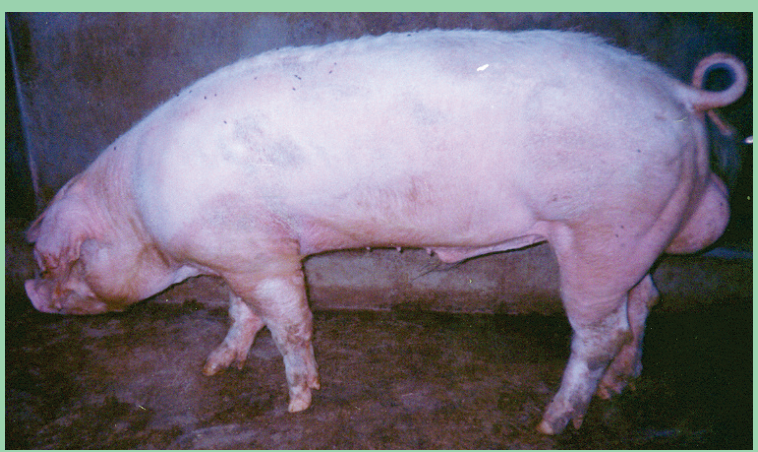
Webinar Proceedings

National e-Workshop cum Webinar

on

"Current Perspective of Swine Diseases in India and its Management Practices"

11-12 January, 2021



Conducted Jointly

ICAR-National Research Centre
Rani, Guwahati (Assam)

&

Indian Association for
the Advancement of Veterinary Research (IAAVR)

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Chairman:	**Dr B.N. Tripathi** DDG (Animal Science), ICAR
Co-chairman:	**Dr Ashok Kumar** ADG (Animal Science), ICAR
Guest of Honor:	**Dr K.M. Bujarbaruah** Former Vice-Chancellor, AAU & DDG Animal Science, ICAR
Moderator:	**Prof. (Dr) Rishendra Verma** Founder Secretary, IAAVR
Convener:	**Dr Swaraj Rajkhowa** Principal Scientist & Director (Acting), ICAR-NRC on Pig
Organizing Secretary(s):	**Dr Ajay Kumar Yadav** Scientist, ICAR-NRC on Pig **Dr Seema Rani Pegu** Senior Scientist, ICAR-NRC on Pig **Dr Santanu Banik** Principal Scientist, ICAR-NRC on Pig
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Co-Joint Organizing Secretary(s):	Dr B.C. Das, Principal Scientist Dr Keshab Barman, Principal Scientist Dr Mohan N.H., Principal Scientist & ICAR-National Fellow Dr Rafiqul Islam, Principal Scientist Dr Pranab Jyoti Das, Principal Scientist Dr Rajendran Thomas, Senior Scientist Dr Juwar Doley, Scientist Dr Souvik Paul, Scientist Dr Kalyan De, Scientist Dr Sunil Kumar, Scientist Dr Sheikh Firdous Ahmad, Scientist Dr Nitin M. Attupuram, Scientist Ms Salam Jayachitra Devi, Scientist

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Abbreviations and Acronyms

ASF	African swine fever
AH	Animal Health
AS	Animal Science
AICRP	All India Coordinated Research Project
AINP-HS	All India Net work on HS
CADRAD	Centre for Animal Disease Research & Diagnosis
COVSc	College of Veterinary Science
CP	Control Programme
CSF	Classical Swine fever
DADF	Department of Animal Dairying & Fisheries
DIVA	Differentiating infected from vaccinated individuals
FMDV	Foot & Mouth Disease Virus
GIS	Geographic Information System
HP	Highly Pathogenic
HS	Haemorrhagic Septicaemia
IAAVR	Indian Association for the Advancement of Veterinary Research
ILRI	International Livestock Research Institute
IVRI	Indian Veterinary Research Institute
ICAR	Indian Council of Agricultural Research
MLV	Modified Live Vaccine
NADCP	National Animal Disease Control Programme
NE	North Eastern
NEH	North Eastern Hill
NRC	National Research Centre
NRCP	National Research Centre on Pig
OIE	Office International Des Epizooties
PRRSV	Porcine Reproductive and Respiratory Syndrome Virus

