosporidium pig genotype2*) in LAMP reaction. Analytical sensitivity was determined by serial dilution up to 10^{-6} in order to determine the lowest RNA concentration the RT-LAMP can amplify. Field validation of the RT-LAMP protocol was done using 320 diarrheic stools from different ages of live pigs from participating commercial and smallhold swine farms in Bulacan and Batangas. Positive RT-LAMP reactors were subjected to RT-PCR and sent for DNA sequencing for confirmation. Test of Agreement and Test of Validity (diagnostic sensitivity and specificity) were determined using RT-PCR as gold standard. Shelf-life of the RT-LAMP premixes were checked by storing at -20°C until day 80. The LAMP premixes were evaluated every 1,3,7,14,21,28,35,42,49,56,63, 70, 77 and 80th day using the cloned cDNA.

Results showed that RT-LAMP protocol was optimized at 63°C for 30 minutes in a total reaction volume of 6.5 ul. Outer forward and backward primers of RT-LAMP used in quantitative PCR are specific for PED virus amplification as seen by the unified peaks at melting temperature above 80.0°C starting at quantitative cycle (Cq) of 4.97. The lowest limit of RNA concentration that can be detected is 0.00031 ng/µl or 10^{-6} dilution at Cq 14.59. Cloned cDNA from field sample was tested with RT-PCR using the LAMP outer forward and backward primers and a product with an amplicon size of 188 bp was visualized in the gel. This was sent for DNA sequencing and was found to be 98% homologous to the cDNA sequence of the target gene of the PED virus. This cloned cDNA was used as reference template in the field validation of the RT-LAMP. PED prevalence was 65.3 (95% CI: 60.0-70.5); diagnostic sensitivity was 100% while the specificity ranged from 64 to 97% when compared to RT-PCR. RT-LAMP uses four to six primers that recognize six to eight regions of the target RNA hence, it is highly sensitive and analytically specific because it can amplify only the target gene and not the non-target genes. Finally, the shelf-life of the RT-LAMP premix was 80 days.

RT-LAMP assay for PED virus detection demonstrates potential and valuable means of detecting PED virus. Moreover, the simplicity of analyzing LAMP products through visual inspection makes it even more feasible for monitoring, surveillance and field diagnosis. Thus, RT-LAMP can serve as an alternative method for RT-PCR.



Acknowledgement: The researchers are grateful to DOST-PCAARRD, CLSU, PCC and the participating owners of commercial and small hold farms in Bulacan and Batangas.

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High Path Porcine Epidemic Diarrhoea PCV2a in the Ukraine in 2014

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An outbreak of high pathogenic Porcine Epidemic Diarrhoea (PED2a) occurred in the summer and autumn in the middle of the Ukraine. The PED2 was 99.8% similar to China/US strains of PED2a. This is the first isolation of this high pathogenic strain in Europe.

Index case

The farm practiced weekly batches of 240 farrowing places. (5000 sows unit). A pig flow model of 300 a week to breed and weaning 3000 piglets per batch. This model had been consistently achieved for over 18 months. The farm practiced 3-site production with nursery pigs leaving the farm at 27 days of age.

The farm was specific pathogen free to Porcine Reproductive and Respiratory Syndrome virus, *Mycoplasma hyopneumoniae*, Aujeszky's Disease, *Brachyspira hyodysenteriae*, *Sarcopties scabiei* var *suis* and Toxigenic *Pasteurella multocida,* Transmissible Gastroenteritis Virus and OIE pathogens free. There was no change in this specific pathogen status during the outbreak. The source of the initial infection appeared to be an adjacent farm 1.5km from the index case.

Clinical signs

The outbreak started in the afternoon of day 1 in a single farrowing sow 10 days post-farrowing. The sow presented with vomiting and profuse diarrhoea. Within hours her piglets started to vomit and had profuse watery yellow diarrhoea. The vomiting and diarrhoea then presented throughout the farrowing area.

A presumptive diagnosis was made the following morning following clinical examination of the farm and postmortem examination of the piglets. This was confirmed by PCR examination of faeces and intestinal contents and pathohistology of the intestine tissue. The virus was completely sequenced and was 99.8% similar to the China/US PED2a strain.

Progression of the clinical problem

Euthanasia of piglets less than 10 days of age. To minimise the suffering of the baby piglets, piglets less than 10 days of age were euthansed.

Piglets older than 10 days of age

These were very sick but generally survived. Given the scale of the outbreak, the most successful was the provision of charcoal, which the piglets and weaners ate voraciously. Electrolytes and other supportive therapies were provided.

Nursery pigs.

Pigs had to be weaned and moved to the nursery. Here pigs in adjacent rooms rapidly demonstrated clinical signs of vomiting and diarrhoea. Within 7 days, majority of the nursery pigs recovered their appetites and diarrhoea stopped. The weaker nursery pigs were slower to recover and virus was still found 30 days post-recovery.

Adult pigs.

A feedback programme to the adults was started on day 1 and this obviously contributed to the spread of the clinical signs in adults. Within 3 days the adults recovered their appetites and diarrhoea stopped. An abortion outbreak in sows, 20 to 30 days of pregnancy occurred following the outbreak and feedback programme. The loss of piglets in the early part of lactation resulted in enormous disruption to the weekly batching breeding programme.

The use of colostrum from sows to gilts was very useful in control.

Cost of the outbreak

Performance took 20 weeks to return to a semblance of normality.

A total of 30,000 weaners were lost in this outbreak. This equated to a loss of 6 weaned pigs per sow per year.

Stockpeople

The impact on the welfare and wellbeing of the stockpeople was a major concern for the company with the loss of so many piglets and the need to euthanase and postmortem such large number of pigs. It is essential to be concerned for the mental health of all stockpeople working on the farm.

Consequences

The consequences has been extremely serious to the developing Ukraine pig industry which combined with the few African Swine Fever cases is economcally very difficult. However, the potential spread into the European Union would be devistating to the EU pig production and would dwarf the impact on China PED 2a on the US herd.

GENETIC DIVERSITY OF PORCINE EPIDEMIC DIARRHEA IN THE PHILIPPINES

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Introduction

Porcine epidemic diarrhea (PED) is caused by PED virus (PEDV), an enveloped, positive-sense, single-stranded RNA virus belonging to the genus *Alphacoronavirus*, family *Coronaviridae*, order *Nidovirales*[1]. PED is an emerging disease of pigs and has been reported to cause devastating outbreaks in the Philippines since 2006[2]. Clinical symptoms associated with PED include severe watery diarrhea and high mortality in suckling pigs. However, there is still limited information regarding the genetic diversity of PEDV reported in the Philippines. Herein, complete spike gene sequences are reported for two PEDV isolates from pigs displaying severe diarrhea from a farm in the Philippines in 2013. The results provide a benchmark for genetic diversity of PEDV and more understanding of the molecular characteristics of PEDV in the Philippines.

