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**HANDBOOK  
RESPONSIBLE USE OF ANTIBIOTICS  
IN LIVESTOCK PRODUCTION  
FOR ANIMAL HEALTH WORKERS IN VIET NAM**



**USAID**  
FROM THE AMERICAN PEOPLE



# **HANDBOOK RESPONSIBLE USE OF ANTIBIOTICS IN LIVESTOCK PRODUCTION FOR ANIMAL HEALTH WORKERS IN VIET NAM**

## **AUTHOR**

**Nguyen Van Thanh**

FAO consultant

## **MAIN CONTRIBUTORS**

**Pawin Padungtod**

FAO Viet Nam

**Nguyen Thuy Hang**

FAO Viet Nam

**Le Thi Hue**

Department of Animal Health

**Nguyen Thi Thanh Ha**

Viet Nam National University of Agriculture

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# Preface

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The use of antimicrobial drugs in terrestrial and aquatic animals is critical to both health and productivity. It contributes to food safety and animal well-being, and in turn to the protection of livelihood and sustainability of animal production. There is a growing concern that resistance to antimicrobial drugs, including antibiotics, will reverse achievements of food safety and animal health. It is important that these drugs remain available and effective in animal health and agriculture.

Animal Health Workers (AHW) play a role in veterinary extension and other livestock production services. He or she provides preventive animal health care, assistance in animal disease control, biosecurity promotion and basic first aid services to farm animals. AHWs serve as the first contact that local farmers refer to when their animals have health problems. AHWs are important communicators for good farming practices and disease prevention and control. Furthermore, they are advocates for the responsible use of antimicrobials, antibiotics and vaccines.

The Emergency Centre for Transboundary Animal Diseases (ECTAD), FAO Viet Nam, has provided various training programmes to AHWs, in collaboration with the Department of Animal Health. Our experience has shown that AHWs are a part of the solutions for responsible AMU and AMR mitigation, as well as animal disease control. AHWs have to deal with many animal health issues, including treatment of diseases with antibiotics but they do not have neither practical guideline nor access to training on AMR and AMU.

This handbook aims to provide first-hand knowledge on AMR and AMU, serving as a practical guideline for AHWs to gain better understanding and advocate them to promote responsible AMU among animal producers and animal drug sellers and ultimately reduce AMR. We hope AHWs will find it helpful.

**Pawin Padungtod**  
Senior Technical Coordinator  
FAO ECTAC Viet Nam

**Nguyen Thu Thuy**  
Deputy Director  
Department of Animal Health

# Acknowledgements

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## 1. Antimicrobials and antibiotics

### 1.1. Antimicrobials and antibiotics

Microorganisms are everywhere. They include bacteria that sometimes cause disease and infection in humans, animals and plants.

Antimicrobials are substances like antibiotics and other chemicals used to kill or stop microorganisms from growing.

Antibiotics are used to tackle diseases caused by bacteria, NOT viruses. At therapeutic doses, antibiotics which prohibit the bacterial growth are classified as “bacteriostatic drugs”, and those directly kill bacteria are classified as “bactericidal drugs”.



*Antiseptics and disinfectants are NOT antibiotics.*

## 1.2. Routes of drug administration for animals

In veterinary practice, there are two common drug routes: oral administration and injections.

Other less common routes are topical (ointment/spray) or intra-mammary/intra-uterine insertion.

- **Oral administration.**

*Advantages:* This is an easy and safe drug application route. In addition, it is the most convenient way when animals are raised in a large numbers, such as in industrial farms.



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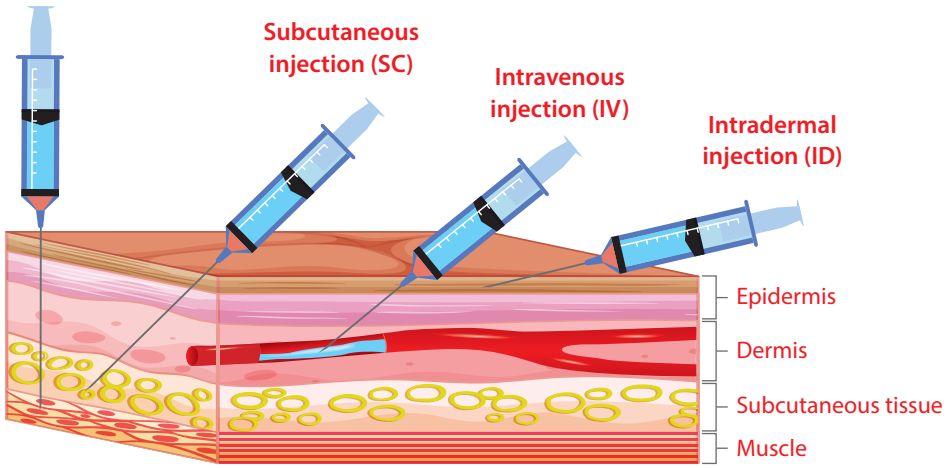
*Oral drug administration can be conducted by mixing antibiotics with drinking water or animal feed.*