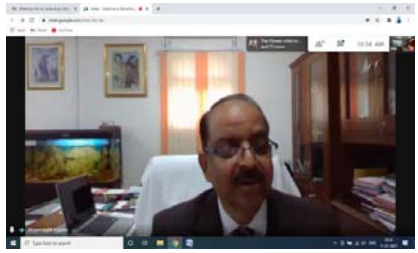
Background

Pig industry, an economically sustainable and viable support to the people of rural India contribute about 1.7% of the total livestock. Pig farming in India primarily a small scale unorganized rural activity is an integral part of diversify agriculture particularly in the tribal belt of the country. Considering pigs to play role in the poverty reduction of the disadvantageous group of the rural population, the ICAR has initiated All India Coordinated Research Project (AICRP) on pig in the year 1970-1971 in 10 locations of the country. Later the mid-term appraisal committee constituted by ICAR in 1990 reviewed the work of the AICRP's on pig recommended the establishment of one National Research Centre (NRC) on pig at Rani, Guwahati, Assam in the IX five year plan. According to 18th Livestock Census of India (2007), the pig population has declined to approximately 12 million heads from a th high of 14 million in 2003, as indicated by the 17 Livestock Census of India (18th Livestock Census, 2007). The states with greatest pig production are Assam and Jharkhand with a census of 2.1 million and 1.28 million respectively. He referred participatory epidemiological study conducted in 2011 in Assam, Nagaland and Mizoram by the International Livestock Research Institute (ILRI) showed that pig farmers in India incur huge losses from mortality, treatment and replacement costs over two billion Indian rupees (ILRI Policy Brief June, 2012). Disease was considered one of the important factors responsible for these losses and decline in pig population. The National e-Workshop cum Webinar on "Current Perspective of Swine Diseases in India and its Management Practices" is being organized to discuss diseases of pigs and their prevention and management.

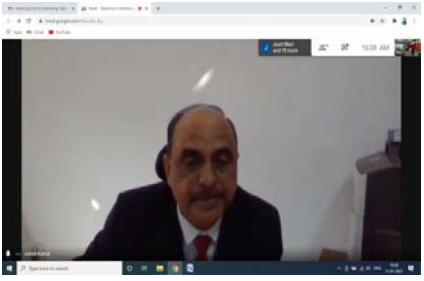
Highlights of the Webinar

Inauguration

The National e-Workshop cum Webinar on **"Current Perspective of Swine Diseases in India and its Management Practices"** was jointly organized by ICAR-National Research Centre on Pig and Indian Association for the Advancement of Veterinary Research (IAAVR) from 11-12 January, 2021. The inaugural session was started by welcome address by **Dr Swaraj Rajkhowa**, Director ICAR-NRC on Pig, followed by thematic address by the **Prof. (Dr) Rishendra Verma**, Ex-Joint Director (CADRAD), IVRI, ICAR-Emeritus Professor and Founder Secretary, IAAVR about the theme of the conference. Dr. Verma opined to analyse reasons for decline of pig population whether it is related to decline in interest for pig farming, non availability of quality pigs, tremendous loss due to mortality, or cost-benefit ratio in treatment.



Dr B.N. Tripathi elaborated the importance of the pig production system in the north eastern part of the country and development and release of the new pig varieties. He has mentioned the contribution of ICAR-NRC on Pig in the area of pig production system in the country. Dr Tripathi emphasized the decrease in the pig population from the previous census and need for the development of multivalent vaccines, advance diagnostics and surveillance system for the diseases. The ICAR-Indian Veterinary Research Institute should take lead in this area along with ICAR-NRC on Pig, College of Veterinary Science Khanapara and ICAR-Research Complex for NEH region should collaborate.



Dr Ashok Kumar emphasized the pig husbandry system for the weaker section of the society, un-organized system of pig rearing in our country. Dr. Kumar pointed the decrease in the pig population over the previous census may be due to increase in pork consumption and incidence of occurrence of many infectious diseases

in the pig industry. He emphasised the importance of the infectious diseases of the pigs including bacterial, viral and parasitic in the production system and biosecurity guidelines to prevent the entrance of the disease in our country through the porous borders. He suggested vaccinating the total pig population against CSF. He has mentioned the importance of development of user friendly Mobile Apps for the farmers.