Materials and Methods

Intestinal samples were collected from 2-3-day-old piglets displaying severe watery diarrhea associated with PEDV from a commercial farm located in Bulacan province in the Philippines in 2013. Two PEDV variants were isolated using the Vero cell line[3]. To amplify the complete S gene sequences, supernatants were evaluated for the presence of PEDV RNA by RT-PCR, using previously described method. In brief, total RNA was extracted from culture supernatant using the Nucleospin® viral RNA isolation kit (Macherey-Nagel Inc., Duren, Germany) according to the manufacturer's instructions. Two overlapping cDNA fragments spanning the full-length were RT-PCR amplified with these primers: PEDS-F-1 (5'-ACG TAA ACA AAT GAG GTC TTT -3') and PEDS-R-1 (5'-ATA CAC CAA CAC AGG CTC TGT -3') used to amplify S1 and the primers PEDS-F-2 (5'-GGT TTC TTC TAC CAT TCT AAT GAC G -3') and PEDS-R-2 (5' –GTA TTG AAA AAG TCC AAG AAA CA -3') used to amplify S2[4]. The PCR products were cloned into vector and sequencing reactions were performed by using an ABI Prism 3730XL DNA sequencer.

Results

The complete spike gene of two PEDV isolates in the Philippines is 4,155 nucleotides (nt) in length. Nucleotide and deduced amino acid were aligned together with reference PEDV including CV7777 and 31 other isolates. The results demonstrated that both isolates own a genetic characterization of 4 amino acids (GENQ) and 1 amino acid (N) insertions at amino acid positions 56-59 and 140, and 2 amino acids (DG) deletion at position 160-161 in spike gene, suggesting that both isolates are new variants of PEDV that caused epidemic outbreaks to swine industry in the Philippines. To investigate the genetic relationship, the phylogenetic tree based on the complete S gene was constructed and revealed that the two isolates in Philippines were clustered in sub-cluster 2-2 suggesting that these two isolates are variants genetically similar to isolates responsible for outbreaks in China during 2011-2012 (Fig. 1).

Fig.1 Phylogenetic analyses based on spike genes of porcine epidemic diarrhea virus

Discussion and Conclusion

The results of the study suggested that Philippines' PEDV are new variants as evidenced by their unique genetic composition of insertions and a deletion in the spike gene region. The genetic relationship between both Philippines PEDV isolates and PEDV from China and Vietnam suggested that they might have originated from a common ancestor, which is a Chinese PEDV isolate.

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BioChek PCV2 qPCR

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Introduction

Detecting and quantifying PCV2 virus in clinical and sub-clinical (PCV2 virus-) infected pigs is important. Reports in literature are very conclusive (1). PCV2 virus, even in low quantities, has a detrimental effect on the performance of the pigs. A lower ADWG and a less efficient FCR are the most important parameters responsible for the economic damage. For that reason different PCV2 qPCR test have been developed and are currently in use. Both in-house produced and commercially qPCR test kits are available. The Animal Health Service (AHS) organization in Deventer, the Netherlands; organized an International Proficiency Testing Scheme (PTS) or ring trial that gave veterinary diagnostic laboratories and commercial test kit producers throughout the world, the opportunity to test their PCV2 qPCR against defined samples.

Materials and methods

The AHS prepared 8 different freeze dried samples that were stored at 3 different temperatures, reconstituted and tested for homogeneity and stability. When the CV% was ≤10 the homogeneity was considered acceptable. The 8 samples were divided in 3 groups. Group with sample number 1, 5 and 7 contained PCV2 field virus strain in different dilutions. Group with sample numbers 2 and 4 did not contain any PCV2 virus (negative or PCV1 virus). The group with sample numbers 3, 6 and 8 contained a second PCV2 virus strain and again in different dilutions. These 8 different samples were send out to 31 different laboratories from 11 countries (Asia Pacific, Latin America, Europe). The 8 different samples were tested at the BioChek BV laboratories in Reeuwijck, the Netherlands; using a BioChek PCV2 qPCR test kit from a routinely produced and released commercial batch. The results of these 8 assays with the BioCheck PCV2 qPCR are presented here.

Result

The sample numbers 2 and 4 that did not contain PCV2 virus, scored negative in the BioChek PCV2 qPCR. This is line with the declared specificity of >99% for the BioChek PCV2 qPCR(2). The PCV2 virus positive sample numbers 1, 5 and 7 were positive in the BioChek PCV2 qPCR. Sample number 5 was highly diluted, while sample number 7 contained slightly less PCV2 virus than sample number 1. This was reflected in the CT values. Sample number 5 had the highest CT value, while the CT value of sample 7 was just higher than that of sample number 1. For the PCV2 virus positive sample numbers 3, 6 and 8 a similar pattern was found. The higher the dilution factor, the higher the CT value. Not only a prove of the high sensitivity (high dilution and still positive) of the used test kit but also indicating good linearity.

Discussion

When samples are submitted to a veterinary diagnostic laboratory, the sample submitter has to rely on the quality of the materials used by- and professionalism- of the laboratory staff. The purpose of these PTS or ring trials is helping the participating laboratories to check the quality of their internal procedures. In this study both in-house and commercially available PCV qPCR test kits were used. Not all participating laboratories performed equally well. When looking at the stringent production protocols and release procedures, it is no wonder that the BioChek PCV2 qPCR fulfilled all criteria that were tested in this International Proficiency Testing Scheme. The positive reference sample in the BioChek PCV2 qPCR helps laboratories to check their procedures.

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Comparison of the efficacy of PCV-2 inactivated vaccine between 1 shot and 2 shot administration

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Introduction

Porcine circovirus 2 (PCV2) causes the complicated syndrome called porcine circovirus-associated disease (PCVAD) which is one of the issues in pig industry in the world. To reduce the economic loss from PCVAD, many kind of effective PCV2 vaccines have been developed and used. This study is aimed to evaluate the efficacy the PCV2 inactivated vaccine administered 1 shot and 2 shot through the viremia after challenging with both PCV2a and PCV2b strains isolated in Korea.

Materials and methods

Experimental design

The details of the experimental designs were presented in table 1.