*Disadvantages:* Slow effects, and therefore not suitable in acute diseases.

Note: Orally administered drugs, especially antibiotics, are particularly used as prophylactic to prevent diseases for ruminants. Microbial activities play an important role in their digestion and oral antibiotics might affect the microbial ecology and cause digestive disorders. Therefore, this route is usually applied only when ruminants are milk-fed, such as for cattle that are less than six month old.

- **Injection:** Injection is the act of putting a liquid antibiotic into the animal's bodies using a needle and a syringe.

**Intramuscular injection (IM)**

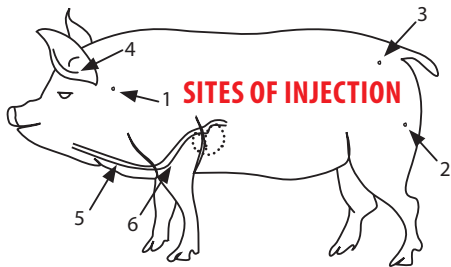


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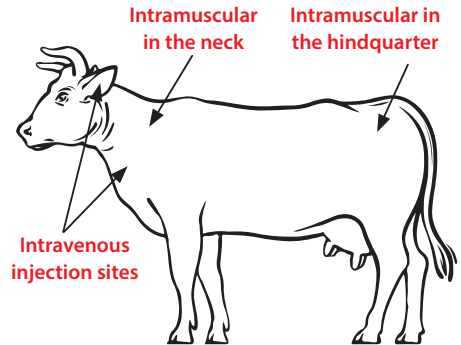
*Common injection routes*

**Advantages:** Easy to treat individual animals. High absorbance rates and therefore are suitable in cases that drugs need to exert their effects early and fast. Absorbance rates depends on injection methods, usually IV (intravenous) > IM (intramuscular) > SC (subcutaneous).

**Disadvantages:** The application is more complicated than oral administration. It requires proper techniques for animal restraint and injection. Criteria such as hygiene or sterilization are necessary to ensure that infection or inflammation does not occur due to the injection process.



1. Intramuscular in the neck (common)
- 2, 3. Intramuscular in the hindquarter (for piglets only)
4. Intravenous into the ear vein
5. Intravenous into the jugular vein
6. Site of anterior vena cava



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*Figure 1. Common positions to inject drugs on cows and pigs*

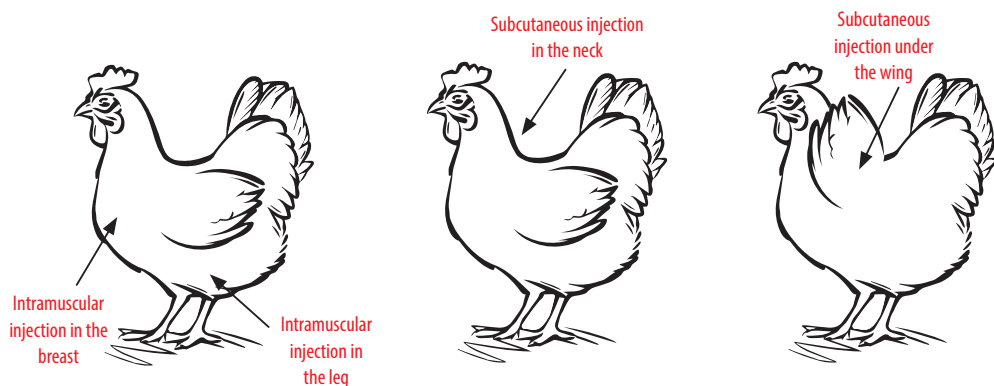


Figure 2. Common positions to inject drugs in chicken

## 2. Antimicrobial resistance

### 2.1. What is antimicrobial resistance?

Antimicrobial resistance occurs when microorganisms like bacteria, fungi, viruses and parasites are resistant to antimicrobial substances, like antibiotics, antifungals and others. The process is accelerated when there is inappropriate or excessive use of antimicrobials. As a result, medicines that were once effective treatments for disease in people and animals become less effective or not effective at all, leading to a reduced ability to successfully treat infections. Poor infection control, inadequate sanitary conditions and inappropriate food handling increase the spread of antimicrobial resistance.