Dr K.M. Bujarbaruah, mentioned about the present status of piggery sector in India (where we stand) and where to go. He has also pointed out that there something wrong (or missing) in our approach for which w are not being able to come up with god management practices against even common endemic diseases of pigs. He has mentioned that we are working on the diseases for a century but we could not limit the occurrence of the endemic diseases. We have to reform our strategies about prevention and control of infectious diseases. He has also mentioned that the entrance of the transboundary diseases in India such as PRRS (in 2013) and ASF (in 2020) has occurred through the porous international borders since the NE-region shares five international borders. We should focus on research along with biosecurity measures. Vaccine for CSF is in demand along with vaccine for ASF and PRRS. He has suggested for constitution of a research team including breeders, nutritionist and health scientists for development of a bred that would be more disease resistant with better feed efficiency. He also suggested for the development of policy paper on biosecruity measures for pig production.

Technical Session-I

Classical Swine Fever (CSF) in Pigs and its status in India

Dr D.K. Sarma deliberated the issues and control measure of Classical Swine Fever (CSF) in Pigs. Dr Sarma discussed the current scenario of CSF and about its change in the genotypes, evolution of new genotypes, Vaccine failure and occurrence of CSF even in the vaccinated stocks. He has discussed about the need for development of multiplex diagnostics, Point of care tests and vaccine against the new emerging strains. He appreciated IVRI for release of new indigenous vaccine for swine fever. He has mentioned that improper vaccination may cause emergence of new strains. India has many challenges to control the CSF namely; low bio-security measures, porous international borders, insufficient doses of vaccine, Wild/feral pig populations and lack of robust surveillance. The Govt. of India should think for sufficient doses of swine fever vaccine, Research & Development for Point of care test, Development of newer CSFV vaccines which can act as DIVA, multivalent vaccine development and evaluation and study of the types of swine fever vaccine available.

Mitigation of African Swine Fever (ASF): Way forward

Dr N.N. Barman, presented his talk on Mitigation of African Swine Fever (ASF) and he has discussed the issues related to entrance and first outbreak of ASF in India in the month of February, 2020 which killed more than 18000 pigs in the Assam and more than 3000 pigs in the Arunanchal Pradesh. The mortality rate as per the data available was 65% in India. He focused mainly on lack of bio-security measures because of that the disease has entered in India. The NER region many a times acts as entry point of the disease. He has mentioned that ICAR-NRC on Pig should take lead in the area of implementation of bio-security and housing system. Dr. Barman has recommended that all scientists should work together for development of vaccine against ASF. There should be multidisciplinary approach and policy formulation to control the ASF spread.

Pasteurellosis in Pigs

Prof. (Dr) Rishendra Verma, presented his talk on "Pig Pasteurellosis". He spoke about the role of *P. multocida* B:2 strain in pigs causing septic pasteurellosis. He said that there is no Indian Vaccine for swine pasteurellosis. The cattle strain P_{52} is using against pig pasteurellosis. *P. multocida* B:2 pig strain was isolated from the pig and designated as "Soron" at IVRI, Izatnagar. A double emulsified vaccine prepared from "Soron" by direct challenge offered 9 months protection. He also referred to a vaccine

prepared from Capsular Type A work undertaken during AINP-HS, College of Veterinary Science, Guwahati. A limited trial of this aluminium hydroxide adjuvanted vaccine offered protection up to 8 months. Dr Verma opined that a bivalent pasteurellosis vaccine for pigs including Capsular Type "A" and "B:2" may be prepared. Dr. Verma also presented information on whole genome sequence of *P. multocida* "Soron" which falls into a separate cluster and not in the cluster of *P. multocida* P_{52}.. In view of CSF and ingression of new viruses hitting pig, *P. multocida* vaccine must be administered to pigs as the viruses lower or cause immuno-suppression.

