The value of successful medication

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The worldwide intensification of production in pig farming has increased the risk of disease emergence due to high concentration of animals in the same areas. The occurrence of diseases can be very damaging for the farming economy as it leads to lower productivity, lower product quality and even increased mortality.

Today, antibiotherapy and vaccination are widely applied to limit the introduction and the propagation of pathogens into pig operations. The generated medication costs impact directly and significantly on the cost of production.

Moreover, some practices, such as the excessive use of antibiotics in animal production are now considered to be part of the increasing antibioresistance issue threatening human health.

Therefore, in a more and more competitive economic environment, facing pressure of disease and the increasing concern of consumers, it is essential to respect some golden rules when choosing therapeutic or prophylactic measures that will ensure successful medication and that will not endanger public health.

This article reviews medication costs in pig production and looks at the basic guidelines that must be implemented to judiciously select a medication strategy.

Direct costs

The direct cost of medication is the cost of all animal health products used during the pig's life. It includes vaccines, antibiotics, growth promoters, parasiticides as well as disinfectants and hormonal products.

This represents a significant part, ranging from 3-7%, of the pig production costs in South East Asia countries (Fig. 1).

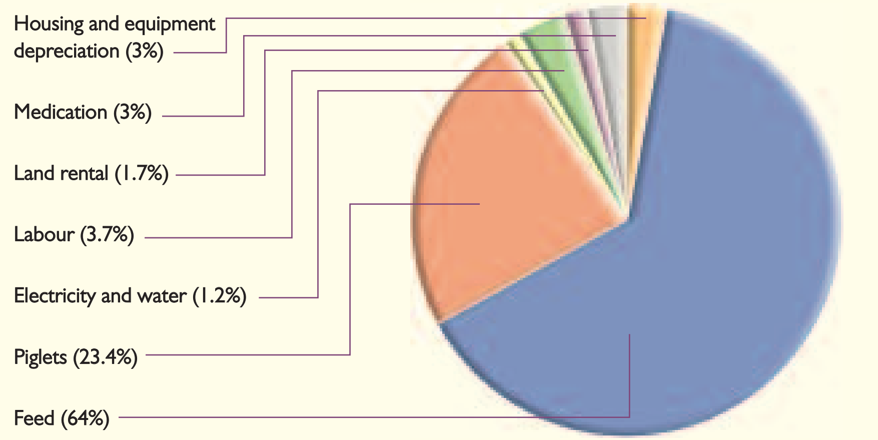


Fig. 1. Production cost breakdown in Taiwan (2003).

A field study run in France in 2001 has estimated the average medication cost at €6.4 for 100kg pig. The most important cost was represented by antibiotics, followed by vaccines.

A comparative study with medication expenses recorded in 1995 has clearly shown an increase in vaccine use while antibiotics were decreasing (Table 1).

This evolution reflects the implementation in the European Union of strict regulations regarding growth promoters and antibiotic medicated premix use in animal production.

Looking at their evolution, medication costs have steadily risen recently due to the onset of more complex diseases (PRDC, PMWS) and due to an increasing and alarming loss of efficacy of several antibiotics that lead to the use of more expensive solutions.

Cost of getting it wrong

However, the direct medication cost does not reflect the total cost of a disease as it does not include animal mortality, growth retardation and increased feed cost.

An evaluation of the efficacy and the value of a medication strategy must include these parameters to assess its real cost efficiency.

Table 1. Evolution of medication cost in 52 French herds. Breakdown per type of products. (Adapted from C. Guyomarch 2003).

	1995	2001
Vaccines (%)	25	37
Oral antibiotics (%)	36	27
Injectable antibiotics (%)	17	17
Hormones (%)	8	8
Parasiticides (%)	5	5
Others (%)	9	6
Total (€ per 100kg pig)	7.65	7.78

The initial medication cost can also drastically increase when a treatment implementation leads to failure:

- **Short term failure (disease relapse).**

This occurs a few days after the initial treatment is completed, it is then necessary to apply a second treatment.

This failure is mainly linked to too short treatment, under dosage or wrong choice of antibiotic.

- **Long term failure.**

This is the worst scenario with antibiotics becoming less effective. The two consequences are the selection of pathogens more resistant, and thus more difficult to control, and the use of more expensive solutions to replace the ineffective antibiotic.

Antibioresistance appears when products are excessively used for a long period of time. The real impact of antibioresistance on public health and the subsequent concern and image of animal production amongst consumers is economically difficult to measure.

Animal medication is no longer only a financial matter for swine producers, but has also become a public health issue.