### 2.2. Why is it an issue?

- Antimicrobial resistant-microbes are found in people, animals, food and the environment (in water, soil and air). They can spread between people and animals, from food of animal origin and from person to person.
- Misuse and overuse of antimicrobials increases the resistance which makes the treatment of bacterial infections becomes more difficult, endangering both animal and human health and welfare.
- Antimicrobial resistant bacteria can spread through food and environment.

- Treatment of infections caused by antimicrobial resistant bacteria is more difficult and takes a longer time.

### **2.3. Examples of improper use of antimicrobials**

- Buying, selling and using antibiotics without the prescriptions or instructions from veterinarians;
- Using antibiotics for growth promotion or disease prevention;
- Misusing antibiotics for disease treatment (for example: use antibiotic to treat viral infection), applying wrong doses, wrong administration routes and not ensuring the clearance periods after antibiotic using (for examples: collect animal product earlier than the withdrawal period); and
- Wrongly prescribing antibiotics that may have no effects on pathogenic bacteria or wrongly combining antibiotics or applying too many antibiotics when it is not necessary.

Resistant bacteria can spread through the environment, especially in farms with low biosecurity.

## **3. Antibiotic residues and consequences**

### **3.1. What is antibiotic residue?**

Antibiotic residue is a status when antibiotics still remain in animal products, which can make consumers exposed to a potential health risk

### **3.2. Why is it an issue?**

When antibiotics remain in food products at a level higher than the minimum residue limit, it can cause the following harmful effects:

- Increase resistance of bacteria that cause human diseases - causing bacteria to resist antibiotics and therefore making these antibiotics become less effective in future treatments; and

- Cause harmful effects to the consumers' health, such as disorders of digestive microbial activities leading to diarrhoea, allergies and many other adverse effects on growth and development.

### ***3.3. What causes antibiotic residues in animal products?***

Antibiotic residues in animal products are due to misuse and overuse of antibiotics in the animal raising process especially when farmers do not follow withdrawal periods required after treatment, slaughtering and selling animal products before this time.

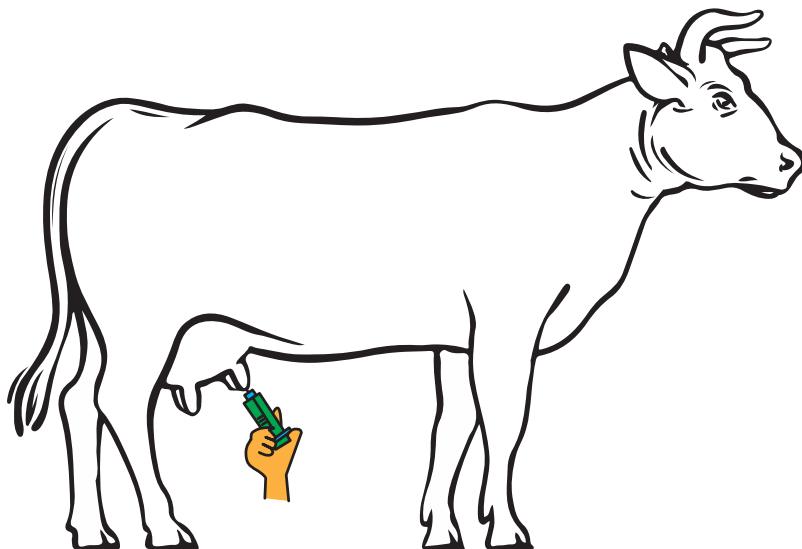
### ***3.4. What causes antibiotic resistance***

- Use antibiotics to prevent bacterial diseases in healthy animals;
- Use antibiotics as growth promoters for animals;
- Use antibiotics that are prohibited to use in food producing animals (such as: Chloramphenicol); and
- Not following instructions when using antibiotics (such as applying wrong doses, wrong treatment regimens).