2nd Day 12th January 2021

Swine Brucellosis and current status of it's vaccine development

Dr V.K. Gupta presented his talk on Swine Brucellosis and current status of it's vaccine development. Dr Gupta emphasized on transmission of Brucellosis and zoonotic importance of Brucellosis including Swine Brucellosis. Dr Gupta mentioned the evolution/emergence of new *Brucella* species. Dr Gupta has focused on different strains of *Brucella* and phases of vaccine trials against them. He has clearly mentioned that there is no commercially available vaccine against *Brucella suis*. He has mentioned about vaccine against *Br. Suis* using non-pathogenic 353-1 strain. Dr Gupta has focused on development of vaccine using different strains of Brucella like *Br. suis* strain-2, B. Suis biovar-2, *Br. abortus* RB-51. He has emphasized on development of Oral vaccine of *Brucella* using Corn Syrup, Recombinant Intra-nasal vaccine, S-19 vaccine or use of S19ΔvjbR vaccine in pregnant swine.

Technical Session-II

Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) infections in pigs

Dr T.K. Rajkhowa talked on Porcine Respiratory and Reproductive Syndrome Virus (PRRSV) infections in pigs. Dr Rajkhowa has elucidated the entrance of PRRS in India and economic losses caused by the disease. The highly pathogenic virus (HP-PRRSV) has emerged in China in 2006 and entered in the NE-region of India through porous international borders. He emphasized the epidemiology of PRRSV, factors associated with transmission of the disease. He opined that there are challenges in the control of PRRS; No effective vaccine is available. The problems of virus shedding, persistent infection, incomplete protection and reversion of virulence in the modified live vaccine (MLV) are of concern.

Vaccines and vaccination in pigs with emphasis on Control Programme of CSF by Govt of India

Dr P. Dhar discussed Vaccines and vaccination in pigs with emphasis on Control Programme of CSF by Govt of India. He mentioned vaccines against classical swine fever in India. Constraints in the development of lapinized vaccines, lack of insufficient doses of swine fever vaccines and policies to control the disease mainly stamping out and emergency vaccination. He mentioned the control programme (CSF-CP) launched by Govt. of India and under this programme state of Karnataka has developed cell culture vaccine. He pointed out the right time of vaccination against CSF is after 3 months of age. Dr Dhar has recommended to shift from lapinized to cell culture vaccine and he has developed a cell culture vaccine using indigenous strain and vaccine was released by Govt. of India on 3rd Feb, 2020. He has also developed one kind of oral vaccine to CSF. There is huge gap between demand and supply of the CSF vaccine therefore one separate laboratory for the vaccine production of CSF should be in the North-Eastern part of the country.

Foot and Mouth disease vaccination of pigs in context of Control Programme of Govt. of India

Dr Aniket Sanyal delivered his talk on Foot and Mouth Disease vaccination of pigs in context of Control Programme of Govt. of India. Dr Sanyal emphasized on vaccines of the Foot and Mouth disease in India. He mentioned that there is gradual decrease in disease incidence in recent years after vaccination. He recommended for improved machinery of surveillance, geographic information system (GIS) for gathering, managing, and analyzing data, shielding of porous international borders, vigilance of disease outbreak, movement of trade of animals, bio-safety and bio-security at lab and vaccine manufacturing process, Zoo sanitary measures, Understanding ecology and landscape genetics of FMDV, biannual vaccination, higher antigen dose in vaccines, uniformity in timing of vaccination and mission mode research.

Vote of Thanks

The two days programme was ended with brief summary of the programme by Dr Swaraj Rajkhowa, the convener of the programme and finally with vote of thanks.

BRIEF NOTES

Classical swine fever and its status in India

Dilip Kumar Sarma, Prof& Head, Department of Veterinary Microbiology, Assam Agricultural University, Khanapara, Guwahati-781022

