Planned implementation of biosecurity measures is crucial in pig health protection and successful production. The acquired biosecurity level on pig farms should be the result of logical conclusions and timely undertaken activities in the given environment and epidemiological situation with the recognition of real threats coming from the environment, and weak points in the technological process of pig production. Profitable pig production can be achieved with the enforcement of more prevention measures and less therapeutic measures, and if the feeding, husbandry and health protocols are strictly observed. Pig health is very important and can be improved in order to achieve better production results. Various diseases are often present on farms, and can endanger pig production within the intensive breeding system. Such are: neonatal scour, oedema disease, oesophagogastric ulcer, osteodystrophy diseases, actinobacillosis, atrophic rhinitis, dysentery, and recently proliferative enteropathy of multicausal aetiology, as well as some parasitoses (isosporiasis, cryptosporidiosis).

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B I O S E C U R I T Y

ON PIG FARMS

BENEFIT MEASURES BIOSCURITY ON PIG FARM

2015.

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INTRODUCTION

A modern approach to, and planned implementation of, biosecurity measures are decisive in the pig health protection and, thence, maintenance of a successful production system. The required biosecurity level on a pig farm should be the result of logical conclusions and adequate, timely undertaken activities with relation to the environment and epidemiological situation, with full awareness of real threats coming from the environment and critical key points within the technological production process. The introduction of HACCP (Hazard Analysis and Critical Control Points) and sanitation protocols are logical solutions that help prevent the introduction and spread of infectious agents into herds. Nowadays, it is largely recognized that biosecurity, animal welfare, good production practice and risk analysis at critical control points are very important elements in intensive pig production, this production system implying a large agglomeration of farm animals within a small space. The enforcement of biosecurity measures is crucial for the pig health protection and profitable production. Biosecurity plans are key factors in disease prevention and spread, as well as in management advancement. In addition, protocols are developed for emergency situations, as the modern tempo will not allow delayed reactions to such situations in order to enable the undisturbed continuation of production process.

The assessment of biosecurity on the basis of certain indicators (isolation/separation, quarantine, herd health status, farm workers attitude towards farm equipment, control of animal movement and traffic, visit regimen, control of feed and feeding equipment, manure removal, carcass disposal, relation to other animals on the farm, bird, pest and rodent control) should become a routine mechanism in the evaluation of farm biosecurity, and will eventually shape the further development and advancement of the pig farm.

Veterinary profession has its own important role in animal husbandry, health protection of humans, animals and the environment. It has become a global issue how to produce more (but healthy and safe) food and feed. Therefore, it is possible, by applying more prevention measures, and less therapeutic measures, in addition to the strict observance of the existing protocols, to protect pig health on pig farms and, at the same time, secure good production.

My intention, in writing this book, was to supply the basic information relevant to biosecurity on pig farms. I sincerely hope that it will be of help to all those concerned

with biosecurity on such farms, as well as to those interested in getting the basic information on pig farm biosecutity itself.

Belgrade, 2015.

CLASSIFICATION OF PIG FARMS/PIG PRODUCTION SYSTEMS

Throughout the world pigs are raised under different production systems. Different production systems produce different results. One of the most popular classifications of pig production systems is made on the basis of the size of herds, production goals (patterns of production) and husbandry management. The usually accepted three stages in production

1. :breeding, gestation, farrowing, and suckling
2. :rearing of young weaned pigs in nurseries up to 25-35kg
3. :growing and finishing to slaughter weight

definitely affect the organization of a farm (farm units) and production process. The variations in pig production systems depend on many factors, among them the level of the country`s economic development and climatic conditions. Animals can be kept indoors, inside the buildings (the so called "intensive type" or "small/large--scale confined pig production") or outdoors ("the extensive type" or "small/large - scale outdoor pig production) with their many subtypes. In undeveloped and some developing countries can be recognized such types of outdoor pig rearing/free-range system as "family pig farms', "small rural households" etc. With the economic and technological advancements it is normal to expect advancement in pig husbandry, to procure safe and healthy environments for animals, to maintain such living conditions that would result in more humane and profitable pig production.

The type of a pig farm will shape the overall farm biosecurity status, and stimulate the development of biosecurity protocols.

General biosecurity criteria for successful farms

Thus**,** a modern, ecologically, technologically and economically advanced farm will have to satisfy the following biosecurity criteria:

1. Controlled introduction of pigs to a farm;
2. AI, instead of natural mating;
3. Quarantine for newly purchased animals;
4. Controlled entrance to the farm and evidence of visitors;
5. Appropriate distances between farms (fences around the farm and closed entrance to it);
6. Nets against birds on windows;

7. Strict control of movement on the farm;
8. Good hygiene of farm workers and specific clothing and footwear;
9. All-in-all-out type of production;
10. Special facilities for removed manure;
11. Separate keeping of animal species;
12. Special loading area.

Cleaning and disinfection measures:

1. High-pressure washing;
2. Low-pressure washing;
3. Regular disinfection of vehicles, premises, equipment, clothing and footwear;
4. Regular disinsection and disinfestations

AN OUTLINE OF BIOSECURITY MEASURES ON PIG COMMERCIAL FARMS

Introduction

Biosecurity implies a range of appropriate, sustainable measures that have to be implemented on pig farms, accompanied with permanent, strict control at all the critical control points of production. Its goal is to maintain a high health status of herds, to prevent the entry and exit of pathogens, i.e. diseases into/from a farm. A planned enforcement of biosecurity measures is crucial for the protection of pig health on commercial farms. The key to the understanding of biosecurity is the proper understanding of the meanings of 'health' and 'disease'. Namely, a ‘disease’ implies a changed condition of an organism, when there occurs a disorder in the otherwise balanced functioning of organs that is manifested in various symptoms, as well as in decreased production and working abilities of animals. A disease means the absence of health. Health, on the other side, points to the correct function of the organs and maintenance of optimal reproduction and production.

The proper understanding of both health and disease leads us to comprehend that only healthy animals can secure optimal production.

In case biosecurity is not implemented properly, or is not implemented at all, this can have a harmful impact on production.

Biosecurity measures in intensive pig production

The optimum level of biosecurity on pig farms should be the result of logical reasoning and opportune activities undertaken in the given environment, in addition to the recognition of direct threats coming from the environment and weak points in technological process of production.

With the introduction of HACCP and sanitation protocol, the logical solution is found that will help to prevent the introduction and spread of infectious agents in herds. Nowadays, it is generally considered that biosecurity equals animal welfare, and that good production practice and risk analysis of critical control points are significant elements in intensive pig production, that includes a large concentration of animals within a relatively small space. The enforcement of biosecurity measures is crucial in the protection of pig health, and advancement of production itself. Biosecurity plans are of utmost importance for decreasing the risk of disease introduction and spread, optimizing productivity, preventing unwanted situations and

promoting advancement of management. Protocols are also developed for emergency situations, in order to secure opportune reactions to the unfavourable events and to secure continuous production. The assessment of biosecurity on the basis of indicators (segregation, quarantine, herd health status, equipment handling, movement control, traffic control, visitors observation of farm protocols, food control, feeding equipment control, manure management, carcass removal, relation to other animals on the farm, bird and rodent control) should become a routine practice that would determine future orientation and changes. While assessing the security status of the farm, various aspects should be taken into account at the same time – related, but at the same time different, biosecurity concepts, the risk assessment at critical control points (HCCP), emergency plans. Biosecurity plans are key factors in disease prevention and avoidance of critical situations.

Many solutions applied to industrial farms with the aim of increasing profitability, efficiency and security of production, very often result in animal discomfort, pain and stress, inhibiting at the same time their natural instinctive behaviour, that in the majority of cases results in economic losses. In addition, it should be taken into consideration that in many cases it has to do with pigs of different age categories, of different geographical and health origins, agglomerated within a limited space, keeping in mind that early matured pigs are very susceptible to stress that ultimately results in an increase in disease outbreaks. Any omission and mistake in the maintenance of the required biosecurity level usually lead to disease outbreaks, decrease in production, higher mortality, economic losses, putting in danger the survival of the entire herd. The above mentioned factors determine a farm biosecurity status, but their interaction and overall function must not be forgotten.

The term *biosecurity* includes three main factors:

1.*isolation* - that prevents unnecessary contacts of newly purchased animals with those from the controlled environment; contacts among the existing batches – classified into different age/or production groups;

2. *movement control*- that includes monitoring of movements of people, vehicles and all animals, entering or leaving the farm, and must be so conceived that prevents and minimize the contamination of herds, feed and equipment;

3. *sanitation*- that relates to disinfection of materials and equipment entering the farm, as well as to the hygiene of farm workers and equipment.

Biosecurity assessment of a farm

There does not exist a uniform biosecurity plan that would work for all farms. In order to achieve the necessary biosecurity level on a pig farm, it is necessary to make a plan that is a result of good planning and timely undertaken activities in the given environment and epidemiological situation.