## **4. Main principles for responsible antibiotic use in animal production**

- Only use antibiotics when prescribed by a veterinarian. In some cases, they will request antibiotic susceptibility test results to ensure that the antibiotic can treat the infection;
- Follow the recommended dosage, route of administration and length of treatment even the animal seems to get better. Antibiotics should be used with right doses and regimes to ensure effective concentrations in blood or infectious tissues;
- Exclusively buy antibiotics from authorized sources;
- Store unused antibiotics as recommended by producers;

- Write down names, doses and dates and purposes of antibiotics used in your farms (including laboratory results if available);
- Have a farm record book for antibiotics and other drugs used for animals;



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*Figure 3. Administer antibiotic directly in an infected udder by using a special applicator*

- Use antibiotic susceptibility tests to support drug selection;
- Antibiotic combinations are only applied with professional oversight and only when a single antibiotic therapy cannot ensure treatment results; and
- Antibiotic combination is usually used to enhance treatment effectiveness and reducing possibility of resistance or if infections are caused by many bacteria.

## **5. How to limit the use of antimicrobials and antibiotics in animal production**

### **5.1. Implementation of strict biosecurity**

- Good biosecurity practice is the best strategy to prevent diseases and reduce the needs for antimicrobial/ antibiotics.

- Biosecurity is based on the following principles: **Segregation - Cleaning - Disinfection**
  - Prevent pathogens from outside and their spreading among animals on farms; and
  - Eliminate pathogens from any possible infected materials in farms by the careful cleaning and disinfection process.
- Biosecurity starts from good design of farms, restrict farm entry, ensure animals and feed come from certified sources, maintain hygiene and safe environments to limit the possibility of diseases to be brought into farms. **Without diseases, farmers do not need to buy drugs, including antibiotics.**



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*By maintaining good hygiene, biosecurity, good husbandry practices, farmers can ensure a safe environment and keep their animals in good health.*

## **5.2. Good vaccination schedule**

A vaccine is a biological product that stimulates the animal to produce immunity to a particular disease. Vaccination is considered one of the most important methods to effectively prevent diseases. Vaccination programs should be developed based on the animal species being kept and the risk of diseases occurring in the areas where the farm is located.

### 5.3. Improvement of animal health with good feed additives

- **Probiotics:** The joint Food and Agriculture Organization of the United Nations (FAO) and World Health Organization (WHO) Working Group defined probiotics as “live micro-organisms which when administered in adequate amounts confer a health benefit on the host” (FAO/ WHO, 2001). This definition is widely accepted and adopted by the International Scientific Association for Probiotics and Prebiotics (Hill et al., 2014).

Probiotic supplements increase the growth of beneficial microorganisms in the digestive systems, which limits the development of harmful bacteria, decreases their numbers and therefore reduces the risk of diseases. In addition, beneficial microorganisms secrete enzymes that digest the remained nutrition in food, so enhancing the feed-conversion of animals and increasing profits.

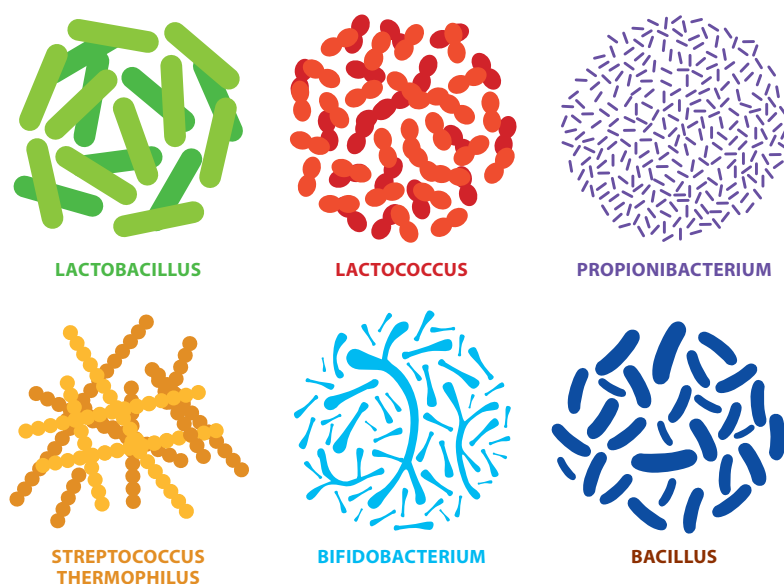
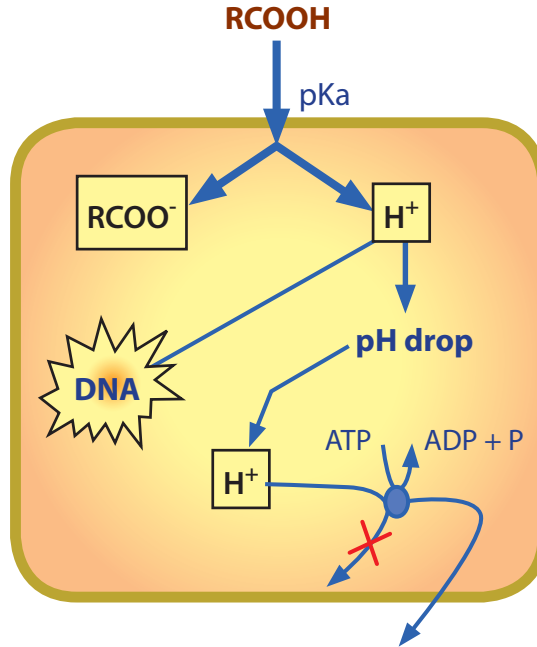