Pig production in India plays a very important role in rural livelihood and nutritional security of the people of India. Despite good prospect, pig husbandry sector is not growing fast and there is about 50% deficit of pork in the country. There is 12 % decline in pig population of the country in the 20th Livestock census and the two important causes of decline are infectious diseases and increase slaughter rate. Among the infectious diseases of pigs, classical swine fever (CSF) caused by a member of the genuspestivirus is the most common devastating disease. The annual loss due to the disease alone is estimated to be more than 4 billion in India. Of the three genotypes of the CSF virus, the subgenotype 1.1 belongs to the genotype 1 is the predominant one , however in the last few years occurrence of CSF due to the sub genotypes 2.1and 2.2 have been reported in India. Considering the economic importance of the disease the Deptt. of Animal Husbandry ,Dairying and Fisheries , Govt of India has launched control programme of CSF in 2016 giving focus on the pig population of the North Eastern (NE)states, India as about 40 % of the India's pig population located in the NE states. To vaccinate all the domestic pig population of the NE states alone required about 7 million doses per annum and for the country the CSF vaccine requirement is about 18 million doses per annum. Presently there is limited availability of the CSF vaccines due to which the mass vaccination programme is not taking place. To control the disease the entire pig population of the country need to be vaccinated twice in a year and vaccination coverage should be more than 80 %. Therefore the availability of quality CSF vaccine is the need of the hour. Further vigorous surveillance of the disease is essential. Due to lack of awareness and organized pig slaughter houses, CSF affected pigs are also slaughtered for human consumption. Besides, the biosecurity level at the farmers field is less and there are illegal trading of pigs from the neighbouring countries to India.

African Swine Fever in India and its Control Strategy

Dr N.N. Barman, Professor, Department of Microbiology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati (Assam)

African Swine Fever (ASF) is a highly fatal viral infectious disease that manifests as a haemorrhagic fever in affected pigs. ASF has been listed as a priority disease in World Organisation for Animal Health (OIE) owing to its socio-economic importance and transboundary potential (OIE, 2020). India has reported the first outbreak of ASF in the domestic pig population of two of the North-Eastern states viz. Arunachal Pradesh and Assam to OIE on the 21stMay, 2020 (OIE, 2020b). Certain risk factors/indicators in Indian context which might serve as a connection for further emergence of ASF beyond North Eastern Region like population density of domestic pigs, farming practices, wildlife reservoirs and their habitat, international trading system. Above all the research gap and a road map for farm bio-security that require addressing such emerging disease.

Pasteurellosis in pigs

Prof. (Dr) Rishendra Verma, ICAR-Emeritus Professor, Indian Veterinary Research Institute, Izatnagar-243 122 (UP)

P. multocida a Gram-negative, bipolar, non-spore-forming and non-motile rod is a member of the Pasteurella genus and the Pasteurellaceae family. *P. multocida* strains are classified into five serogroups (A, B, D, E and F) based on capsule antigens and further classified into 16 serotypes (1–16) based primarily on lipopolysaccharide. There are three types of Pasteurellosis viz: i) Penumoic, ii) Septicaemia and iii) Atrophic. Tonsils serve reservoir of *P. multocida.* In India, the frequency distribution of Serotype A was higher (49.52%), followed by serotype D (29.92%) and serotype B (20.56%) (AINP-HS; Unpublished data). According to Dr Rajkohwa Group *P. multocida* type D was isolated from 66.70% of pigs with clinical respiratory disease from local pigs in India. In an other study, a total of 87 (8.40%) *P. multocida* isolates were recovered from diseased and apparently healthy pigs, out of which, 54.02% belonged to capsular type A and 43.67% to capsular type D. (Rajkhowa et al., 2015). 21 porcine *P. multocida* were isolated from Assam and these grouped into capsular type A (66.66%) and type D (33.33%). Vaccination with Lapinized swine fever vaccine was reported to lower the resistance of pigs to *P. multocida.* Outbreaks of classical swine fever (CSF)