Numerous restriction factors impede the attainment of the necessary level of herd health protection and successful production system. The herd size and production normally have an impact on the size and quality of the undertaken measures; the same could be said about the production intensity. This actually means that the economic factor (cost effectiveness) plays a decisive role in the determination of the goals that have to be achieved by applying some biosecurity protocol or at least some individual biosecurity measures, expressed in the form of good breeding practice, good veterinary practice or HCCP oriented plans.

Isolation as biosecurity factor

The location of a farm is a key factor in the sustainable biosecurity plan. The isolation of breeding facilities from the potential reservoirs of pathogenic microorganisms presents an important protection measure, especially in the case of airborne infections. However, it must be kept in mind that the viruses of foot - and - mouth disease, Aujeszky's disease, enzootic pneumonia and porcine reproductive and respiratory syndrome (PRRS) can be transmitted from long distances; whereas classical swine fever (CSF), African swine fever (ASF), transmissive gastroenteritis (TGE), atrophic rhinitis (AR), dysentery, pleuropneumonia, or leptospirosis can be diagnosed within the range of 100 m from the original focus of infection. Many authors have stressed the importance of the farm location and its distance from other potential threats, emphasizing the risk of the vicinity of other neighboring farms- providing a minimum distance between the neighbouring pig farms and between units within a pig farm-pig population density, elimination of the proximity of public roads, any contacts with other animal species, types of nearby farms and other possible sources of infection, such as slaughterhouses, garbage dumps, water facilities, etc. Not so often the importance of green protective belt is overlooked and it has in most cases a decorative role.

Quarantine

Newly purchased pigs must be kept in isolation **(**quarantine**)** prior to their introduction to a new farm for at least 6o days in order to assess their health status

and help their adaptation to the new environment, new housing facilities. Great care should be taken about the site of the isolation unit/facility (the suggested minimum is 3oo m) and the duration of quarantine, the longer the isolation the stricter the health control. It usually lasts 4 weeks, although the limit of 6 weeks is recommended.

Herd health status

The sustainable health protection and profitable production are possible only if the pig herds are free of infectious agents and other factors that can cause technopathies. The use, keeping, maintenance and handling of therapeutic means, instruments, semen, as well as the handling of disposable materials, all greatly contribute to the achievement of the satisfactory health status.

Handling of farm equipment, tools and instruments

Infectious agents can be transmitted in different ways: through direct pig-to-pig contact; viral shedding through semen; aerosol transmission of organisms; pig workers can have their own role in the spread of disease; vehicles can transmit swine pathogens; feed and water can be contaminated; manure and bedding material contain large quantities of bacteria, viruses and parasites; Birds, bats, rodents, stray animals can all be carriers of infectious agents. Last but not the least, farm equipment and instruments can transport pathogens, too. In order to mitigate the spread of infectious agents via these, certain measures must be undertaken: hand washing prior to any entrance to any segment of the farm, as well as after handling diseased pigs, the obligatory use of gloves at farrowing, the use of different equipments for handling feed and manure, use of disposable needles, sterilization of the equipment used for castration and pig marking. All visitors and farm workers should be provided with special clothing and footwear, and should wash their hands on entry. The clothing should be washed with detergent and hypochlorites.

Control of movement and traffic

Strict control of movement of people, animals and vehicles to the farm and from the farm must be an indispensable part of production technology and be conceived in such a way as to prevent or minimize the contamination of pig herds, feed and equipments or instruments. However, in practice, some very important factors are being overlooked that have to do with full fencing of farm units or enclosures, creation and maintenance of barriers, observation of the farm protocols during the entrance to the farm of vehicles, visitors and farm workers. The existing biosecurity

protocols with regard to this should be strictly observed. Disinfection barriers are, as a rule, uncovered, exposed to harmful atmospheric conditions, rain and surface waters, and the applied practice is not changed as often as it should with regard to the traffic frequency. Even in the highly developed countries, it is often forgotten how important is the consistency in the application of preventive measures, as is the case in Denmark during the preparation and loading of fattening pigs for transport.

Visit protocol

In order to minimize the possibility of infectious agents shedding, every successful farm must have a set of protocols developed for visitors and drivers: the prevention measures they should adhere to, their cooperation necessary to minimize contamination of the animals and premises, prevention of visitors entrance to the pig housing and feeding premises, putting up of 'NO ENTRANCE' signs that contain the necessary telephone contact number for the entrance into the farm. In addition to the observation of the usual '*stand down'* period and prevention of any contact between pigs and visitors, the use of clean clothing and rubber boots, or PVC overshoes is obligatory, the control of feedstuffs and feeding equipment, and the choice of an adequate feed storage that will protect feed from contamination and introduction of microtoxins. It is also necessary to mark and sort feed with regard to different pig categories in order to prevent mistakes. It is also indispensable to monitor water quality and provide the appropriate watering system. In case feed is obtained from outside the farm, it is best to buy it from manufacturers with the controlled regimen of food production, its quality and biological safety.

Manure management

The location of a dump for manure disposal within the farm, and organization of manure disposal tell a lot about biosecurity level on the farm itself, and the awareness of those working there of the seriousness of the problem. For the time being, not all the countries have strict legal obligations concerning manure removal.

Disposal of carcasses

It is very important that all carcasses be removed from the farm on time and in the prescribed way.

Relation to other animals on the farm

Although not always desirable, certain situations arise when it is impossible to neglect the wish of some farm owners to keep pets- dogs, cats or some other animals. Such animals should be banned any access to certain parts of the farm and direct contact to the pigs. Dehelminthization of dogs is obligatory, as well as the enforcement of other prophylactic measures.

Bird control

Birds (pigeons, sparrows, starlings, swallows, bats) can be carriers of infectious agents. Potential refuges for rodents must be systematically eliminated. It is recommended to fill in all the holes to prevent rodent and bird entrance and birds making nests, and to install nets against birds on windows, providing ventilation openings, closing the existing openings on silos and removing the possible nesting places under roofs and eaves.

Rodent and pest control is a compulsory part of any biosecurity protocol, including: building of objects where rodents cannot penetrate, closing any places suitable for rodent hiding, not providing any watering or feeding places for them, and the elimination of the existing populations by poisoning, smoking or setting traps.

Sanitation

Sanitation relates to maintenance of hygiene, good sanitary conditions, cleaning and disinfection of people, materials, equipment and instruments entering the farm, and the hygiene of people and equipment present on the farm itself. The chemical agents used must be harmless to human health and farm animals.

In the assessment of the biosecurity level indicators it must not be forgotten that the awareness of those employed on the farm of a real necessity of protection of the entire production, and permanent efforts to eliminate any threat to biosecurity are the key to the success in development and application of biosecurity protocols for every possible situation and pig farm. Pig breeders are most responsible for the protection of their herds from disease introduction, for movement control, adequate handling and housing of animal batches and sanitation. Visitors must abide with the prescribed protocols within the farm biosecurity system. Farm workers and visitors must be fully aware of their role in the maintenance of the farm health status and good sanitary conditions.

The role of biosecurity under modern pig production conditions is a key factor that helps to maintain the high health status inside herds. The analysis of the imposed

biosecurity measures on the farm can point to the risk of an outbreak of diseases. Biosecurity is a relative term that can be understood in general as the measures undertaken in infectious diseases control. It can also be presented as a group of measures that protect herds from infections that can be introduced from outside, and at the same time, as methods for mitigating the risk of infection transmission between different categories within a herd. In case biosecurity measures are planned and applied in the right way, the risk of a potential herd infection and spread of the already existing infection will be reduced to the minimum.

The attitude to the problem of planning and application of biosecurity will be determined by the goal itself. According to it, biosecurity measures can be divided into two types:

a) External biosecurity measures,
b) Internal biosecurity measures.

EXTERNAL BIOSECURITY MEASURES

The external biosecurity measures include: general measures for infection control, routes of disease transmission (direct transmission, airborne transmission), types of pig units (farrowing pen, fattening unit, pen for growers, nucleus pen, nursery pen/room, sow unit), farm protection measures (strict control of entrance/entry concerning employed people, feedstuff, instruments and equipment), control of pest populations (rats, mice and birds), work with live pigs, introduction of novel pigs to the farm.

Routes of transmission of swine diseases can be: direct transmission when infection with faeces originating from infected pigs is transmitted by footwear, clothing, hands, equipment. In this way some intestinal infections can be introduced into herds, whose causes are mostly S*almonella***,** *Brachyspira hyodisenteriae, E. coli, Lawsonia,* as well as *Bordetella bronchiseptica, Pasteurella multocida* that cause atrophic rhinitis. In addition to faeces, the causative agent can originate from saliva, snot, urine, semen, blood, etc., but also from equipment (veterinary instruments, tools for farm cleaning, etc.). The experience shows that the possibility of the transmission of pulmonary diseases with faeces is rare (in comparison with intestinal infections), but still exists: whereas it is more frequent with direct contact with saliva and air droplets from the outside air.