Figure 4. Beneficial microorganisms (probiotics)

- **Organic acids**

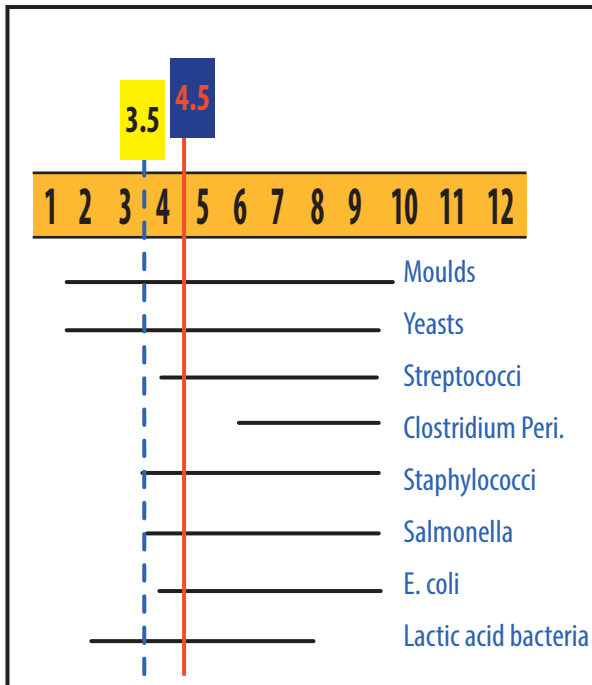
The supplement of organic acids in drinking water or animal feeds decreases the pH in intestines, making the environments less suitable for harmful bacteria and therefore increasing the development of beneficial bacteria. Organic acids enhance animal growth, prevent diseases and reduce the

need for antibiotics. Common organic acids used are propionic, formic, lactic and butyric acid.



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Figure 5. Mechanisms by which organic acids inhibit harmful bacteria.



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Figure 6. Harmful bacteria are inhibited at low pH environments (pH less than 4.5 or 3.5), while beneficial bacteria are not inhibited.

## 5.4. Herbal medicine

The supplement of some medicinal plants in animal feed has good effects on immunity and increases the body resistance to diseases. In addition, they can stimulate digestive activities (such as garlics and gingers) or enhance the quality of animal food products (such as star anise oil and cinnamon).

Many Vietnamese medicinal plants contain phytoncide components, which are able to inhibit the development of bacteria. Therefore, they can be used as an alternative to antibiotics, in both disease prevention and for treatment purposes.

### 1) Viet Nam (*Lactuca indica*)



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- Use whole plants, except roots.
- Effect: to treat mastitis and clogged milk ducts, stimulate milk secretion and treat inflammation.
- Preparation and application: decoct and mix in drinking water, or crush plant materials and cover on inflammatory tissues.