occurred in four herds in Punjab state. All herds were located in the same geographical area, but were approximately 100 km apart. *P. multocida* isolates from two outbreaks were characterized morphologically and biochemically. Serotype B:2 was identified from both outbreaks by polymerase chain reaction using *P multocida* specific primers (KMT1T7, KMT1 SP6) and B:2-type-specific primers (KTSP61, KTT72). We also found pigs dying both with CSF and *P. multocida* during outbreak at LPR (Pig) IVRI, Izatnagar. Pure culture of Serotype B:2 was isolated confirmed both by conventional and molecular methods. It appears that CSF causes immunosuppression. Comparative genomic analysis of *P. multocida* from different host species found that there are no genes in the *P. multocida* genome that are specific to any type of host. Core genome phylogeny revealed PM_SORON forming a separated cluster with two other strains(HNO1 and HN02). These isolates were recovered from the goat and sheep lungs in china in the year of 2017 and 2018 respectively. Whereas, PM_52VAC formed a separate group that involved 12 strains. Among them, involved few strains were from Bangladesh (PM_BAUTB2 (Bangladesh, buffalo throat samples, 2016)together with PM_RAZI_PM0001 (isolation soure: vaccine, bovine, iran,1936). Immunogenic potential of bacterin vaccine prepared from the most pathogenic isolate of *P. multocida* Type A was undertaken under AINP-HS at Guwhatai (2014-15,2016,17). Trial in 4 piglets of 4 weeks of age with Aluminium hydroxide adjuvanted bacterin showed ELISA titres in vaccinated animals from 7^{th} day onwards till 8 months. Immunized pigs were protected against homologous challenge on 8^{th} month post vaccination. A. double emulsified (DE) vaccines containing 2.5 mg inactivated antigenic mass of pig field strain (B:2) (named as "soron") isolated from an outbreak of septicaemic death in pig, IVRI and *P. multocida P52 cattle strain (B:2).* The duration of immune responses were monitored at 3, 6 and 9 months post immunization in pigs. By direct challenge, pigs showed that the vaccines were protective at 21 days and up to 270th day (9 months) post immunization. The results showed that pig strain (Soron) would be a potential homologous strain of *P. multocida for the vaccine against* pasteurellosis in place of use of cattle *P. multocida* P_{52} *strain.* Swine Pasteurellosis and haemorrhagic septicaemia are controlled by vaccination of animals with H.S. vaccine. The vaccines preparation used for cattle buffaloes and pigs are same. The vaccinated and non-vaccinated animals were affected during each outbreak of swine pasteurellosis in Chhattisgarh with variable mortality rates and different disease manifestations. It indicated that there is possibility of variation in antigenicity between vaccine strain and field isolate of *Pastuerella.* Vaccination with homologous strains give better protection against a homologous challenge than against a heterologous challenge

Vaccine and vaccination of pigs with emphasis of control programme of classical swine fever by Government of India

Dr P. Dhar, Principal Scientist, Division of Biological Standardization, ICAR-Indian Veterinary Research Institute, Izatnagar-243 122 (U.P.)

Classical swine fever is still an important disease of pigs in India. A lapinized vaccine has been used in the country since 1965. Since this vaccine is produced from the spleen of CSF virus inoculated rabbits and only 50 doses are produced from a single rabbit, smaller batches of only 4000-5000 doses have been produced by several State Biological Units. Total capacity of vaccine production has been only 1-2% of the total pig population. This vaccine is currently produced by the State Biological Units of Kolkata, Ranchi, Kerala, Haryana and Punjab. Due to low productivity, the country suffered from vaccine insuffiency and hence CSF outbreaks have always reported from the pigs which are not vaccinated. Although Government of India launched CSF control programme during 2014-15, the programme has not been very successful due to the non-availability of a high yielding cell culture vaccines. Around 15000 doses can be produced from a 25 cc tissue culture flask. In the recent past, CSF cell culture vaccines have been developed in the country. At IVRI, we developed a CSF cell culture vaccine from the lapinized vaccine virus and the vaccine is being produced by M/s Indian Immunologicals since mid **2020**. The same technology has also been transferred to Punjab Veterinary Vaccine Institute, Ludhiana in 2015. During the same time, similar lapinized cell culture CSF vaccine has also been developed by IAHVB, Bangalore for use in the State of Karnataka. In Dec 2019, a Korean cell culture vaccine (LOM strain) has become available in the country. Very recently, we at IVRI developed another cell culture vaccine for CSF from an Indian virulent virus during 2017-2019 and the technology is yet to be commercialized. Thus, presently the country has a good number cell culture vaccines which can be used effectively in the CSF control programme and the country's present requirement of 18 million doses of the vaccine can be fulfilled to a greater extent. Painful killing of rabbits for this vaccine production are no longer required now.. Hence the country can switch from the lapinized vaccine production to cell culture vaccines with the newer technologies available with us at IVRI. Time of vaccination is also very important for eliciting a protective immunity. Vaccination done in the presence of maternal antibodies is as good as the animals have never received the vaccines and can get the disease if they come in close contact with any CSF infected pigs. Hence the right age of vaccination is three months when the level maternal

antibodies in the new born piglets are almost nil and hence a good immune response is developed . Presently vaccination are done at very early age of 42 days when maternal antibodies are very much present.