The transmission by air –aerosol droplets- (*Mycoplasma hyopneumoniae, Acti*nobacillus pleuropneumoniae, PRRS, influenza, etc) depends on the type of th*e* causative agent. Thus, viral infections (e.g. influenza) can be transmitted by air to

long distances, thus making their control difficult. However, bacteria are transmitted to smaller distances (not all: *Mycoplasma* hyopneumoniae can be transmitted by air even to 5 km), and in that way controlled more effectively.

The purpose of the farm buildings/units and their location are important factors in risk assessment. From the point of view of biosecurity, it would be ideal if different categories of pigs be housed on different farms, respecting the required distances between them. Thus, nucleus should be on one farm, breeding stock on another, piglets on a separate farm; the same applying to nursery and feedlot.

The nucleus should be isolated from other farms (those that are not an integral part of it) at least 5 km, and 1 km from the sow unit. The sow unit should be 1km distant from the nucleus, and nursery unit, but 3 km from those that are not its integral part. The nursery should be 1 km away from the sow unit, and 2 km from any other units that are not its integral part. The feedlot should be 1 km away from the nursery unit, and 1km away from pigs that are not within the production programme. In this way critical categories are separated, mitigating the risk of disease introduction.

Farm protection

Entry control implies that every farm be fenced properly, with only one entrance and wardens for 24 h.

Workers and visitors control: Any person entering the farm must report at the entrance.

Control of equipment, tools and feedstuffs entering the farm: All equipment entering the farm must be checked if it originates from a place that is a potential source of infection and where it could have been in contact with infected pigs. If it had been, it must be thoroughly cleaned, washed and disinfected prior to entering the farm and then stored at special premises serving as quarantine, where they should be kept for a minimum of 3 days prior to being used. Disinfection reduces the risk of infection introduction into the farm. Feedstuffs should be transported in closed vehicles (trucks) and these must be disinfected prior to entering the farm. It would be ideal if every farm had its own truck for feed transportation. In case feed is prepared on the farm itself, then the same protocol applies to the truck that transports the necessary ingredients to be mixed on the farm. Unloading should be done at special premises. If there are no silos for feed storage on the farm, but feed is transported in special sacks, they must be disinfected previously.

Pest/rodent control: Regular pest and rodent control should be practiced. The populations of rats, mice, birds, flies are a particular risk for disease spread. The

prevention of their introduction to the farm is done with the goal of preventing the introduction of infectious agents to herds. Regular pest and rodent controls should be practiced, with rodenticides or by keeping the premises clean. The first line of defense from the carriers of the majority of infectious diseases (rats and mice) is outside the farm (including the ploughing of neglected fields-if any). Then follows the instalment of fences (a part of the wire and concrete are dug in the ground) around the farm. Only after this has been done, it is time for the defense of the farm premises. All around the farm buildings a belt of gravel, 1 m wide, is made in order to prevent the entrance of pests and rodents into the buildings. In addition, traps are put next to the buildings, supplied with poison (poison must be placed in special boxes and specially marked). Flies also represent a big problem in the disease transmission, so that special care must be taken of their extermination (especially preventing their entrance into the farm buildings during warm weather). For their extermination special chemical agents are usually used, although today, with intensive pig production being more and more present (due to the detrimental effect of chemical agents), some alternative biological methods are recommended (fly-killers), as well as physical methods (special preparations are used to attract and destroy flies). The control of the entrance to the farm of the above mentioned species is done in order to minimize the risk of introduction and spread of infectious agents to the farm and from the farm.

Management and transport of live pigs

Pigs that have once left the farm premises, must not be returned there. Their transport should be done in special trucks. These must be thoroughly cleaned, washed and disinfected prior to transport, and must have been kept in quarantine for 3 days (it would be ideal if the farm had its own truck for pig transport). The obligatory certificates will certify that the prescribed measures have been carried out. All this is done in order to minimize the risk of the transmission of infectious agents (the PRRS virus stays virulent for 8 h at lower temperatures, and 72 h on flies). Currently, SPF trucks are available, specialized for pig transport (mostly brood sows), and they are safe from the harmful impact of the environment they pass through.

Control of dead pigs

Carcasses should be disposed in special containers; each pig category having its own container, and they must be kept on a special plateau next to the door for carcass removal. After that they are taken to a special isolated precollection carcass

storage facility on a concrete area, kept at low temperatures, near the farm entrance, so there is no need for the truck to enter the farm premises; it will simply take the carcasses to the city pound. Trucks must be kept at the distance of 400 m from the farm animals, and 200m from the farm premises. Special premises should be supplied for trucks to be cleaned, washed and disinfected, as well as safely stored (3 day quarantine).

Introduction of pigs to a farm

Incoming stock is the greatest risk to the farm pigs, especially is infected. New animals (mostly replacement gilts) introduced to a farm must be free of disease, and they should undergo the prescribed period of 4-5 weeks (optimally 6o days) of a quarantine. Some of the referent information is necessary, such as the clinical status of the farm of origin. Every farm should have its quarantine for housing animals in order to mitigate the risk of direct transmission of infectious agents. The newly obtained pigs should originate from herds with the history of 4—5 years of absence of any diseases (certified by the pig farm log book, and certificates issued by specialized veterinary services). Additional serological tests are necessary to be ensured that the animals are healthy. The quarantine period is required so that the animals be observed for signs of diseases, the necessary analyses be performed, and animal health improved. If the animals are found ill, they must be removed from the farm, i.e. sent to slaughterhouses or be culled humanely. Nowadays the practice is that the animals from the farms with a high health status can be transported to any farm of the same or lower health status.

SPF system

Currently many farms have been accorded the special SPF status. 'SPF' means' *specific pathogen free'*, and is a special classification of farms on the basis of their health status, i.e. the presence /absence of particular disease(s) covered by SPF regulations, implying a permanent state control of farm health status. SPF protocol is developed by the Health Department of each country for itself, so that the diseases included differ from one country to another. The farms that respect the SFP protocol have it in a printed form announced at the entrance to the farm. SPF system applies to intensive pig production with high health control level (it is difficult to maintain high biosecurity levels over longer periods) and control of pig transport to other herds. Animals are housed in closed, ventillated pens, connected in the way that all the communication within the farm is isolated from the outside facilities. The biosecurity

measures, those concerning disease introduction, prevention and spread, and good sanitary conditions, are strictly applied, and under regular supervision of the local veterinary authorities.

This kind of classification is also called *'The traffic light system'*.

The traffic light system for biosecurity measures [1]

Colour	*Level of threat*	*When applicable*
Green	Low	Disease not present in the country or neighbouring countries
Amber (blue)	Medium	Disease present in neighbouring countries but at low level and not close to border
Red	High	Disease present in neighbouring countries close to border or at high levels

Red level- relates to the nucleus and selection farms that supply and sell breeding material for herd renewal/stock replacement. Prior to being introduced to a particular farm and used, the material must be kept in a quarantine. The health control is performed by an external veterinary inspection once a month.

Blue/Amber level – is characteristic for farms producing weaned piglets or fatteners.

The renewal of herds is permitted from the red and blue SPF level farms without any previous quarantine. Health checks are done every three months.

Green level – includes farms trying to achieve the blue level. The animals with this SPFstatus have a high health status, but do not originate from the SPF farms. In order to obtain the blue SPF status they must adopt all regulations required for that level.

The red and blue SPF farms are obliged, in case of an outbreak of a disease, to notify the nearest authorities within 12 weeks since the outbreak, or within 12 months after the disappearance of all symptoms. The SPF farms are free of some of the main swine diseases, such as: enzootic pneumonia, pleuropneumonia, atrophic rhinitis, dysentery, porcine reproductive and respiratory syndrome (PRRS), scabby, louse infestation. *Salmonella* spp is monitored, too, in addition to oedema disease and *Yersinia* enterolitica.

[1] The FAO, World Organisation for Animal Health, World Bank, GOOD PRACTICES FOR BIOSECURITY IN THE PIG SECTOR, in "FAO animal production and health paper 169", Rome, 2010, p.37

INTERNAL BIOSECURITY MEASURES

The Internal biosecurity measures include: workers entrance to the farm, visitors surveillance, farm employees behaviour, movement of piglets and sows (cleaning of housing premises), all-in-all-out system, supply of semen for AI, feed supply and control, removal of carcasses.

Workers entry to the farm

A farm should have only one entrance and it must be connected with the shower room and serve as an exit at the same time. It is very important that it is under one roof, i.e. that all its sections be connected with corridors. Only persons that do not keep pigs at their homes, and have no other contact with pigs except that one on a farm, can work at it. There exists also a special protocol for their entrance to the farm, i.e. there is a special room where they should change their clothing and footwear, and put on new clothing and footwear (special overalls). They must have several pairs of footwear, one for every section of the farm. Thus, a farm must be divided into two sections: a clean one and a dirty one. The dirty part of the farm includes: a courtyard, a room through which workers enter the farm and where they change their clothing and footwear, and the part of the bathroom adjacent to showers. The clean part includes the premises next to the showers (housing facilities for pigs, resting and eating facilities for workers, management facilities).