### 2) Myrtle (*Rhodomyrtus tomentosa*)



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- Use flower buds, young leaves and fruits
- Effect: to treat diarrhea, dysentery, bloody diarrhea and colic caused by poisonous food
- Preparation and application: decoct and drench

### 3) Ginger



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- Use bulbs
- Effect: The plant has anti-bacterial and digestive stimulative effects. Use to treat colic cause by cold, indigestion, low appetite, diarrhea, dysentery, cold limbs, weak pulse and cough
- Preparation and application: mix fresh bulbs in feed

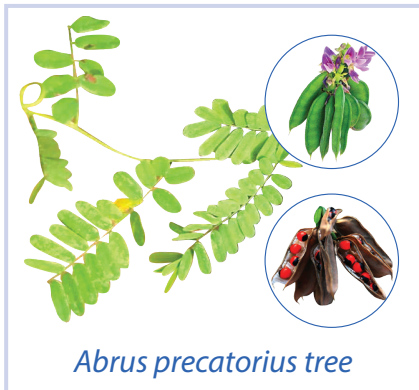
### 4) Garlic



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- Use whole plant or bulbs. Plant materials can be used fresh or dried.
- Effect: to treat indigestion, cough and dysentery caused by bacteria.
- Preparation and application: mix fresh plants in water or feed.

### 5) Abrus precatorius tree



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- Use whole plant (root, branch, leave), but branches have best effect
- Effect: to treat cough, fever and jaundice caused by a virus
- Preparation and application: decoct and mix in drinking water

## 6) Pomegranate



*Pomegranate tree*

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- Use fruit skin, bark of branch and root
- Effect: to treat tapeworms and diarrhea
- Preparation and application: decoct and mix in drinking water

## 7) Heartleave (*Houttuynia cordata*)



*Heartleave tree*

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- Use whole plant, except roots
- Effect: to treat dysentery, eyesore and inflammation in eyes and ears
- Preparation and application: mix fresh parts (not roots) in feed or crush and extract liquid from plant materials to mix in drinking water or to wash injured tissue

## 8) Curstard apple (*Annona squamosa*)



*Custard apple tree*

©FAO

- Fruits are used as food. Use leaves and seeds as herbal medicine
- Effect: fresh leaves: to treat blood parasites. Seeds: external uses to treat ecto-parasites, such as ticks, scabies and fleas
- Preparation and application: leaves: decoction and mix in drinking water; seeds: crush and steep in hot water, use the cooled down solution to wash the animal (avoid contact with eyes).

## 9) Mugwort



*Mugwort tree*

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- Use whole plant
- Effect: treat fetal derangement, cough, cold and colic.
- Preparation and application: crush and extract solutions from plant materials to mix in drinking water.

## 10) Achyranthes bidentata tree



*Achyranthes bidentata tree*

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- Use bulbs or whole plant. This plant can be harvested all year around.
- Effect: bulbs: to treat bone and joint pain, to stimulate digestion; other parts: to treat piglet diarrhea, back pain, dysuria.
- Preparation and application: decoct and mix in drinking water

## 6. Annexes

### **Annex 1. List of banned antibiotics and chemicals for livestock production**

(based on Circular 10/2016/TT-BNN dated 1 June, 2016)

No	Names of antibiotics or chemicals	No	Names of antibiotics or chemicals
1	Chloramphenicol	9	Olaquidox
2	Furazolidon Nitrofurantoin	10	Bacitracin Zn
3	Dimetridazole (Emtryl)	11	Green Malachite
4	Metronidazole	12	Gentian Violet (Crystal violet)
5	Dipterex; DDVP	13	Clenbuterol
6	Ciprofloxacin	14	Salbutamol
7	Ofloxacin	15	Ractopamine
8	Carbadox	16	Diethylstilbestrol (DSE)

### **Annex 2. List of banned antibiotics and chemicals for aquaculture**

(based on Circular 10/2016/TT-BNN dated 1 June, 2016)

No	Names of antibiotics or chemicals	No	Names of antibiotics or chemicals
1	Aristolochia spp and other supplements	13	Nitroimidazole
2	Chloramphenicol	14	Clenbuterol
3	Chloroform	15	Diethylstilbestrol (DES)
4	Chlorpromazine	16	Glycopeptides
5	Colchicine	17	Trichlorfon (Dipterex)
6	Dapsone	18	Gentian Violet (Crystal violet)
7	Dimetridazole	19	Fluoroquinolones
8	Metronidazole	20	Trifluralin
9	Nitrofurantoin	21	Cypermethrin
10	Ronidazole	22	Deltamethrin
11	Green Malachite (Xanh Malachite)	23	Enrofloxacin
12	Ipronidazole	24	Ciprofloxacin

### Annex 3. Antibiotic susceptibility tests

- Antibiotic susceptibility tests are conducted in a laboratory and used to identify the antibiotics that are effective on tested bacteria and the level of susceptibility.
- Performing an antibiotic susceptibility test is the best method to choose the right antibiotic for each specific bacterial infection.
- The tests should be performed in a certified and reliable laboratory to ensure result accuracy.
- Main steps in the protocols of antibiotic susceptibility tests

There are several methods to perform antibiotic susceptibility tests. However, the most common method is the Kirby-Bauer disc diffusion method, due to its simplicity.