Table 1. Experimental design

Vaccination*	Challenge†	No. of pigs‡
1 shot§	PCV-2a	3
	PCV-2b	3
2 shot§§	PCV-2a	3
	PCV-2b	3
Not vaccinated	PCV-2a	3
	PCV-2b	3
Non	Non	2

*: PCV2 inactivated bivalent vaccine (PCV2a+PCV2b) from Green Cross veterinary products co. ltd. (CircoShield, GCVP)
†: Field isolates PCV 2a and 2b, $10^{5.0}TCID_{50}$/ml, Two weeks after last vaccination. ‡: 3-week old piglet, §: 1-shot 1ml/dose, IM, §§: Two weeks interval, 1ml/dose, IM

Clinical signs and sampling

Clinical signs had been observed for 14 days after challenge. In order to measure the titers of viremia, blood samples were collected at the day of challenge, 3, 5, 7, 10, 14 days after challenge.

Viremia

Viremia of PCV2 was measured using quantitative SYBR real time PCR.

Result

Clinical signs

There were no clinical signs in vaccinated and PCV2 challenged group, however pathognomic signs of PCV2 infection including anorexia, mild loose feces were shown in some pigs which was challenged without vaccination.

Viremia

Until 14 days after challenge, viremia were lower than not vaccinated group in vaccinated group (vaccinated and challenged). However, the levels of viremia in not vaccinated group were higher and lasting more than 14 days after challenge.

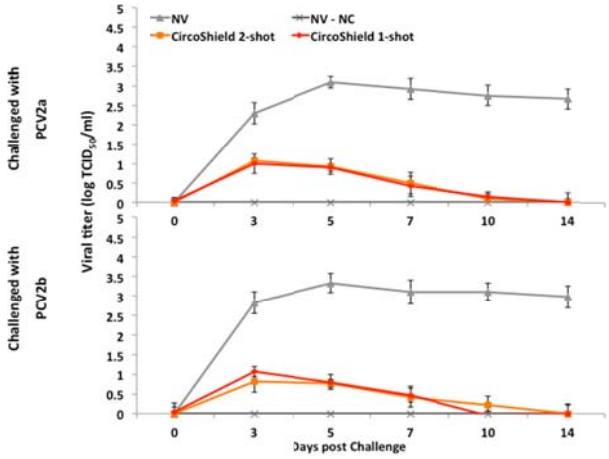

Figure 1. Viremia after challenging with PCV2a and 2b in PCV2 inactivated vaccine administered piglets.

Discussion

As presented in this study this vaccine could efficiently reduce the viremia in 1-shot and 2-shot group. Especially, this bivalent PCV2 inactivated vaccine can reduce the viremia level when challenged with both of PCV2a and 2b strain. Through the comparative experiment on 1-shot and 2-shot administration of CircoShield vaccine, both of the method can be effective to reduce the viremia after challenge with PCV2

A Mhyo-PCV2-PRRS vaccine mixture achieves comparable results as separate injections of a Mhyo, PCV2 and PRRS vaccine under Thai swine farm conditions.

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Introduction

Respiratory Disease complex (PRDC) are common in Thai swine industry. Mycoplasma hyopneumoniae (Mhyo), PCV2 and PRRS are three major pathogens which contribute to economic losses in swine production1. To minimize economic losses, vaccination against these three pathogens has become the method of choice. In order to reduce animal stress and human workload, combination of vaccines has been developed against these 3 major pathogens2. In 2013 the trivalent mixture vaccine was granted in Thailand for mixing of Mhyo, PCV2 and PRRS vaccine (3FLEX®) under Boehringer Ingelheim's license. The objective of the field observation was to confirm the efficacy of combined use of Mhyo, PCV2 and PRRS vaccines under Thai swine conditions.

Materials and Methods

The study was performed in a 1000 sows farrow to finish farm with AI/AO system. The farm had already been using Mhyo, PCV2 and PRRS MLV vaccine as separate injections for 9 years. Later on, the farmer decided to apply the trivalent vaccine mixture (3FLEX®). The trivalent vaccination was applied to pigs at the age of 14-17 days. In this retrospective study the finishing performance for the period before and after use of the trivalent vaccine mixture was compared. A total of 15 batches (about 400 pigs per batch) was included in this observation. Performance parameters such as mortality, average daily gain and FCR were evaluated using Statistical Process Control (SPC) method. The differences between the groups were evaluated by student T-test.

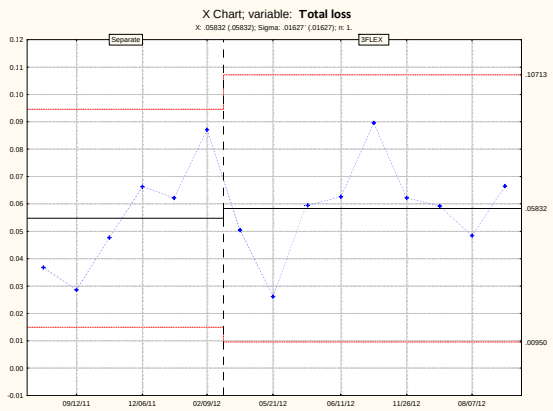
Results

Results for finishing parameters are shown in table 1. The overall growth performance showed no significant differences between both groups. No statistic significant differences were observed with regard to total losses (figure 1) and no adverse reactions were seen in the vaccinated animals after the new vaccination scheme was applied.

Table1. Evaluation of finishing pigs batches with two different vaccination schemes.

	Separate	3FLEX	P-value
Prod.Batches(N)	6	9	
Avg Weight in (kg)	18.2	18.0	N/A
Avg Weight out(kg)	113	113	N/A
ADGW(g/d)	763	760	0.406
FCR	2.56	2.50	0.027
%Total loss	5.48	5.8	0.726

Figure 1. SPC I charts for the total loss in finishing period.



Discussion and Conclusion

The results of this field observation indicate that there were no differences on finishing performances between the 2 vaccination schemes. 3FLEX® vaccination has proven to be efficacious and safe. This mixing license not only provides the protection for 3 pathogens, but also reduces the number of injections, pigs stress and workload.