Visitors

The farm authorities must be informed in advance of the arrival of any person/visitor not employed on the farm. Visitors should not have been in any contact with pigs for 24 h prior to their entrance to the farm, signing a special statement with regard to that.

Farm workers

Workers on the farm should avoid the unnecessary contact among themselves. Different workers should be working at different production sections, e.g. a worker working in the farrowing unit must not also work in a feedlot or nursery. They should strictly observe the protocol to minimize the risk of disease spread within the farm. In order to monitor better their work on separate premises, they might wear overalls of different colours.

Movement of piglets and sows within the farm

From the point of view of biosecurity, it is very important to keep the flow (streaming) of piglets in the strictly determined direction - piglets from farrowing pens are moved to nursery pens; the sick young ones to hospital. The piglets from one farrowing unit are never moved to another farrowing unit, or from a nursery to a farrowing pen. The system is valid for the movement of piglets from nursery to feedlot.

When pigs have to be delivered from the farm, they are moved through the system of corridors to an assembly point, where they are loaded on trucks. Farm workers are in charge of their transport to trucks. Once outside the farm premises, pigs should not be reintroduced to their home herds. Their movement is restricted in order to prevent any introduction or spread of infectious agents. In the same way the movement of workers in charge of them is restricted. It is of the utmost importance that all the premises where the animals have stayed previously, as well as the corridors, be thoroughly cleaned and disinfected.

All-in-all-out system

This is one of the key points within the internal biosecurity system. It implies that all animals from one technological production phase should be taken out prior to the arrival of the next group of animals. The premises must be thoroughly cleaned, washed and disinfected. Cleaning, washing and disinfection are three main requirements in the internal biosecurity system. After the pigs have been removed from the premises, mechanical cleaning is applied in which way the feed leftovers and manure remains are removed. Then follows washing with high-pressure washers to make it more efficient. It is desirable to use liquid soaps, as they degrease the equipment and floors, thus making it much easier to destroy bacteria and create more favorable conditions for disinfectants. The equipment and floors should be left to dry fully, leaving no organic matter behind, as it may protect pathogens from disinfectants. The whole process is controlled from the beginning till the end.

The choice of disinfectans depends on the farm pathology, how dirty the buildings, equipment etc. are. The choosing of disinfectants resembles the choosing of medications. No product is effective against all pathogens in pig production. It is necessary to read the manufacturers' instructions prior to any use of disinfectants, and to stick to the prescribed dosage. The use of a greater dose does not increase the efficasy of the administered substance. On the contrary, it only increases the costs. It is also important to monitor the withdrawal time.

Pig feed supply

The feed brought to the farm must be stored in special silos, made of solid material, to prevent its contamination by rats, mice, birds, etc. It is necessary that feedstuffs are brought to feeders via a closed system of pipes. Feedstuffs are delivered to farms in special, airtight trucks. Feed must be prepared in special factories where all biosecurity standards are observed. The special standards for feed production are documented in the enclosed certificates.

Entry of hardware (equipment and tools)

All the hardware introduced to the farm must be washed and disinfected, regardless of the previous procedures applied in the external biosecurity system. It would be best if every farm had its own workshop.

Disposal of carcasses

The carcass disposal is done through the doors that are kept unlocked exclusively at the moment of the disposal. It is necessary to have at least one door for every category or units, and corresponding containers that are, after the disposal of carcasses into them, taken to the assembly point.

Sometimes, biosecurity is not taken seriously enough, disregarding how crucial its role in pig husbandry is when trying to achieve such goals as an increased production and reduction of direct costs, export, etc.. It is impossible to implement the biosecurity measures in its entirety on all farms. Their enforcement protects home herds from novel diseases, and, in addition to adequate therapies, helps eliminate the already existing diseases.

BIOSECURITY vs PIG DISEASES

This chapter deals with health problems present on pig commercial farms where biosecurity measures are being introduced or have already been introduced.

In the industrial pig production several valid parameters are used for the evaluation of its profitability, regardless of the herd size (the number of live-born piglets, daily weight gain). However, the simplest way to present pig production is through the number of bred piglets, i.e. delivered fatteners per sow for a calendar year. The numbers vary from one country to another. In order to advance the pig production it is crucial to secure good health of sows and piglets during the first days post parturition. Many are diseases that can affect production and, in some cases, cause great economic losses.

In veterinary medicine, particularly with regard to farm animals (in this case pigs), health is interpreted as an established harmonious relation among morphological, physiological and functional abilities of an organism, while maintaining good reproductive, namely production abilities.

"Health' is not synonymous with 'health status'. The term 'health status' is much broader; it includes health (whether animals are clinically healthy or not, whether a herd is free of some infectious diseases), as well as the application of a series of biotechnological measures in order to maintain good production. It is possible for animals to have a poor health status (the presence of some latent infection), and be clinically healthy and productive at the same time. This may happen in the conditions of good management when immunity is in balance with possible dangerous pathogens that might even be present without any visible signs of the disease, i.e. when subclinical forms of disease or latent infections are present However, it is possible that animals retain a very high health status, and no clinical signs be observed, in spite of the existing inadequate farm management, housing conditions, animal care and feeding. In such conditions production can be affected seriously. Regardless of their different pathogenicity, consequently different mortality and morbidity rates, many of these diseases can be suppressed, or even eliminated from the premises by applying adequate health protection measures. Optimally, no infection should be allowed to enter the farm. If it still does, then monitoring diagnostics is applied, i.e. it is necessary to detect the infection and keep it under control. In order to do that with success, it is indispensable to collect some data: the disease status of the resident herd, the disease status of the farm of origin, clinical

signs of the disease, history of the disease, route of the transmission of the disease, available means for the assessment and treatment of the disease, and its economic importance and potential risk. This is the job of specialized veterinarians.

Disease is, in essence, absence of health, a disorder in the normal, proper function of some body organs and appearance of certain symptoms or signs relevant to the disease, otherwise called a *clinical form* of disease. However, very often, some diseases are present in their subclinical or latent forms, when it is possible to diagnose them exclusively using some of the serodiagnostic methods. The most reliable method is the identification of the causative agent, the use of pathoanatomical methods, or detection of some parameters that point to production decrease. The number of such diseases is not negligible (pneumonia, intestinal adenomatosis, leptospirosis, parvovirus infection, PRRS). Important differences exist between subclinical forms of diseases and latent infections. PRRS can be used as an illustration, as it can be present in a latent form for a long period in a herd, and be observed only in production decrease. Therefore, it is necessary to fulfil all the prescribed and agreed conditions (regarding animal feeding, housing and care), as well as to promote the good health status of animals, this implying the absence of some infectious diseases. This is achieved with an intensified animal health control. In addition, it is obligatory to exclude the presence of some latent infection, manifested in production decrease (higher stillbirth rate, mummified fetuses and increased mortality of suckling piglets during the first two days after birth -without obvious clinical symptoms). This can be achieved by the application of serodiagnostic measures.

A high health status requires the precise establishment of special criteria, clearly defined by the relevant veterinary service, more and more aimed at preventive health protection of pigs in intensive breeding system.

In the countries with a highly developed management, and consequently very developed pig production, a very high health status is expected in their herds. This means that the herds are free of infectious viral and/or bacterial diseases, such as classical swine fever, Aujeszky`s disease, leptospirosis and some other infectious diseases. It is not always possible to obtain the highest health status in all the herds. It is in correlation with high production only when management conditions are optimal, satisfying the currently valid biotechnological directives related to production and maintenance of elite reproductive and production herds. However, it is possible to sustain production consistent to the required directives even under unfavourable management conditions, without presence of some virulent microorganisms, i.e. with

low morbidity and mortality rates, particularly among suckling piglets. On the other hand, with very high biotechnological requirements, it is possible to maintain satisfactory production even if some pathogens are present, thanks to a harmonious relation (good balance) between immunity and pathogens virulence, and thus without the outbreak of infections or some other disorders, while maintaining stable production at the same time.

'***Stamping out'***, as a radical method, can be applied in the countries with high production, where additional subsidy measures are at disposal, such as compensation for economic losses caused by the application of such radical eradication measures. In some other countries that do not fulfil such conditions, in addition to 'stamping out' method, some additional immunoprophylactic measures (vaccination) are used, for example, in the treatment of swine fever.

The frequency of some disease occurrence is also a very important factor. Some of them affect only certain animal age categories. Particularly susceptible and critical could be the farrowing period itself, then early puerperium, the first two days post parturition (both for the sow and farrowed piglets), as well as the first 10 - 14 days after piglet weaning.