Consequently, several countries began to ban some products that are of great importance in pig production, reducing the number of solutions offered to pig farmers for disease control.

Finally, the possible meat condemnation

Continued on page 16

Continued from page 15

linked to a misuse of pharmaceutical products should be added in the total cost of medication. The use of pharmaceutical products of inadequate quality, or not respecting recommended withdrawal periods leads to the presence of residues in meat. If detected at slaughter, meat will be withdrawn for human consumption.

Moreover, excipients or diluents in injectable products (antibiotics, vaccines) can induce some muscle lesions. It is important to respect withdrawal periods recommended by the manufacturer for complete recovery and to use products that have been manufactured according to GMP standards.

There are a few golden rules for a rational and cost efficient medication, which include the following:

● **Identification of the disease.**

Because the treatment to be applied can drastically vary depending on whether the cause is a bacteria or a virus, it is essential to establish a correct disease diagnosis.

Based on clinical signs and post mortem examination, a presumptive diagnosis can be determined and a first choice treatment can be proposed.

However, it is necessary to use further laboratory investigations to confirm the causative agent and to propose an appropriate treatment with an antibiotic that specifically targets the agent. This identification is particularly important in complex diseases where several pathogens are involved. Only one or two agents can be considered as primary causative agents. They initiate the disease (PRRS virus, mycoplasma) that can be complicated by a secondary infection, such as pasteurella or haemophilus. These primary agents must receive priority in the medication strategy. Addressing only secondary pathogens will lead to failure.

● **Selection of appropriate pharmaceutical products.**

– Antibiotics

If a broad spectrum antibiotic can be chosen for the first line treatment according to the history of the farm, the necropsy examination and the experience of the swine practitioner, a narrow spectrum antibiotic is highly recommended after isolation of the causative bacteria and testing its antibiotic sensitivity. This is the best way to avoid the selection of resistant strains.

It is also important to remember the pharmacokinetic properties of the antibiotic to be sure it will reach the infectious agent.

The parameters to be checked for the right selection are resorption (ability to cross the intestinal barrier to be used by oral route), distribution (concentration in target tissue), diffusion (only in blood flow or capability to enter into infected cells) and elimination (renal or digestive). They are summarised in Table 2 for the most commonly used molecules in Asia.

– Vaccines

The strain used in the vaccine influences

	Intestinal Resorption	Distribution	Diffusion	Elimination
Ampicillin	++	Extracellular	Vascularised	Kidneys
Amoxicillin	++++		organs	Kidneys
Oxytetracycline	++	Extra and	Large	Digestive
Doxycycline	++++	intracellular		Kidneys
Colistin	0	Extracellular	Blood flow	Renal +
			Digestive	
Tylosin	++ to +++	Intracellular	Lungs and	Digestive
Tiamulin	++++	Intracellular	gut	Digestive
Enrofloxacin	+++	Intracellular	Large	Renal +
				Digestive

Table 2. Pharmacokinetic properties of several antibiotics.

directly the efficacy and the conferred protection.

It is important to keep in mind that the control of clinical signs in a farm does not mean the virus is no longer circulating. For instance, in classical swine fever, OIE recommends a minimum of 100 PD50 (protective dose) per dose of vaccine to achieve a complete stop of the replication and spread of the virus. A recent study (Table 3) has shown that all the CSF vaccines available in the market do not meet this requirement.

The selection of a killed or live strain, combined with adjuvant or not, must be decided according to the epidemiologic situation, the targeted animals and the purpose of the vaccination – to enrich colostrum or produce fast immunity.

● **Selection of the right timing and the right way of administration.**

– **Antibiotics**

Even if antibiotics should be used only for curative purpose, preventive medication is commonly practiced in pig production.

When applied, such programmes must be placed at a strategic time before the appearance of the disease is usually reported in the farm. This strategic input should only be temporary and should let the animals develop natural immunity.

Pulse medication programmes (full treatment, then discontinued for a period slightly less than the incubation time, and then repeated) are successfully used in control of chronic diseases such as proliferative enteropathy.

In case of emergency, priority must be given to injection or treatment in drinking water as animals rapidly stop their feed consumption after infection. In case of strategic medication (prophylaxis), both feed and drinking water are used.

The comparative advantages and drawbacks of different ways of administration are summarised in the Table 4.

– **Vaccines**

To achieve a successful vaccination response, two parameters must be considered:

● The time necessary to stimulate the immune system and to get a protective response. It takes usually 2-3 weeks after the second shot. The vaccination programme must be built accordingly to ensure the animals will be protected at the expected onset of the disease.