References

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Field application of 3 FLEX™ in a PRDC case farm

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Introduction

The term Porcine Respiratory Disease Complex (PRDC) has been used to describe a complex characterized by respiratory symptoms and poor growth in growing and finishing pigs. PRDC is caused by several factors including different pathogens, environment and management. Among the pathogens, porcine reproductive and respiratory syndrome virus (PRRSV), swine influenza virus (SIV), porcine circovirus type 2 (PCV2) and a variety of bacteria like Mycoplasma hyopneumonia (M. hyo) are frequently involved in PRDC. 3 FLEX™ is the trade name associated with the mixture of Ingelvac CircoFLEX®, Ingelvac MycoFLEX® and Ingelvac® PRRS MLV to control the 3 major pathogens involved in PRDC. Improving management and environment are usually costly and time consuming so that vaccination is a simple way to reduce losses due to PRDC in Korea [1, 2]. In this field case, we confirmed the efficacy of 3 FLEX™ in comparison to the separate use of Ingelvac CircoFLEX® and other one shot M. hyo vaccine.

Materials and methods

The farm is a farrow to finish herd with 200 sows. The farm has already been applied Ingelvac CircoFLEX® at 3 weeks of age and Maha-1 as a M. hyo vaccine at 2 weeks of age. In April 2014, PRRS clinical signs appeared in the nursery. After diagnosis, PRRS vaccination was implemented to weaning piglets from 29 May, 2014. The trivalent vaccine mixture (3FLEX™) was applied at 3 weeks of age to reduce stress of piglet and risk of pathogen transmission. To compare the mortality between two groups, the number of dead animals was recorded in 4 consecutive batches before and after the change of vaccines, respectively (table 1).

Results

The mortality of 3FLEX group was decreased from 26.5% to 10.8%. Furthermore, the mortality was less varying between batches after 3FLEX was implemented. The sample standard deviations of two groups were 5.11 and 0.98.

Table.1 *The number of dead animal and mortality of each continuous batch*

Before (April/May 2014)	1	2	3	4	Total
	MaHa-1 / CircoFLEX				
# of weaning piglet	98	94	91	90	373
# of dead nursery	14	19	13	18	64
# of dead finisher	8	11	7	9	35
Total number	22	30	20	27	99
% Mortality	22.4	31.9	22.0	30.0	26.5
After (May/June 2014)	5	6	7	8	Total
	3FLEX				
# of weaning piglet	97	101	127	146	471
# of dead nursery	7	8	8	9	32
# of dead finisher	2	3	6	8	19
Total number	9	11	14	17	51
% Mortality	9.3	10.9	11.0	11.6	10.8

Discussion

In this field case, the mortality improvement was described after introducing PRRS live vaccine to piglets as a 3FLEX™. The farm already has used PCV2 and M. hyo vaccine at 2 and 3 weeks of age individually. After changing vaccination scheme to 3FLEX™, farmers may have time to improve management and treatment. The improvements of mortality may result not only from additional PRRS control but also reduction of injection stress and risk of pathogen transmission due to several injections.

Reference

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Imuvant™ – a novel adjuvant; efficacy and safety properties in Hyogen® vaccine

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Introduction

In previous studies the safety and potency of several adjuvants, such as carbomer 974, DDA, squalene, Montanide ISA 206, competitors' swine vaccine adjuvants and Imuvant, a proprietary Ceva adjuvant were evaluated in pigs by using a model antigen. Based on these earlier results, only Imuvant was both safe and immune-potentiating. Subsequently, Imuvant was selected to be the adjuvant for Hyogen, a bacterin vaccine for the prevention of enzootic pneumonia caused by Mycoplasma hyopneumoniae (M.hyo). Imuvant consists of mineral oil and Escherichia coli J5 non-toxic LPS, which significantly boosts both the cellular and the humoral immune responses.

The aim of the current study was to assess the safety of Hyogen and evaluate the boosting effect of the J5 component of Imuvant on the efficacy of Hyogen vaccine in 3-week-old piglets.

Materials and methods

Safety

Three different batches of Hyogen vaccine were injected into 3-week-old seronegative piglets under placebo control. In addition to monitoring the systemic and local reactions to the vaccines, measuring body temperature increase at several time-points, aspartate aminotransferase (AST) and creatine kinase (CK) blood biochemical tests were also performed as being fine indicators of possible tissue damage due to vaccination.

Efficacy

Forty-five (45) piglets seronegative to M.hyo were divided into 3 groups of 15 and then vaccinated with the following vaccines: (i) Hyogen: M.hyo bacterin adjuvanted with Imuvant (containing J5), (ii) M.hyo bacterin adjuvanted with mineral oil only, no J5 added and (iii) Placebo. Eighteen (18) days after vaccination, the pigs were challenged with a virulent M.hyo strain. At 28 days post challenge the animals were slaughtered and subjected to lung scoring according to the European Pharmacopoeia. Tracheal swab samples were also taken for real time PCR analysis to determine the level of colonization of the lungs by the M.hyo challenge strain.

Results

Injection of three batches of Hyogen into 3-week-old piglets revealed no major systemic or local reaction to the vaccines. The rectal temperatures remained in the normal range. The AST and CK enzyme analysis indicated no tissue damage due to the vaccination.

Based on the evaluation of lung lesion at 28 days post M.hyo challenge, a clear advantage of Imuvant (mineral oil + J5) over the mineral oil adjuvanted vaccine was observed (Figure 1). Hyogen, adjuvanted with Imuvant significantly reduced the lung lesions compared to the placebo group ($p=0.028$). The mineral oil adjuvanted M.hyo vaccine (containing no J5) also reduced the lung lesion scores but statistical significance could not be demonstrated against the placebo group ($p=0.288$).

The real time PCR analysis of the trachea swab samples confirmed the benefit of J5 in Hyogen, indicating that the level of M.hyo challenge strain colonization was lower with J5, compared to mineral oil adjuvant only.

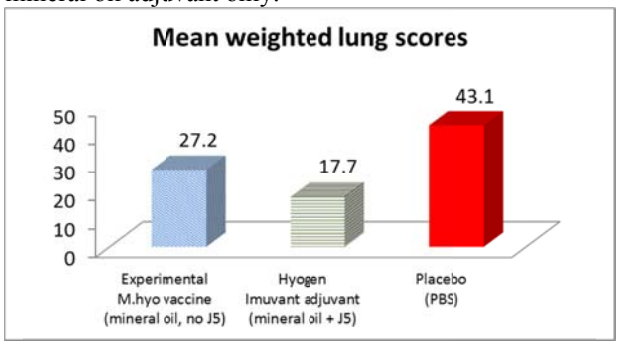

Figure 1. Three-week-old pigs were vaccinated and 18 days later were challenged with M.hyo. Mean weighted lung scores were calculated at 28 days post challenge.

Conclusions

In summary, this study demonstrated the excellent safety of Imuvant, and confirmed that J5 non-toxic LPS is a key component to enhance the efficacy of Hyogen, compared to an experimental M.hyo bacterin adjuvanted with mineral oil only. Hyogen, adjuvanted with Imuvant (containing mineral oil + J5), provided protection against M.hyo challenge as early as at 18 days post vaccination.