Sows, gestating sows, especially first litter sows, can become carriers of many diseases that will not affect them. The diseases can be transmitted to piglets that are insufficiently immune to the new environment during the early neonatal period of several hours. This requires special timely measures to be conducted prior to farrowing with regard to pregnant sows and the environment (the preparation of pregnant sows, monitoring of parturition, induction of parturition- if necessary, reception and handling of new - born piglets; special care must be paid to every individual new - born piglet). This includes an adequate housing of the first- litter sows so that they are put between two multiparous sows. The housing of the first - litter sows between two multiparous sows has proved to be very effective, creating a barrier, i.e. prevention of colibacillosis that is very frequent in piglets of first - litter sows. The multipara piglets are well protected via colostrum, as is not the case with the first - litter sow piglets. The sows in the farrowing pen require adequate nutrition (sufficient quantity of safe, quality feed, special feeding regimen, in addition to sufficient fresh, clean drinking water).

Only a healthy sow is able to consume sufficient quantity of feed necessary for a good milk production that will insure the optimum number of healthy piglets in a litter. However, in spite of all these preventive measures, it is possible that some diseases and disorders occur, usually connected with the reproductive organs and

mammary gland function. Most frequently, these are: hypogalactia and agalactia, endometritises, mastitises and, not so rarely, even the Syndrome. Mastitis - Metritis, - Agalactia (MMA) syndrome occurs in different percentages (1 – 37 %) on various farms, but is possible, by enforcing special (preventive) measures to avoid it, and by applying therapeutic measures even to cure it. In all this the role of a specialized veterinarian is decisive. Enough data have been gathered on this puerperium disorder and could be narrowed down to several procedures, such as regular and obligatory thermometry of sows (critical temperature being 39, 2 ^{0} C), denial of meals one day prior to parturition, laxative application two to three days prior to and two to three days post parturition, introduction of effervescent tablets into the uterus after parturition, obligatory monitoring of the whole parturition. The above mentioned will help prevent the outbreak of MMA syndrome, ensuring at the same time good lactation, and supply of colostrum from mothers that is of crucial importance for good viability of suckling piglets and their further development, ensuring, on the whole, a very successful production. As for piglet diseases and causes of their mortality during the first two days after birth, these have to do mainly with contusion (bruises), hypoglycaemia, and are in close relation with the health status of sows.

Piglet anaemia can be prevented by preventive administration of dextran (iron preparation) during the first two to three days after birth. Currently it is recommended to be administered perorally to gravid sows.

During the first 7 – 10 days after birth, suckling piglets are most often, in addition to bruises, hypoglycaaemia, straddling, and piglet anaemia, prone to the so called 'neonatal scour', i.e. diarrhoea of different aetiology (mainly *E. coli, Clostridium* spp., in addition to some viruses).

Severe **diarrhoea** and dehydratation, i.e.the loss of body mass and an inhibited growth as its consequence, require urgent rehydration, either perorally and/or intraperitoneally, and administration of antimicrobial agents (antibiogram should be consulted).The role of farm workers is here of utmost importance. In some countries, exclusively female workers are engaged. During this period, some other diseases can also occur, with varying morbidity and mortality percentages, and they are accordingly treated more or less successfully with adequate medications.

During this susceptible period, called also '*the* ***weaning period'***, that can vary greatly , animals are very susceptible to infections, being very easily affected by stress, i.e. stress factors (piglet separation from their mothers, adaptation to new premises, cohabitation with other animals, intensive diet regimen), and among the

most frequent diseases that occur are: cannibalism, coccidiosis, oedema disease, dysentery, actinobacillosis, and proliferative enteropathies.

During the first 10 days after weaning, piglets should be classified according to age criterion and body weight, and housed in boxes (7- 10 piglets per box), restricted feeding system applied, so that piglets are given only water during the first day, and during the following days ratios are slowly increased so that on day 10 feed and water are provided *ad libitum* from automatic feeders and watering cups. During the first ten days after weaning piglets should receive the same supplementary feed they had received while in the farrowing pen. After 30 days in the nursery pen they should begin with starters with 20 % of digestible proteins. In this way oedema disease (enterotoxaemia) is avoided, that otherwise would even affect the piglets in the best condition with a lethal outcome.

Dysentery, caused by *Brachyspira hyodisenterae (*earlier *Treponema* and *Serpulina),* is a persistent disease of all swine categories and can seriously endanger pig production. However, dysentery most frequently affects piglets in nursery and feedlot, weighing from 25 to 60 kg.

There are various programmes for eradication of dysentery, mostly narrowed down to a good choice of medications (respect of antibiogram and withdrawal time is required, because of possible problems during control at slaughter).

Pig production on commercial farms is strongly affected by piglet health. Piglets are a part, but a very important one, in the reproduction and production chains. Due to a great agglomeration of animals within small spaces, horizontal and vertical transmissions of infectious agents are easy, bringing about some production and technological diseases. Particular attention is drawn to the variation of pathogenic microorganisms in piglets, the presence of resistance to drugs, even the occurrence of genetic recombinations that affect the clinical picture and disease course, thus making difficult a correct diagnosis, therapy and prophylaxis. On many pig farms are encountered the following diseases: neonatal colibacillosis, oedema disease, necrotic enteritis, *Circovirus* infection, spirochetal colitis, enterohaemorrhagic syndrome, dysentery and a complex of respiratory infections. Many farms have recently reported outbreaks of a complex of respiratory diseases (PRDC), threatening to become a serious health problem in all technological phases of production. PRDC is a simultaneous infection of lung tissues with several respiratory pathogens, and is a common term for different types of swine pneumonia of multifactorial oetiology. The isolated pathogens vary between and inside production herds. The monitoring of PRDC is difficult and complex. The importance of PRDC is based on the interaction

of respiratory pathogens. The understanding of this interaction is indispensable for the enforcement of disease control measures. Swine respiratory diseases may occur in case some live infectious agents are present in their immediate vicinity, or if there is an unexpected disorder in the reaction of the respiratory system defence mechanism. Unlike the control of classical diffuse infectious diseases in pigs that persist in many countries, and whose eradication is a legal obligation, the detection and suppression of technopathies is more an economic issue. On commercial farms where no biosecurity measures had been implemented there was an outbreak of infectious diseases.

Clostridial infections of suckling piglets are a serious health and economic problem. Their oetiology is related to *Clostridium perfringens* - type C, *Cl.. perfringens* type A and *Cl. difficile.* They are responsible for haemorrhagic necrotic enteritis of suckling pigs.

Dramatic changes have taken place in pig farming over the recent years, caused by series of factors, where an increased incidence of the existing and appearance of novel diseases played the key role. Unfavourable production conditions have provoked the outbreak of respiratory diseases (PRDC). Pathogens are those that, in correlation with predisposing factors, are responsible for such disorders in the porcine respiratory system. Among the primary causes are porcine reproductive and respiratory syndrome (PRRS) virus, swine influenza virus (SIV), porcine circoviruses (PCV_2), *Mycoplasma hyopneumoniae, Actynobacillus pleuropneumoniae (*APP), *Bordetella bronchioseptica, Haemophilus parasuis,* less often the Aujeszky's disease virus, and porcine respiratory coronaviruses (PRCV). Among the secondary causes are detected *Pasteurella multocida, Streptococcus suis, Salmonella cholera suis,* and others. The viruses act in unison more frequently than individually, and that is why their interaction is so important.

The control of porcine respiratory disease syndrome is narrowed down to the implementation of a specific drug therapy and vaccines, alterations in management, and introduction of a new system of swine production, as well as strict monitoring of epidemiology and pathogenesis of causative agents present on farms. Special care should be taken of the farms ability to deal with the problem, and implement the required measures within certain programmes.

Postweaning multisystemic wasting syndrome (PMWS) is a circoviral (PCV_2) infection of postweaning piglets, most often at the age of 6-16 weeks, affecting several organs and organ systems. It suppresses the immune system, and is accompanied with secondary bacterial infections. The obligatory monitoring of the

animal health status (animals kept in large agglomerations,) and regular recording of relevant health indicators have shown that this form of circoviral infection can present a serious problem on some farms. The usual clinical signs are: progressive loss of body mass, profuse watery diarrhoea, dyspnoea, tachycardia, lymphadenopathy, anaemia, hepatitis, and the animals' failure to respond to antimicrobial treatment. Pathohistological investigations have showed lymphocyte depletion and hystocytic infiltration with amphophylic intracytoplasmatic inclusions. In addition to this picture, lymph nodes were found to contain giant nuclear cells. The kidney tissue gave the picture of intestitial nephritis; whereas, the lung tissue exhibited the signs of lymphohistocytic interstitial pneumonia. The liver had frequent mild changes of nonsuppurative periportal hepatitis, and extensive necrosis was detected in some severe cases, most frequently accompanied by jaundice. Pancreatitis, granulomatous enteritis with atrophy of intestines and myocarditis completed the picture.