● The presence of maternal derived antibodies (MDA) (Fig. 2). MDA, coming from colostrum intake, can neutralise the vaccine strain. The vaccination injection must be delayed until the MDA concentration is too low to interfere with the vaccine. For instance, this delay is usually 8-10 weeks for pseudorabies.

	% of protected animals after 1/1000 dilution
Lapinized Chinese	70
Tissue Culture Chinese	40
Thiverval	100
Tissue Culture GPE	65
Tissue Culture Lorm	25

Table 3. Determination of the PD50 of several commercial classical swine fever vaccines (Adapted from Dr J. Satra, 2004).

	Advantages	Disadvantages
Feed	Mass treatment Cost	Lower resorption due to possible feed interaction. Palatability/taste (erythromycin, tetracyclines). Degradation during heat process (amoxicillin, tiamulin)
Water	Mass treatment Rapid absorption (dose dependence) Sick animals do not stop drinking Treatment flexibility	Solubility and stability (amoxicillin, tetracyclines) Specific equipment (dosing pump) Water quality (pH)
Injection	Targeted/individual treatment Rapidity of action (acute diseases)	Labour cost Stress due to handling

Table 4. Comparative features of different routes of administration for antibiotic treatment.

● **Full respect of the dosage and of the treatment length.**

A vaccine dose is usually 1-2ml. A dose contains the right amount of antigens that correctly stimulates the animal's immune system. Use of half a dose can greatly endanger a swine herd as the farm protection may be not strong enough to overcome any outbreak.

Antibiotic dosage must strictly follow the international recommendations. Under dosage is particularly dangerous as it leads to therapeutic failures and selects multi-resistant bacteria.

The antibiotic dose should be estimated according to the body weight of the animals and not per kg of feed. A full treatment course by oral route is a minimum of five days and should not exceed 10 days.

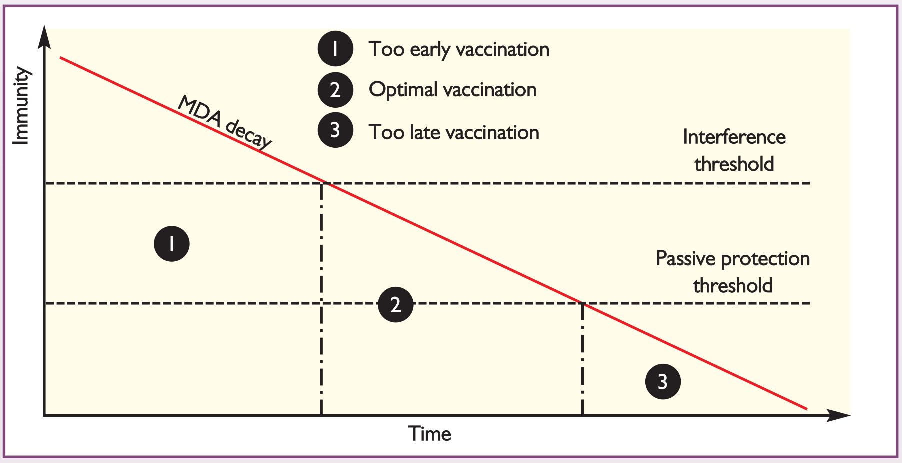
● **Importance of biosecurity, management and hygiene.**

Preventive strategies such as appropriate husbandry (density, batch management, ventilation, water and feed quality), hygiene (strict terminal disinfection) and routine health monitoring (hospital pen, quarantine, strategic culling) must be emphasised.

It is important to recognise and to correct all contributing factors playing a role in the course of the disease – genetics, nutrition, housing, management.

Implementation of any medication strategy without application of basic rules of biosecurity will not be effective on a long term basis as it does not allow the infection pressure to be fully controlled. These basic measures are costless with regard to the excessive use of pharmaceutical products.

Fig. 2. Maternal derived antibodies interference and vaccination programme.



Conclusion

Today, medication is compulsory in intensive production to control diseases. Their increasing costs may affect the economic viability of modern pig production.

Moreover, excessive use of antibiotics has lead to the selection of multi-resistant pathogens and public health concerns have arisen.

The decision process to apply a medication strategy must be based on an appropriate diagnosis. The selection of the pharmaceutical products should be finalised by experienced swine practitioners to optimise therapeutic efficacy and cost efficiency, to minimise antibioresistance and to protect public and animal health.

Biosecurity including correct management is the most effective and the most economic mean of controlling swine health and thus optimising medication cost and farm profitability. ■