Swine Brucellosis

Swine Brucellosis and current status of it's vaccine development

Dr V.K. Gupta, Joint Director, Centre for Animal Disease Research & Diagnosis, ICAR-Indian Veterinary Research Institute, IZATNAGAR-243 122 (Uttar Pradesh)

Swine brucellosis is an infection caused by biovar 1, 2 or 3 of *Brucella suis*. *Br. suis* biovars 1 and 3 are serious human pathogens. It occurs in many countries including India where pigs are raised. Unlike in cattle, sexual transmission of *B. suis* is the main source of transmission and can induce spontaneous abortions early in gestation. Boars can present with appreciable genital infections, with unilateral testicular enlargement, which can result in infertility. Swine brucellosis can be difficult to diagnose and is usually recognized as a herd problem rather than a disease of individual swine. No commercial vaccine is available yet. Various attempts have been made by using traditional and molecular approaches but all failed in giving protective responses in host.

Porcine reproductive and respiratory syndrome (PRRS) infection in pigs

Prof. Tridib Kumar Rajkhowa, Department of Veterinary Pathology, College of Veterinary Sciences & Animal Husbandry, Central Agricultural University, Selesih, Aizawl- 796014

Porcine reproductive and respiratory syndrome (PRRS) is an economically important viral disease of swine, characterized by reproductive failure and acute respiratory disease in pigs of all ages. The aetiology, porcine reproductive and respiratory syndrome virus (PRRSV) is a single strand, positive sense RNA virus with a genome of approximately 15kb in size, belongs to the genus *Porarterivirus* of family *Arteriviridae* in the order of the *Nidovirales.* There are two distinct antigenically different species of PRRSV: the porcine

reproductive and respiratory syndrome virus type 1 (PRRSV 1) and porcine reproductive and respiratory syndrome virus type 2 (PRRSV 2) with nucleotide identity of only 55–70% causing similar disease symptoms in susceptible pigs. Highly pathogenic PRRS virus (HP-PRRSV), a novel variant of PRRSV was first emerged in southern China in 2006. HP-PRRSV causes prolonged high fever, cutaneous red colorations and high mortality rate in pigs of all age group and presently circulating in most of the south east Asian countries including Laos, Vietnam, Cambodia, Bhutan and Myanmar resulting huge loss to the local pig husbandries. The first outbreak of PRRS in India was reported in pig population of Mizoram state in 2013. The outbreak which devastated the pig farmer of the state was later identified as HP-PRRS. The molecular epidemiological studies have characterized the circulating PRRSV that caused the outbreak as HP-PRRSV of Chinese origin that might have entered through the porous international border of Mizoram with Myanmar. Since 2013, the pig husbandry in the state is devastated by four major outbreaks of the disease and now has been reported to spread to the neighboring states of NER India. An effective prevention and control strategy is essential to protect both the domestic and wild pig population India.

Vaccination in pigs in the context of foot-and-mouth disease control programme in India

Dr Ankit Sanyal, Joint Director, ICAR-Indian Veterinary Research Institute, Bangalore- (Karnataka)

Foot-and-mouth disease (FMD) is a highly contagious and economically important disease of cloven-hoofed domestic and wild ruminants including cattle, buffalo, swine, goats, and sheep. FMD is Risk Group 4 disease of trans-boundary importance, characterized by high body temperature and appearance of vesicular lesions on oro-nasal mucosa, interdigital cleft, coronary band, udder, and teats. The disease is endemic in India and three serotypes of the virus *viz*: O, A and Asia1 are circulating with a predominance of serotype O. There is no cross protection among the serotypes and even within a particular serotype different genotypes/lineages/strains are prevalent. FMD in pigs is characterized by fever, inappetence and reluctance to move. The more severe lesions occur in the feet, with lameness and blanching of the skin around the coronary bands. Abortion could occur in sows. Pigs may liberate vast quantities of airborne virus in their expired breath. Although pigs are highly susceptible to FMDV, they do not become carriers. The respiratory route is likely to be the most usual portal of entry, but pigs are more susceptible to infection by the oral route than ruminants.