Porcine circovirus type $_2$ ($PCV_{2)}$ and hepatitis E virus (HEV) are among the most frequently recognized causes of infectious hepatitis in pigs and may or may not act independently in the development of the disease. Recently it has been suggested that swine torque tenoviruses (TTVs), in coinfections with some viral pathogens, may aggravate the severity of disease.

Histopathological techniques, nested polymerase chain reactions (nPCRs), polymerase chain reaction (PCR), and one-step reverse transcriptase polymerase chain reaction (RT – PCR) are usually applied in order to detect hepatitis lesions, TTVs genogroups 1 and 2, PCV2 and HEV infection.

The commercial pig farms, that have not completely enforced the zoohygiene measures, are faced with the problem of pathology of the locomotor system in boars used for gathering of semen, as well as in sows.

Lameness - The problems with the musculoskeletal system in all pig categories are common at industrial pig farms. They may result in the exclusion of their sows and boars from the production process. Musculoskeletal diseases may severely endanger animal health. The most common symptom is lameness. It leads to atrophy of muscle tissue, and this may compromise the quality of pork. The degree of lameness is determined on the basis of the extent to which the animal may endure difficulties associated with the affected extremity. Each segment of the extremity with the signs of abnormalities is examined, as well as the injuries, temperature, pain presence, and swelling. Joint(s) mobility is monitored. Swine behavour makes this type of observation very difficult. An accurate diagnosis is essential for the

establishment of the cause, prognosis, prevention and treatment. A large number of infectious agents are associated with the onset of arthritis. An inadequate housing and maintenance of the premises may also lead to the problems with the growth of pig populations and huge housing capacities as possible causes of the locomotor problems. Severe cases may be checked using ultrasonography. The application of radiological methods in the assessment of fractures and other mechanical lesions may be useful, too. However such diagnostics is very expensive. Therefore, it is nowadays rarely used. If the treatment is considered to be justifiable, it should be started as early as possible. Otherwise, uncertain recovery and prognosis make the treatment questionable. If the onset of the disease is influenced by the environment, housing and other contributing factors, the efforts must be made to eliminate all such factors from the immediate environment. Pigs of all age groups must be carefully observed for any signs of the disease in order to diagnose the onset of lameness in an early stage. Swine lameness must be carefully monitored, and possible spread to other animals prevented.

The majority of investigators agree that on large industrial pig farms the diagnosis is, in most cases, made on the basis of the characteristic clinical picture. It is recommended for the feed to be regularly tested, as well as to rule out the genetic predisposition.

Problems associated with the locomotor systems are frequent on industrial pig farms, and represent a major problem as may result in the exclusion of sows and boars from the production process.

Locomotor system diseases may cause serious economic losses in the intensive production system.

Vaccination

Infectious disease prevention and control can be effective only when three goals are achieved. They are:

1. A rapid detection of infection (surveillance);
2. Rapid and humane culling of infected animals (targeted culling and disposal);
3. Stopping infection spread (biosecurity, vaccination).

Vaccination (today has the same meaning as `immunization`) is a specific form of animal protection from certain diseases, where special antigens are introduced into the body to produce immunity to a specific disease, by creating specific antibodies against the disease. Many vaccines are available for many major infectious diseases (e.g. foot-and-mouth disease, classical swine fever; not African swine fever).

Currently there exist vaccines that are administered to gestating sows and via them new - born piglets are protected. Pregnant sows have to be vaccinated at least 15 days prior to parturition (vaccines against *E. coli, Clostridium etc.)*. The dam is vaccinated to protect the unborn litter. There are vaccines intended for the vaccination of new - born piglets (e.g. for mycoplasma). Unfortunately, the immune response is not always present in all the animals; it can be absent due to various reasons, such as an inappropriate administration of the vaccine, or because animals are inactive or hyperactive (there might be some allergic reactions).

The particular vaccination programme applied at a farm is the result of the farmer`s own choice, and is drawn up on the basis of the particular epizootic situation. Currently, the most frequently used vaccines are against clostridiosis, coli diarrhea, PPV, mycoplasmosis. They are the standard procedure at the majority of the pig farms in the developed countries.

Vaccination of fatteners: PRRS, Mycoplasma pneumonia, Lawsonia;
Vaccination of sows: PCV virus, Mycoplasma pneumonia, pleuropneumonia.

Some vaccines are obligatory, while others should depend on individual circumstances and risk assessment.

Medication

The administration of remedies is still the indispensable method of control and maintenance of animal health status on pig farms. There is a tendency to reduce it to the minimum. Anyway, the treatment of animals is an every - day job, either as a preventive treatment of particular pig categories (via feed or water), or treatment with drugs. The most important aspects in treatment are: choice of drug, dosage, drug storage, handling of drugs, type of treatment, duration of treatment, withdrawal time.

The most frequent reproductive problems on commercial pig farms

In an intensive pig production system the control of herd reproduction is a primary task. It is well known that pigs, compared to other domestic animals, have a very great reproductive potential, due to their early sexual maturity, high ovulation value, while gestation and lactation are of a relatively short duration and pregnancy is easily diagnosed soon after the weaning of the previous litter. From an economic point of view, a regular, proper reproductive activity of pigs is of great importance. The reproductive efficiency of one herd is assessed on the basis of breeding female age at their first parturition, the length of their reproductive exploitation, the length of intervals between successive parturitions and the size of weaning litter. The

reproductive activity of pigs is influenced by several factors, among them: hereditary factors, endogenous factors (hormones, immunoglobulins, enzymes), the environment, the presence of causative pathogens, management and production technology. Some additional factors must be included: the husbandry system, nutrition, season, farm location, microclimate, biosecurity measures enforcement, herd size, herd health status (the presence of parasitic and infectious diseases), animal fitness, AI system application.

Infertility problem is very frequent on commercial farms. The causes of infertility are numerous and of different origin. One of the frequent problems is seasonal infertility, a health phenomenon that is present on the farms during the summer months creating a serious problem to producers that are trying to optimize the reproductive efficiency of their herds.

One of the key factors for a good cost - effective reproduction is the optimum temperature and humidity within the housing pens. Therefore, nowadays within the system of intensive pig production a particular attention is drawn to secure the optmum microclimatic conditions within pig housing units by applying the computerized ventilation system, proper cooling, light regimen, proper nutrition, manure removal etc., with a possibility to programme the wished parameters in certain time intervals, giving animals a chance to express their genetic potential, achieving high productivity, and last, but not the least, stress is reduced.

An adequate health protection of farm animals, high degree of the hygiene of animals, equipment, farm workers, and proper application of all AI technological procedures represent a primary precondition for a high reproductive efficiency of breeding animals.

The conventional evaluation of semen quality of boars, as a segment in AI technology, is still widely applied on many commercial pig farms. The classical assessment of semen characteristics under commercial conditions recognizes ejaculates with reduced conception potentials, and is not highly efficient in the prognosis of fertility parameters . That is why today, in order to prevent infertility and enable the proper control of swine reproductive efficiency, in cooperation with the relevent institutes, certain laboratory methods are applied, such as: CASA (the assessment of spermatozoa_motility_by_using_the_computer_analyzer, _ASMA (automatic analysis of spermatozoa morphology), FLOW CYTOMETRY (for determination of chromatin integrity), HOS test and alike. Thus, it is possible to monitor closely boar fertility and react on time in production itself. The technology of preparation of heterosperm insemination doses that include the sperms of two or

more terminal boar breed thas been widely used in AI on numerous farms in order to produce more piglets per sow.

Frozen semen is used on numerous pig farms of industrial type. The advantage of the semen stored at very low temperatures lies in a prolonged preservation of the genetic material and significantly lowered risk of disease introduction to herds. However, its use is still rather limited due to the still unsatisfactory deep freezing technology.

In addition to AI centres (where the collected semen is stored, its quality tested and later on distributed to farmers) numerous boar keepers are still key factors in reproduction and animal genetic improvement, providing the necessary semen for AI and boars for natural service.

Porcine stress syndrome

Stress is a physiological response of an organism to stimuli of shorter or longer duration. It is not a pathological reaction, but the attempt of the organism to adapt to, or overcome, the negative stimulus. In case it does not succeed in it, i.e. the negative stimulus overpowers the adaptation ability of the organism, there occurs a pathological state called *distress.* Many factors can cause stress, lowering the animal`s immunity, disturbing the function of the mammary glands and digestive organs. Pigs belong to species living in a community (herds), and it is important to avoid any kind of isolation of individual animals.

The stress phenomenon is a very serious problem on commercial pig farms. Today, more and more attention is paid to it. The farms that are in the initial stages of management development are faced with a more serious problem concerning stress than those with a completely organized production system. The modern pig farms have managed to reduce stress to the minimum, and to assure maximum comfort to their animals.