A field trial of Porcilis PCV2 M Hyo in Hungary

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Introduction

Porcine circovirus type 2 (PCV2) and *M. hyopneumoniae* (M hyo) are the two most prevalent pathogens in finishing pigs. Vaccination against PCV2 and M hyo is standard practice in the pig industry, but a convenient ready-to-use one dose combination product has not been available in Europe until now. Here, a study to assess the safety and efficacy of such a new combination vaccine - Porcilis® PCV M Hyo –under field condition, is presented.

Materials and Methods

The study was a controlled, randomized and blinded field trial and conducted in a farrow-to-finish herd of approx. 550 sows and their offspring, in Hungary, with confirmed PCV2 and M hyo associated diseases. Three week old piglets from 6 consecutive weekly farrowing batches were allocated randomly, within litters, to one of two groups of ±300 piglets each. The test group was vaccinated with Porcilis® PCV M Hyo and control group was injected with PBS as placebo. Primary efficacy parameters were PCV2 viremia, lung lesions at slaughter and average daily weight gain (ADWG) during finishing. Secondary parameters were overall ADWG during the study, mortality, morbidity, pleurisy lesions and PCV2 shedding. Severity of M hyo lungs lesions was scored at slaughter according to Goodwin and Whittlestone. PCV2 viraemia and virus shedding were tested with a real time PCR by using a dual labelled hydrolysis probe (log_{10} copies/µl DNA extract) in serum and rectal swab samples from ±60 pigs per group every 4 weeks during the observation period. Presence of field infection and serological response to vaccination were determined by quantitative PCV2 ELISA (Intervet R&D Service Laboratory) and M. hyo antibody ELISA (Swine HerdChek M. hyo [IDEXX Laboratories Inc., Westbook, USA]).

Average daily weight gain and lung lesions scores were compared between the treatment groups using a mixed ANOVA model with the lung lesions log transformed before analysis. Pleurisy, mortality and morbidity were analysed with the Cochran Mantel Haenszel (CMH) method.

Results

PCV2 viraemia and faecal shedding was significantly reduced (ANOVA $p<0.0001$) in vaccinated compared to controls. Study animals were raised until end of nursery period (±14 weeks of age) in the breeding farm (farm A), but fattened in two separate finishing farms (A at the breeding farm, and B a smaller fattening farm ±16 kms away). The distribution of the study animals between farms A and B was approx. 2:1, with no difference by vaccination group. ADWG increase in vaccinated animals vs controls during finishing was 65 g/day in finishing farm A and 6 g/day in farm B. The ADWG during the nursery phase and the overall weight gain was also improved in the Porcilis PCV M Hyo group. Animal management differences in fattening farm A and B can explain the ADWG differences and may support the hypothesis of higher infection pressure of PCV2 on fattening farm A. All sampling animals, however, for practical reasons were set on farm A, therefore, information about the presence and extent of PCV2 infection on farm B is lacking. Lung lesions were significantly reduced from 16.1 in the controls to 4.1 in vaccinates (mixed model ANOVA $p<0.0001$). The severity of pleurisy was also significantly reduced in the vaccinated pigs (CMH test $p<0.0001$).
Mortality was numerically lower in the vaccinated (7.1%) than in the control group (9.5%) Vaccinated pigs had a substantial antibody response 4 weeks post-vaccination to PCV2 and M hyo and a clear field infection was present for both agents during the fattening period. No vaccine related local or systemic reactions were observed.

Conclusions and Discussion

Porcilis® PCV M Hyo proved to be safe and efficacious against PCV2 and/or M hyo infections under field conditions.

PRV vaccine AUSKIPRA® GN (A3 solvent; Bartha k61 strain) provide quick and strong protection against Chinese PRV variant

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Introduction

Since 2011 several Pseudorabies (PR) outbreaks have damaged Chinese swine industry [1].

The aim of this study was to asses clinical protection of PRV MLV (AUSKIPRA®GN, HIPRA) in piglets infected with new Chinese PRV variant (AH02 strain)

Materials and methods

Fifteen healthy and free PRV, 4 to 6 weeks old piglets, were randomly separated into 3 groups: Group A: Treated intramuscularly (IM) with 2ml AUSKIPRA®GN (Bartha k61 strain) reconstituted in A3 solvent and challenge intranasaly (IN) with AH02 strain (n=5), Group B: Treated IM with 2ml PBS solution and challenge IN with AH02 strain (n=5) and Group C: Treated IM with 2 ml PBS no challenge (n=5). Piglets were treated at D0 and challenged at D7.

Clinical signs and increase in body temperature of all animals were recorded from three days before vaccination until 14 days post challenge.

Results

All animals in groups A and C remained healthy throughout the study. All animals in group B suffered from clinical sings and moreover, 3 piglets died after challenge (60% mortality) (*Table 1*). Clinical sings of depression, loss of appetite, difficulty of breathing due to cough, sneeze and purulent nasal discharge were observed. Convulsion and ataxia were also observed from D5 post challenge in group B (*Table 1*).

Table 1 . *Clinical signs of piglets before and post challenge. Morbidity and mortality records.*

Group	Before challenge	Post challenge	Morbidity	Mortality
A	-	-	0/5	0/5
B	-	+	5/5	3/5
C	-	-	0/5	0/5

Note: "-" indicates no clinical signs. "+" indicates clinical signs.

No increase in body temperature was seen in groups A and C during the study. All animals in group B showed fever between 4 to 7 days (≥40,5^{0}C) (*Table 2*).

Table 2. *Incidence and duration of fever.*

Group	Fever(≥40.5℃) frequency	
	Number of piglets (a/b)	Lasting time (days)
A	0/5	/
B	5/5	4～7
C	0/5	0

Note: "a" piglets that showed fever. "b" number of piglets of the group.

Discussion

In this study, PRV vaccine AUSKIPRA®GN reconstituted in A3 solvent, showed clinical protection after challenge with new Chinese pathogenic PRV strain. Therefore, AUSKIPRA®GN can be a useful tool to control PRV infection in Chinese farms.

Reference

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Field observation on the efficacy and economic improvement of the FLEXcombo in an integrated swine farm in China

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Introduction

Porcine circovirus type 2 (PCV2) and *Mycoplasma hyopneumoniae* (M. hyo) are two major contributors to the Porcine Respiratory Disease Complex (PRDC). Vaccination is an efficient tool to control both pathogens. FLEXcombo is the combination of the two commercial vaccines Ingelvac CircoFLEX® and Ingelvac MycoFLEX®. The aim of this field observation was to determine the effect and economic impact of FLEXcombo under China conditions.