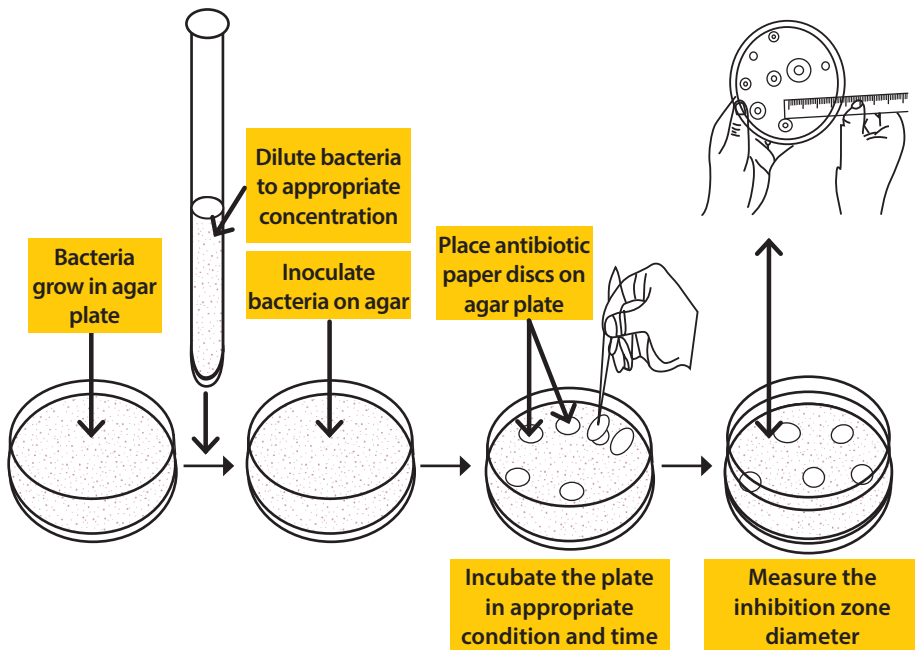
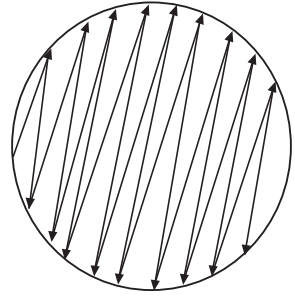
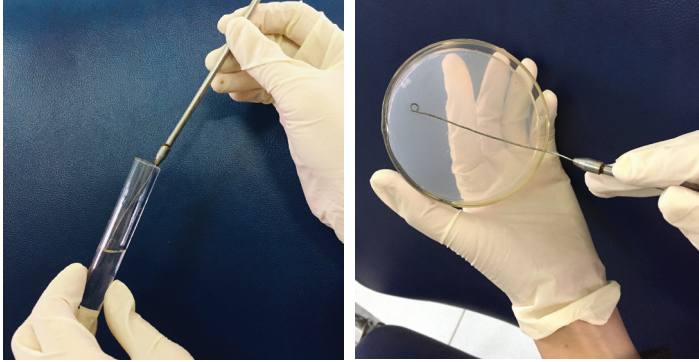
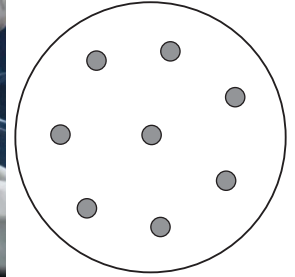
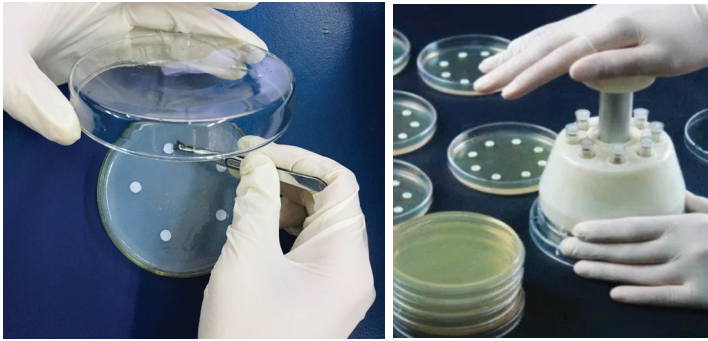


Figure 7. Main steps to perform antibiotic susceptibility tests by the Kirby – Bauer disc diffusion method.