Pigs of some breeds can exhibit high susceptibility to various stress factors. In some pig herds this may present a serious health and economic problem. It is rare in piglets and gilts, but very frequent in growers and finishers. An increased reaction is present particularly in meet breeds. Porcine stress syndrome has not been observed in autochthonous pig breeds. It is a common view that stress reaction in pigs is the result of hereditary factors, as well as environmental factors. The reaction depends in a great deal on the duration intensity of stress factors. The first symptoms (expected to appear very soon after the animal`s exposure to stress factors) are a lowered adaptation ability of the animal, then tremor, dyspnoea, abnormally rapid heart rate.

Panting is a very important symptom and remains part of the clinical picture till the very end. There is also an increase in temperature, even up to 42, 5^{0}C. The skin and mucous membrane are hyperaemic. The body muscles are contracted more and more. At the end the animal collapses and dies.

Pig nutrition is also crucial in stress prevention. Fattened sows, e.g. with numerous fetuses, and that are, at the same time, fed huge quantities of feed inside housing facilities with increased humidity and temperature, are more susceptible to stress and exhibit signs of respiratory distress. All this is in favour of the acceptance of the latest nutrition recommendations based on the production phases and animal categories. For example, the nutrition curve for breeding sows has been defined for each production phase in order to enable an early entrance into oestrus after piglet weaning, as well as more ovulated and implanted embryos, more live – born and vital piglets, satisfactory lactational performance, while preserving good health and body condition of breeding females, to reduce to the minimum the administration of drugs, to prolong as much as possible females` lifespan and productive life. Thus, it does not surprise that today there exist farms with 35 and more weaned piglets per sow annually.

ECOLOGICAL PROBLEMS ON PIG FARMS

The pollution/contamination of the environment affects adversely humans, plants and animals. Harmful agents, i.e. toxic materials of the contaminated environment, can have a direct or indirect impact. The indirect influence of the harmful agents manifests itself on plants and animals, that are both part of the human food chain, and as such are introduced into human body and can affect seriously his health. The indirect impact brings about changes in the environment, and thus indirectly affects humaan health via the polluted air, water (and not only drinking water) and soil. The living agents are permanently exposed to the detrimental impact of those chemical compounds that exhibit mutagenic and teratogenic properties. A huge number of chemical compounds are used in all agricultural branches, forestry and households. Every day, a large quantity of industrial wastes reaches rivers, lakes and seas and in that way changes the physical properties of water, directly affecting the flora and fauna of the aquatic ecosystem. The waste materials include organic and inorganic matters (acids, phenol compounds, pesticides, cyanides, and heavy metals), which, in the organisms of fishes and other living creatures of the aquatic ecosystem, produce cumulative effects, potentially harmful to humans.

Polluted air, via the respiratory organs, is introduced into the man's organism with its toxic materials. The development of basic industries is responsible for an ever increasing presence of heavy metals in the organisms of the domestic animals, such as cadmium and lead. They are introduced into the animal organisms via feed, water, respiratory organs and skin. In addition to their teratogenic effect, those harmful substances can have also a genotoxic effect, thus affecting the hereditary base, resulting in infertility problems, and early embryonic mortality.

With all this in mind, it is easy to understand that an increasing presence of various pollutants in the environment can lead to some serious disturbances in the living world, such as ecosystem disturbances and hereditary changes. These are not necessarily manifested immediately, but their effects can be detected not only in the immediate descendants, but also many later generations (e.g. disturbances in reproduction and metabolism). The changes in descendants are manifested in the presence of various anomalies and disorders of their vitality resulting in early embryonic mortality. Thus it is normal to conclude that all organisms living in a contaminated environment can suffer from harmful hereditary changes.

Heavy metal toxicity

Arsenic

The inorganic forms of arsenic are present in the soil, water and food, and can seriously affect human and animal health; whereas, organic arsenic is not toxic. The absorbed arsenic is distributed through the organism and stored in all body muscles. Arsenic biotransformation occurs in the liver via monomethyl arsenic acid (MMA) to dimethyl arsenic acid (DMA) and is eliminated with urine. Arsenic with its toxic effect inhibits the biosynthesis of haemoglobin. The consequences of chronic exposure of animals to arsenic are anaemia, peripheral neuropathy, skin irritation, liver and kidneys damages, keratosis and skin cancer.

Cadmium

Cadmium is considered one of the most toxic substances in the environment, one of the most dangerous cancerigenic agents. The elimination period lasts from 10 to 30 years. Cadmium from the upper soil layer, via plants, enters the food chain. The absorbed cadmium is transported by erythrocytes and albumin. It can be found in the liver bound to metalotionein (Mt). The Mt-Cd complex it transported to the proximal tubules. Chronic cadmium poisoning causes renal diseases, osteoporosis, osteomalacia.

Chromium

Sexivalent chromium is carcinogenic and mutagenic and may damage DNA. Chromium metabolism is related to its ability to be reduced with the action of different enzymatic and nonenzymatic factors in the endoplasmic reticulum. Chromium is eliminated in urine (the kidneys) and faeces (gale).

Nickel

It is one of the most dangerous cancerigenic substances. It is absorbed through the intestinal tract. The distribution is very fast, and it is accumulated in the kidneys, less in the lungs and liver. It is transported with albumin and α_2 macroglobulin, while excreted with urine and faeces.

Lead

Inorganic lead is absorbed relatively weakly (10%) in the intestinal tract. Lead absorption depends on the presence of other metals, particularly calcium and iron.

After absorption it is transmitted to erythrocytes, and 10% of the totally absorbed lead remains in plasma, bound to albumin. It causes erythrocyte haemolysis and obstructs haematopoiesis. The excretion is done exclusively through the kidneys, although small quantities are excreted via gale and milk. The developing nervous system is susceptible to lead effects, causing apoptosis of the nerve cells. The main storage site is the skeleton. Bones contain 90 to 95 % of total unabsorbed lead. Changes in the percentage of the stored lead in bones are in balance with mineralization intensity, i.e. demineralization. Bone decalcification causes lead mobilization and increases its content in blood and muscles. The kidneys are target organs of acute and chronic exposure to lead. The toxic effects of lead on the kidneys are manifested in an increased glomerular function and appearance of proteinuria, accompanied with some morphological changes. The latest research has shown that a longer exposure to lower lead concentrations increases the risk of subcellular nephropathy. However, the longer exposure to higher lead concentrations results in chronic nephropathy, mitogenesis, transcription changes, and oxidative damages to biomacromolecules.

Mercury

Mercury is toxic both to humans and animals in all its three forms. The symptoms of acute mercury poisoning are anxiety, incoordinated movements, increased salivation, vomiting and colic. Excessive proteinuria is observable and, due to the renal disfunction, a suppressed urine excretion is present, even anuria, uraemia and death. The biological halftime of organic mercury varies, dependent on the affected animal body organ, being longer for the brain than other body organs. The greatest accumulation is in the kidneys, regardless of its chemical form; whereas the damage to the nervous system is more severe than to the kidneys. Mercury can causes lesions on nerve cell membranes.

The toxic effects of heavy metals can create serious problems within pig farms, particularly if these are situated in, or near some industrial region. On such farms many severe cases of heavy metal toxicity have been detected in all pig categories.

CONCLUSION

Planned implementation of biosecurity measures is crucial in pig health protection and successful production. The acquired biosecurity level on pig farms should be the result of logical conclusions and timely undertaken activities in the given environment and epidemiological situation with the recognition of real threats coming from the environment, and weak points in the technological process of pig production. Profitable pig production can be achieved with the enforcement of more prevention measures and less therapeutic measures, and if the feeding, husbandry and health protocols are strictly observed.

Pig health is very important and can be improved in order to achieve better production results. Various diseases are often present on farms, and can endanger pig production within the intensive breeding system. Such are: neonatal scour, oedema disease, oesophagogastric ulcer, osteodystrophy diseases, actinobacillosis, atrophic rhinitis, dysentery, and recently proliferative enteropathy of multicausal aetiology, as well as some parasitoses (isosporiasis, cryptosporidiosis). It is possible to have them all under control if prophylactic, therapeutic measures and strict control of pigs in intensive breeding system are enforced.

Nowadays, veterinary services play a very important role, particularly from the point of ecology. Global issues are how to produce more healthy and safe food, intended for human consumption. Thus, with the continuous health protection of farm animals, application of more prevention and less therapeutic measures, it could be possible to achieve the popular concept "*From field to stable to table"* which implies a profitable pig production**,** comprehensive health control in which we are all expected to participate.

A P P E N D I X

GLOSSARY

All-in-all-out A strategy for controlling infectious disease: The building (section, room, etc.) is emptied of all animals, then cleaned and disinfected and left empty for drying before being repopulated. During the down-time, the entire building is empty and clean.