Materials and methods

The study was performed in a 900-sow farrow-to-finish one-site production system in Henan province of China. Piglets had been vaccinated against M. hyo with a commercial M. hyo vaccine (Ingelvac M.hyo®) from 2009 to February 2013 at 2 weeks of age. PCV2 vaccination with Ingelvac CircoFLEX® was implemented from January of 2012. In March 2013 Ingelvac M. hyo was replaced by Ingelvac MycoFLEX® and from then on Ingelvac CircoFLEX® and Ingelvac MycoFLEX® were used freshly mixed as vaccine combination (FLEXcombo®). Also in 2012 mass vaccination of the breeding herd twice per year with Ingelvac CircoFLEX® was implemented. The production and economic data was collected and compared for 2010 to 2014

Result

A clear improvement in marketed pigs per sow per year (M.S.Y.) was seen after implementation of PCV2 vaccination in 2012. (Figure1). Wean-to-finish FCR was improved from 2.92 to 2.52 at year 2010 and 2014. Farrow-to-finish mortality and culling rate was reduced from 26.99% in year 2010 to 8.21 % in year 2013; in 2014 an PEDV outbreak occurred in the farm and the mortality rate increase again to 13.51% (Figure2). Furthermore, the costs of disinfectants and antibiotics were significantly reduced in the farms (Table 1).

Discussion

In this field observation vaccination of sows twice per year with Ingelvac CircoFLEX® and vaccination of pigs at weaning with FLEXcombo® as a combinationdid improve overall herd
especially for the parameters M.S.Y., mortality rate and FCR. FLEXcombo immunization can alleviate clinical symptoms of swine PRDC, which leads to improved performance andreduction of antibiotic use, resulting in a clear economic benefit to the farmer. As PCV2 and M.hyo are widely distributed in swine farms, routine application of the FLEXcombo® ensures the productivity of farms.

Figure 1. M.S.Y.

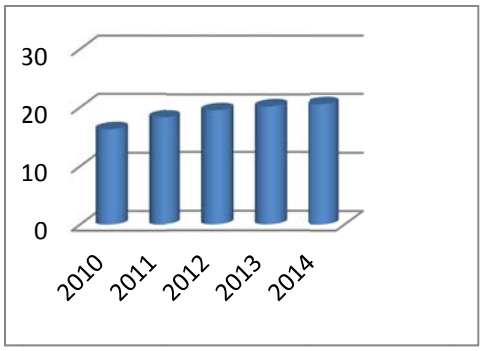

Figure 2.Farrow-to-finish mortality and culling rate (%)

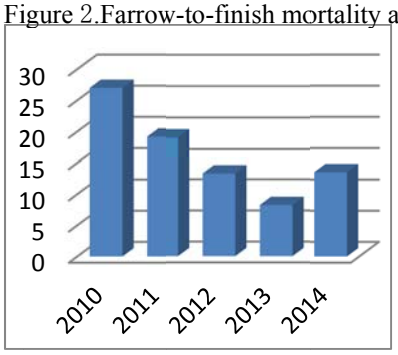

Table 1.Annual cost of Vaccines, disinfectants and antibiotics

Year	Vaccines cost (RMB)	Disinfectants cost (RMB)	Antibiotics cost (RMB)	cost ration of Vaccines: disinfectants: antibiotics
2010	381463	104973	923701	100 : 27 : 242
2011	609160	125334	789371	100 : 21 : 130
2012	1113641	74889	927158	100 : 7 : 83
2013	1205286	63795	604434	100: 5: 50
2014	1635116	69135	601594	100 : 4 : 32

Reference

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3. Segalés et al. (2012) Diseases of swine, chapter 26.

Vaccination with Ingelvac CircoFLEX® reduces pro-inflammatory cytokine response after PCV2b challenge

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Introduction

In a preliminary study we assessed the early pro-inflammatory and anti-inflammatory cytokine response in pigs vaccinated with Ingelvac CircoFLEX® before challenged with a known PCV2b strain, or left unvaccinated.

Materials and methods

Three groups of six Babraham pigs (inbred Large White) at 3 weeks of age were used. These animals tested negative by qPCR and antibody-ELISA for PCV1, PCV2, PRRSV, three different strains of SIV, and M. hyopneumoniae. At three weeks of age, pigs were vaccinated with 1 ml of Ingelvac CircoFLEX® (Boehringer Ingelheim) or left untreated. At five weeks of age (week 2 in graphs) pigs in both groups were challenged intra-nasally with 8 x 10^9 viral copies of a recently cloned PCV2b strain, grown in IFN-/- PK15 cells. The alternates were left unvaccinated. Pigs were kept in rooms with completely separated air-flowand faeces collection and under optimum husbandry conditions and feed ad-lib. In addition to growth performance parameters and temperature, blood samples were collected on a weekly base and sera subsequently analysed for the presences of PCV2b by qPCR as well as PCV2 specific antibodies, IFNγ, TNFα, IL-4 and IL-10 by multiplex ELISA.

Result

Whereas no IL-4 and IL-10 was detected as systemic response in all pigs, clear systemic responses were seen for IFNγ (Fig. 1) and TNFα (Fig. 2), which were less pronounced in vaccinated pigs.

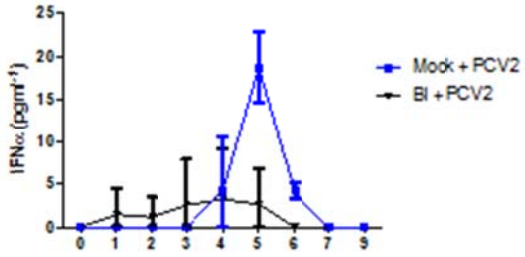

Figure 1: IFNγ values in pigs either vaccinated (BI+PCV2), or challenged only (mock+PCV2). Pigs were vaccinated at week 0, and challenged as described at week 2. Controls were always at "0" and are not shown.

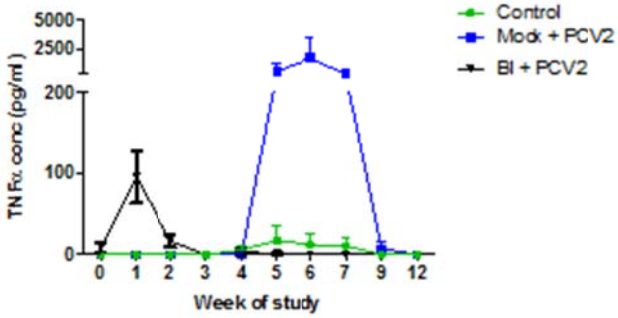

Figure 2: TNFα values in pigs either vaccinated (BI+PCV2), challenged only (mock+PCV2) or left untreated (control). Pigs were vaccinated at week 0, and challenged as described at week 2.