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*Inoculate testing bacteria on agar plates.*



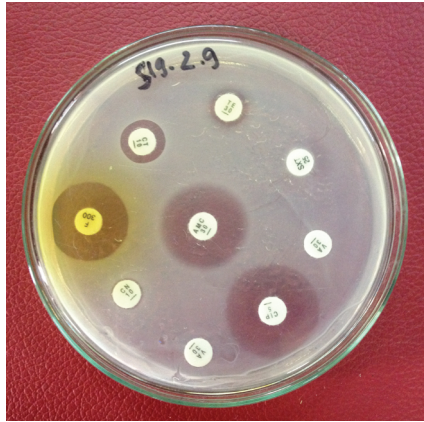
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*Place antibiotic paper discs on agar plates  
(by hand or using machines).*



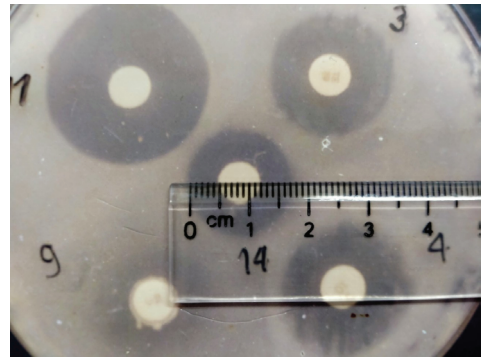
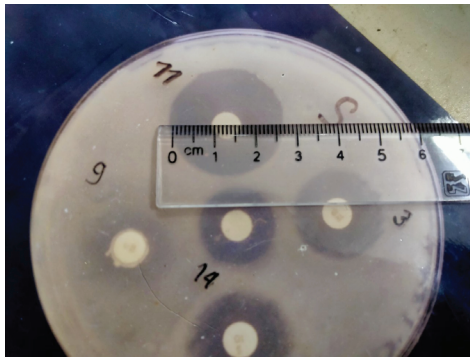
©FAO

*Antibiotic paper discs produced by commercial companies,  
which are specifically designed for the Kirby – Bauer diffusion method.*



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*Inhibitory zones induced by the paper disc diffusion test.*



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*Measure inhibitory zones manually or using the result reading machines.*

Based on the diameters of inhibitory zones, examiners can identify the antibiotics that pathogenic bacteria are sensitive to and determine the sensitivity levels of all tested drugs. The criteria are usually established by The Clinical & Laboratory Standards Institute (CLSI, the United States). By referring to these criteria, we can identify the susceptibility of bacteria to tested antibiotics, which are divided into 3 levels: Susceptible (S), Resistant (R) and Intermediate (I). An example of criteria established for *Escherichia coli* is shown in Table 3.

**Table 3. Criteria to classify the antibiotic susceptibility levels of *Escherichia coli* based on the diameters of inhibitory zones induced with the Kirby-Bauer paper disc diffusion method.**

Antibiotic (concentration/ disc)	Inhibitory zone diameter (mm)		
	Resistant	Intermediate	Susceptible
Amikacin (30µg)	≤14	15-16	≥17
Ampicillin (10µg)	≤13	14-16	≥17
Gentamycin (10µg)	≤12	13-14	≥15
Tetracycline (30µg)	≤14	15-18	≥19
Trimethoprim (5µg)	≤10	11-15	≥16

(Note: Criteria are established by the Clinical & Laboratory Standards Institute – CLSI)

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Contact information:

**Food and Agriculture Organization of the  
United Nations (FAO) in Viet Nam**

One UN Building, 304 Kim Ma St., Ha Noi, Viet Nam

Email: [FAO-VN@fao.org](mailto:FAO-VN@fao.org)

Tel: 84 24 38500100

Fax: 84 24 37265520

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