Animal categories on a pig farm:

Boar = a male pig more than 6 months old intended for use as a sire

Fattener = a pig category in the process of fattening

Finisher = a pig category in the final phase of fattening

Gilt = a female breeding pig that has not yet had a litter or piglets

Grower = a pig category in the process of fattening

Growing finishing pigs = pigs in the 25 to 100 kg body weight class being grown and fattened for slaughter

Hog = a male pig that is kept for its meat

Pig = (called also "hog") (:bacon pig, breeding pig, fattening pig, growing pig, meat pig)

Piglet = baby pig from birth to weaning age, usually 8 weeks (:farrowed piglet, suckling piglet, weaned piglet)

Sow = an adult female pig (:bred sow, dry sow, farrowing sow, gestating sow, in/with-pig sow, sow with litter, sucking sow)

Suckler = (suckling piglet**)** A young animal that is still drawing milk from its dam; a nursing female animal

Swine = (a pig, hog)

Weaner = a young pig in the period immediately after weaning and up to 6 to 8 months of age

Animal health status The status of a country or zone with respect to an animal disease, according to the recognized criteria.

Animal identification system The inclusion and linking of components such as identification of establishments/owners, the person/people responsible for the animal(s), movements and other records with animal identification.

Animal traceability The ability to follow an animal or group of animals throughout all stages of its/their life/lives.

Artificial insemination centre (AI centre) A facility that is approved by the veterinary authority and meets the required conditions.

Biosecurity plan A plan that identifies potential pathways for the introduction and spread of disease in a zone or compartment, and describes the measures that are being or will be applied to mitigate the disease risks.

Commodity Live animals, products of animal origin, animal genetic material, biological products and pathological material.

Containment zone A defined zone around and including suspected or infected establishments, based on epidemiological factors and the results of investigations, where control measures to prevent the spread of the infection are applied.

Contamination The presence of an infectious, toxic or otherwise harmful agent on or in the body – also on or in clothes, bedding, buildings, vehicles, etc.

Dam Female parent.

Disinfection The direct application, after thorough cleansing, of chemical or physical agents intended to destroy the infectious or parasitic agents of animal diseases, including zoonoses; is applied to premises, vehicles and objects that may have been directly or indirectly contaminated.

Disinfestation The application of procedures intended to eliminate the arthropods that may cause diseases or that are potential vectors of infectious agents of animal diseases, including zoonoses.

Emerging disease A new infection resulting from the evolution or change of an

existing pathogenic agent, a known infection spreading to a new geographic area or population, or a previously unrecognized pathogenic agent or disease diagnosed for the first time and that has a significant impact on animal or public health.

Eradication The elimination of a pathogenic agent from a farm, country or zone.

Farm units: Pigs are housed in separate rooms (sections, premises) according to age and physiological stage:

Barn = a large building on a farm in which crops and animals are kept

Feedlot = a management system in which animals are confined and fed on stored feed

Nursery = (=nursery pen/room**)** premises on a pig farm where farrowed sows and suckling piglets are kept

Pen = (: farrowing pen, nursery pen, pig pen, pens for boars, pen for fatteners, pen for gestating sows, pens for sows with litter)

Premises = a building (or part of it) used for veterinary purposes **(e.g.** farrowing premises**)**

Quarantine = Isolation unit where novel animals are kept prior to being introduced to a new herd.

Room = (e.g. farrowing room, nursery room)

Section = a segment of a pig farm **(**e.g. farrowing section)

Shelter = a small building that gives protection (pigs may be housed at night in a small shelter)

Unit = a part of a farm(: boar unit, farm unit, outdoor pig unit, pig unit, sow unit)

Fresh meat Meat that has not been subjected to any treatment irreversibly modifying its organoleptic and physico-chemical characteristics.

It includes frozen meat, chilled meat, minced meat and mechanically recovered meat.

Hazard A biological, chemical or physical agent in, or a condition of, an animal or animal product that has the potential to cause an adverse health effect.

Herd A number of animals of one kind kept together under human control; an epidemiological unit. (: home herd, nucleus herd)

Incidence The number of new cases or outbreaks of a disease that occur in a population at risk in a particular geographical area within a defined time interval.

Incubation period The period between the introduction of the pathogen into the animal and the occurrence of the first clinical signs of the disease.

Infection The entry and development or multiplication of an infectious agent in the body of a human or an animal.

Litter All the young animals that are born to one sow at the same time.

Loading/unloading Loading means the procedure of moving animals on to a vehicle/vessel or into a container for transport purposes; unloading means the procedure of moving animals off a vehicle/vessel or out of a container.

Market A place where animals are assembled for purposes of trade or sale.

Meat products Meat that has been subjected to a treatment irreversibly modifying its organoleptic and physico-chemical characteristics.

Notifiable disease A disease listed by the veterinary authority that must be brought to the attention of that authority as soon as it is detected or suspected, in accordance with national regulations.

Pork Fresh, uncured meat of the pig.

Outbreak of disease or infection The occurrence of one or more cases of a disease or an infection in an epidemiological unit.

Premises A swine premises is a contiguous land location, based on land title records, including all structures housing pig(s) and other livestock.

Quarantine Restriction of apparently healthy animals to prevent disease transmission during the maximum possible incubation period of a selected range of infectious diseases.

Quarantine station A premises under the control of the veterinary authority where animals are maintained in isolation with no direct or indirect contact with other animals, to prevent the transmission of specified pathogen(s) while the animals are undergoing observation for a specified period and, if appropriate, testing and treatment.

Registration The action by which information on animals (such as identification, animal health, movement, certification, epidemiology, establishments) is collected, recorded, securely stored and made accessible to and usable by the competent authority.

Risk The likelihood that an adverse event or effect will occur and the likely magnitude of the biological and economic consequences of that event or effect for animal or human health.

Sanitary measure A measure destined to protect animal or human health or life.

Slaughterhouse /abattoir A building for the slaughter of animals for human food. Premises, including facilities for moving or lairaging animals, used for the slaughter of animals to produce animal products and approved by the veterinary services or other competent authority.

SPF system **"**specific pathogen free'. A special classification of farms on the basis of their health status,i.e. the presence/absence of particular disease covered by SPF regulations.

Stamping-out policy Carrying out, under the authority of the veterinary authority and on confirmation of a disease, the killing of the animals that are affected and those suspected of being affected in the herd and, where appropriate, those in other herds that have been exposed to infection by direct animal-to-animal contact or by indirect contact of a kind likely to cause the transmission of the causal pathogen. All susceptible animals – vaccinated or unvaccinated – on an infected premises should be killed, and their carcasses destroyed by burning, burial or any other method that will eliminate the spread of infection through the carcasses or products of the animals killed. This policy should be accompanied by the cleansing and disinfection procedures.

Surveillance The systematic ongoing collection, collation and analysis of information related to animal health, and the timely dissemination of information to those who need it so that action can be taken.

Sire Male parent.

Transport The procedures associated with carrying animals for commercial purposes from one location to another by any means.

Vaccination The immunization of susceptible animals through the administration of a vaccine comprising antigens appropriate to the disease to be controlled.

Vehicle /vessel Any means of conveyance, including train, truck, aircraft or ship, used for carrying animal(s).

Veterinarian A person registered or licensed by the relevant veterinary statutory body of a country to practice veterinary medicine/science in that country.

Veterinary services The government and non-governmental organizations that implement animal health and welfare measures and other standards and recommendations in the territory. The veterinary services are under the overall control and direction of the veterinary authority. Private sector organizations, veterinarians or veterinary para-professionals are normally accredited or approved for delivering functions by the veterinary authority.

Weaning The act of separating the young from the dam that it has been sucking.

W**eaning age** The average age at which weaning is carried out.

Zone/region A clearly defined part of a territory or set of premises containing an animal sub-population with a distinct health status regarding a specific disease for which required surveillance, control and biosecurity measures have been applied for the purpose of international trade.

Zoonosis Any disease or infection that is naturally transmissible from animals to humans.

- We are thankful for the majority of te Glossary to *Good Practices for Biosecurity in the Pig Sector"

ACRONYMS AND ABBREVIATIONS

AI = artificial insemination
AI centre = Centre for artificial insemination
APP = *Actynobacillus* pleuropneumoniae
AR = atrophic rhinitis
ASF = African swine fever
ASMA = automatic analysis of spermatozoa morphology
CASA = the assessment of spermatozoa motility by using the computer analyzer
DMA = dimethyl arsenic acid
CSF = classical swine fever
FAO = Food and Agriculture Organisation of the UN
FMD = foot - and - mouth disease
HACCP = Hazard Analysis and Critical Points
HEV = hepatitis E virus
HPAI = highly pathogenic avian influenza
MMA = mastitis - metritis - agalactia
MMA = monomethyl arsenic acid
$nPCR_s$ = nested polymerase chain reactions
OIE = the World Organisation for Animal Health
PCR = polymerase chain reaction test
PCV_2 = porcine circovirus type **2**
PMWS = postweaning multisystemic wasting syndrome
PRDC = porcine respiratory disease complex
PRRS = porcine reproductive and respiratory syndrome
RT-PCR= reverse transcriptase polymerase chain reaction
SIV = swine influenza virus
SPF = specific pathogen-free
TGE = transmissive gastroenteritis
TTV_S = torque tenoviruses
WHO = the World Health Organisation

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