Discussion

In all vaccinated pigs, a short, transient reaction to vaccination was seen with regards to IFNγ and TNFα. However, after challenge, this response was absent vaccinated pigs. We believe that the initial response is due to adjuvant in the vaccine, and protects pigs for the potentially negative effects of proinflammatory cytokines after infection.

The Success of *Streptococcus suis* Type 2 Vaccine to Prevent Production Losses in Intensive Pig Farming in Thailand: Case Report

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Introduction

Streptococcus suis type 2 (SS-2) is a pathogen typically seen in nursing pigs associated with septicemia resulting in meningitis, pneumonia, arthritis, endocarditis, polyserositis and bronchopneumonia. The infection can be more severe in cases of co-infections with other pathogens especially PRRSV[1]. Combined infections result in significant production losses. There are many strategies to handle mixed infection in pig such as management, medication, vaccine and biosecurity[2]. This paper aims to report the success of SS-2 vaccine (Prefarrow StrepShield®) to prevent production losses in PRRSV and SS- 2 co-infection cases in a pig farm in Thailand.

Materials and methods

Case history: A 4,000 sows pig farm had been suffering from increase of mortality rate in starter pigs since February, 2015. The pigs had sudden death at 11-13 weeks old for over 10 pigs/ day. From clinical observation, the pigs had fever, convulsion before death, edema of eyelids and stain with ocular discharge, coughing, labor breathing, dog-sitting, joint swelling, PCV2 linked-skin lesion and rough hair coat. Feed medication was Tiamulin + Amoxicillin, and injection with Tulathromycin but without positive effect. Three pigs were selected for necropsy and laboratory diagnosis.

Necropsy and laboratory diagnosis

The lesions are lymph node enlargement (3/3), tonsillitis (3/3), peritonitis and pericarditis (2/3), interstitial pneumonia (3/3), hemorrhagic pneumonia (2/3), joint swelling and filled with synovial fluid (3/3) and pus (2/3). Blood and internal organs (spleen, lymph node, kidney, tonsil, and ileum) were sent to test for PRRSV, PCV2 and CSFV by PCR, RT-PCR and IFA test. The results were found positive on US-PRRSV (RT-PCR) in both blood and pool organ. IFA test resulted in weak positive results on CSFV. Lung and joint culture identified SS-2 and *Mycoplasma hyorhinis*.

Vaccination by SS-2 vaccine (Prefarrow StrepShield®) and medication

Prefarrow StrepShield® vaccination was used in sow at 5 and 2 week before farrowing and in piglet at 3 and 5 week after birth, combined with feed medication (Tiamulin+Amoxicillin) and biosecurity measures to stabilized PRRSV status within the herd.

Figure 1: A; PCV2 liked-skin lesion, B; Convulsive pig, C; Interstitial pneumonia with hemorrhagic lung, D; Peritonitis.

Results

Table.1 Laboratory results before and after SS-2 vaccination

Date	Condition	Found SS-2 by bacterial culture (+/All)
Mar. 16'15	Before Vac.	2/3
May. 28'15	After Vac.	0/2

No mortality in nursery piglets after Prefarrow StrepShield® vaccination for around two months was found. Two pigs were necropsied and no SS-2 was isolated from bacterial culture.

Discussion

This report shows the efficacy of SS-2 vaccine to prevent production losses in the case of PRRSV and SS-2 co-infection .

Reference

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Evaluation of PRRSFREE™ Subunit Vaccine of Nursery Piglets and Pregnant Sows under Field Conditions

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Introduction

Porcine Reproductive and Respiratory Syndrome virus (PRRSV) has been the major cause of porcine diseases for years resulting in tremendous economic losses. There have been live and killed PRRS vaccines in the market. Because there are some disadvantages of these vaccines, such as PRRS virus mutation, the protection conferred by these vaccines is not satisfactory. Therefore, Reber Genetics Co., Ltd, developed PRRSFREE™ subunit vaccine which is a safe and efficacious PRRS vaccine and has already been patented in Taiwan and the United States [1]. In this study, the efficacy of PRRSFREE™ in nursery piglets and pregnant sows were evaluated under field conditions.

Materials and methods

Pregnant sows Experimental sows were vaccinated with PRRSFREE™ at 8 & 5 weeks before farrowing. Blood samples (N=10) were randomly collected from sows before and 1 and 2 weeks post-1st-vaccination (1WP-1V and 2WP-1V) and post-2nd- vaccination (1WP-2V and 2WP-2V), respectively. All blood samples were submitted for lymphocytic phenotyping, PRRSV-specific intracellular IFN-γ production assay and antibody detection.

Nursery piglets 200 piglets aged 3 weeks were randomly selected and allocated into two groups, the V group (n=100) and the C group (n=100). V group was vaccinated PRRSFREE™ at 3 & 6 weeks old, while the C group was administered with the same volume of saline. The body weight and mortality of piglets were monitored and recorded at 3 and 11 weeks old.

Result

Pregnant sows PRRSV ELISA antibodies were rapidly elevated 1 week after sow vaccinated with PRRSFREE™. The number of lymphocyte subpopu-lation, especially $CD3^+CD4^+$ and $CD3^+CD8^{high}$, were 7~26% increase in different intervals after sows vaccinated with PRRSFREE™. Peripheral blood mononuclear cells stimulated with live homogenous PRRSV show that the percentage of IFN-γ^+ producing cells, especially $CD8^+IFN\gamma^+$, were increased in 2 weeks post- vaccination.

Nursery piglets There were no significant difference in BW between V group and C group during 1-4 week period. At 11 weeks of age, the BW of the V group (34.65 kg) significantly increased than that of C group (29.85 kg). ADWG of V group (560 g) were significantly higher compared with C group (4720 g) during the 4-11 week period. The mortality of V groups was 6 % lower than that of control groups

Discussion

In this study, it showed PRRSFREE™ subunit vaccine could rapidly develop secondary immune responses, including elevating antibody response 1 week post-vaccination and enhancing PRRSV-specific CD8+ IFN cellular immunity 2 weeks post-vaccination in sows. The enhanced immunity may reflect the abortion control and suckling piglet protection. It also showed that giving PRRSFREE™ subunit vaccine at 3 and 6 weeks of age is efficient to not only increase of ADWG and BW ($P<0.05$), but also decrease of mortality in nursery pig during 3-11 week period in the treatment group.