In some herds, FMD associated piglet high mortality is reported. The role of pigs in the FMD epidemics has been significant, mainly in countries from eastern Asia. There is transmission of FMDV during the incubation period in pigs housed in groups. The transition from latent to infectious phases of disease occurs approximately 24 h prior to the appearance of clinical signs of disease. NADCP scheme was launched in September 2019, with an objective to vaccinate 100% cattle, buffalo, sheep, goat and pig population for FMD. Currently used FMD vaccines are inactivated viral antigen and oil adjuvanted for use in swine. In pig herds in high-risk areas routine vaccination is considered to reduce the susceptibility of the herds. Immune response to FMD vaccine in young pigs is poor; protection best provided by vaccinating pregnant sows. Presence of maternal antibodies delay the effectiveness of the vaccine. Hence, vaccination should not be done before 8 weeks of age. In conclusion, major approach to control FMD is by bi-annual vaccination of all susceptible species in India. Use of higher antigen payload/dose of vaccine will help to maintain required protective antibody level in the population.

RECOMMENDATIONS

Bio-security

1. Development of biosecurity based farming practice protocol. Awareness on the disease and biosecurity measures need to be carried out and illegal trading of pigs or pork products from the neighbouring countries should be checked.

[Action: All pig farms/AICRP on Pigs]

Classical swine fever (CSF)

1. Age of CSF vaccination may be fixed at three months of age to avoid the interference of maternal antibodies in eliciting a good immune response.

[Action: AICRP on pigs]

2. Surveillance of CSF is to be strengthened and cost effective pen side / point of care diagnostic is to be developed indigenously for rapid diagnosis and to differentiate CSF from other emerging pig diseases.

[Action: NRC on Pig, RDDLs, State Diagnostics Labs]

3. State Biological Units may be encouraged to adopt the CSF cell culture vaccine technology from IVRI or elsewhere and produce at least 10 lakh doses annually. Thus 10 million doses can be produced if 10 State Biologicals Units start producing this cell culture vaccine and killing of rabbits for vaccine production may be banned totally.

[Action: State Biological Products, Guwahati, Assam]

4. DADF should circulate to all State Animal Husbandry Departments to abandon the use of lapinized vaccine.

[Action: DADF/ICAR]

African swine fever (ASF)

1. Development of indigenous robust diagnostics and vaccine against ASFV.

[IVRI, NRC on Pig, COVSc, Khanapara & Animal Health Division, Barapani, NEH Regions]

Brucellosis

A vaccine alone will not be sufficient to eradicate *B. suis* from a swine population. Test and slaughter, selective depopulation policy may be adopted if disease eradication is the goal. Herd additions for uninfected herds should come from brucellosis-free states. Research on development of new generation vaccines

[Action: DBT, ICAR,IVRI, NRC on Pig, COVSc, NEH Region,

ICAR Research Complex, Barapani].

Pastuerellosis

1. As per recommendation of AICRP pasteurellosis vaccine should be administered in all centres of AICRP. One shot of oil adjuvanted vaccine of pasteurellosis against pig shall provide immunity up to 9 months. A bivalent pasteurellosis vaccine including serotypes B:2 (Soron) and Capsular type A may be prepared.

[Action: NRC on Pig, COVSc, NEH Region]

2. Further work on the serotypes of *P. multocida* across East, West, North and South regions may also be conducted which will help vaccination strategy

[Action: NRC on Pig, COVSc, NEH Region], IVRI/CADRAD, RDDLs, State Diagnostic Labs, AICRP on Pigs]

Foot and Mouth Disease

Uniformity in timing and density of vaccination is required for better results. Mission mode research programs to improve thermo-stability and to enhance duration of immunity will likely to help in effective control of the disease.

1. Periodic about 20% screening of serum of pigs for Foot and Mouth antibodies should be tested to assess the herd immunity.

[Action: AICRP on Pigs]

PRRS

1. An indigenous effective PRRS vaccine is the demand of time to control and prevent the disease.
2. Robust surveillance & monitoring system, development of rapid diagnostics, early disease detection and quick identification system.

[Action: COVSc, Aizwal, ICAR/ IVRI & NRC on Pig]