Reference

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Operationalizing EcoHealth Approach: Balancing environment and animal health decisions in Smallholder Swine Farms in the Philippines

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Introduction

The success of the swine industry has for many years been measured in terms of production outputs that are aligned to economic revenue. Thus, early interventions initiated by government bodies tend to be geared towards improving animal health via improved breed selection, improved feed conversion efficiency and higher reliance on biological products such as vaccines. These are particularly manifested in various national programs such as breeding, vaccine development, disease diagnostics, disease investigation protocols, diagnostic test kit development, and the establishment of demonstration farms. Currently, the livestock sector is growing in the Philippines, with swine production as a major activity for smallholder farms in rural areas.

The principle of sustainable development — on which many of the national policies are now based — indicates that swine production must incorporate social, economic, and environmental considerations. For a fully integrated approach, the concepts, principles, and methods from the natural, social, and physical sciences must be used in addressing the inherent complexity and uncertainty of agricultural production. Essentially, an approach that transcends disciplinary boundaries is needed. Achieving this transdisciplinary approach may be difficult but the challenge could be aided by establishing a relationship based on mutual communication of ideas, observations, and innovations among and between bodies of knowledge including the academe, government, non-government organizations, community and end-users.

Materials and methods

This paper presents the initial experience and early plans of a four-year project jointly funded and implemented by various organizations (ACIAR, PCAARRD, DA-RFO III, PVOs, academe, and LGUs) to improve production and competitiveness of the smallholder swine system in the Philippines. Using an EcoHealth approach, this pioneering project will examine how optimal health could be achieved for the swine-dependent communities, animals and the environment. This research will demonstrate how swine diseases that are limiting smallholder production could be better managed along with an analysis of the environmental and socioeconomic impacts at the ecosystem level. A combination of a baseline survey, semi-structured interviews and focus groups that use participatory methods, and veterinary assessment of swine health will be used to (i) develop a full understanding of the smalholder system and (ii) prioritise constraints to swine production. A companion modeling (ComMod) framework will then be applied to identify, classify, and analyze key stakeholder perceptions on disease control Agent-based decisions of smallholder swine operators will be simulated under various management scenarios identified during a series of workshops. This will be done by conducting focus group discussions including role-playing exercises that aim to simulate how a maximum reduction of disease could be achieved within the context of sustainable total ecosystem (human, animal and environment).

Results

This project is still in the initial stages. Current work on the project has focused on initial baseline surveys with a total of 246 survey forms available for preliminary analysis. After the completion of the baseline survey, the focus of the work will move to semi-structured interviews and focus groups that involve representatives from all stakeholder groups. In addition, on-farm visits are planned.

Discussion and Conclusion

We believe that an EcoHealth approach to the smallholder swine farming system can enhance swine production and the control of a range of diseases. Importantly, the project will seek to maximize an integrated approach that builds on strong inter-agency and inter-institutional collaborations. These collaborations will be critical to scale-out programs that may occur in the future.

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EcoHealth in the Philippines Phase 1: Survey of Smallholder Pig Farmers in San Simon, Pampanga

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Introduction

A four year project to improve the production and competitiveness of the smallholder pig system in the Philippines commenced in 2015. The project follow the principles of EcoHealth research: systems thinking, transdisciplinary research, participation, sustainability, gender and social equity and knowledge to action. The focal site of the project is the municipality of San Simon, Pampanga. The objectives of the baseline survey reported here are to (i) identify and map the active (current raisers) and inactive (previous raisers who still have pig pens) smallholder pig farmers, (ii) establish their socio-demographic and pig raising profiles, (iii) identify which disease syndromes are most commonly observed by smallholder pig farmers and (iv) identify those farmers interested in participating in the next phase of the project.

Materials and methods

A survey was conducted from June – August 2015 in San Simon, Pampanga, the Philippines. Co-operation was sought from the Mayor and representatives from all barangays (n=14). A questionnaire was designed and piloted on local pig farmers. It was comprised of three sections: (i) farmer details - location and socio-demographic profile, interest in further participation (ii) inactive farmers – type of operation and reasons for stopping raising pigs, (iii) active farmers – type of operation, management practices, constraints to pig raising, observed disease syndromes, management of diseased pigs, vaccination and biosecurity practices and waste disposal methods. Prior to the survey teams visiting barangays, local representatives identified active and inactive farmers via a door-to-door approach combined with local knowledge. They tagged houses with color-coded markers. Survey teams consisted of a trained enumerator and a barangay representative. Multiple teams visited each barangay over one to three days depending on the number of farmers. GPS co-ordinates were used to plot the location of farmers and descriptive statistics used to summarize other data.

Results

To date, data from 246 farmers from 3 barangays have been analyzed. Of these, 116 (47%) were active and 130 (53%) were inactive. Of the inactive farmers, most stopped raising pigs in 2014 or 2015 (45%). The main reasons for stopping raising pigs were financial and disease, reported by 51% and 38% respectively. Most (81%) bought piglets for fattening; only 19% kept sows and/or gilts. Of the active farmers, 58% keep sows/gilts and sell piglets and/or fatteners and 42% buy piglets for fattening. Most (85%) derive less than half their household income from pig raising. Most farmers (99%) keep their pigs confined in pens and the majority (67%) feed both commercial and other feeds (e.g. by-products, leftovers). Natural mating is more commonly used than artificial insemination (74% of those farrowing). The main constraints to keeping more pigs are financial (46%) and lack of space (21%). Disease is considered less important (8%). Diarrhoea is the most commonly reported sign of disease in both piglets (34% of those farrowing) and fatteners (22% of those fattening). Most farmers (91%) seek assistance when they observe that pigs are diseased. Assistance is most commonly sought from agrivet supply stores (49%) and government veterinarians/technicians (38%). Most pigs are kept <20m from neighbours' pigs (69%) and can be accessed by other individuals (67%). Waste disposal is usually into a canal, lagoon or river (29%, 20% and 17%, respectively). Nearly all farmers (89%) are interested in further participation in the EcoHealth project.

Discussion and Conclusion

Both active and inactive pig farmers in San Simon are keen to participate in the next phase of the project. This will involve (i) focus groups and semi-structured interviews to better understand the smallholder pig system and to estimate enterprise budgets and (ii) farm visits by a veterinarian to gather data on productivity, observed health and management

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