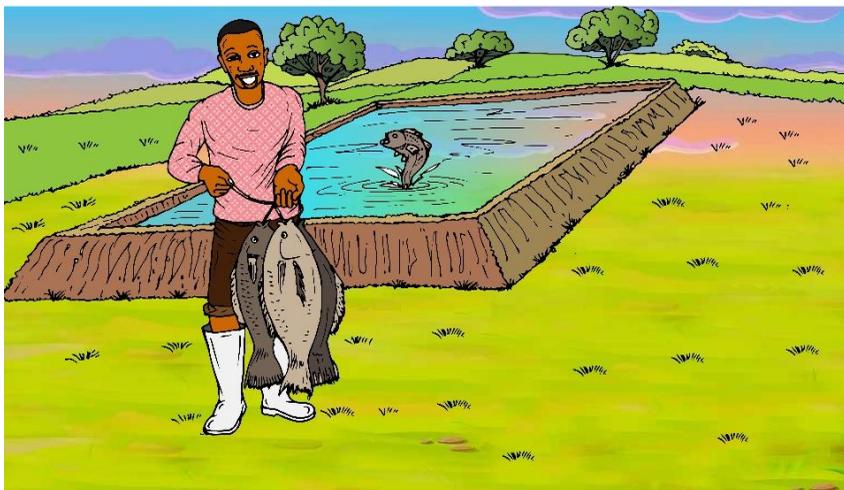




GUIDELINES FOR INFECTION PREVENTION AND APPROPRIATE ANTIMICROBIAL USE IN THE ANIMAL SECTOR:

Fish Farming



2020

Cover page – Fish farmer after harvesting tilapia (Sabulenya) from his pond.

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Guidelines for Infection Prevention and Appropriate Antimicrobial Use in Animal Sector: Fish Farming

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FOREWORD

Welcome to the first edition of the *Guidelines for Infection Prevention and Appropriate Antimicrobial Use in the Animal Sector*. This edition focuses on five livestock production systems, namely cattle farming, fish farming, goat and sheep farming, pig farming, and poultry farming. We trust that these operational guidelines will be valuable for farmers and frontline veterinary practitioners.

The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) is grateful to the Directorate of Animal Resources, and particularly the Department of Animal Health, for completing this task. We also thank the technical team of Dr. Dominic Mundrugo-ogo Lali, Dr. Patrick Vudriko, and Dr. Freddy Eric Kitutu for the technical support, as well as Makerere University and the USAID-funded Medicines, Technologies and Pharmaceutical Services (MTaPS) Program, implemented by Management Sciences for Health (MSH), for the material, technical, and financial support for this output.

Indeed, these guidelines play an important role in implementing the Uganda National Antimicrobial Resistance National Action Plan to slow the spread of resistant microbes. Around 75% of emerging resistant pathogens are related to zoonotic care. Taking steps to ensure the livestock industry improves its use and management of antimicrobials reinforces our commitment to strengthening the country's capacity for global health security—a goal that can only be achieved through a concerted effort focused on health management at the interface between human and animal health.

Farmers in Uganda will play a critical role in promoting food safety and security, improving household incomes, and promoting animal and environmental welfare. These guidelines are intended to help farmers:

- Understand strategies for infection prevention and appropriate antimicrobial use.
- Establish practices for recordkeeping of herds and medicinal products used.
- Better understand the need for withdrawal periods for cases in which animals are justifiably given antimicrobials.



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PREFACE

Farmers and frontline veterinary practitioners offer essential services that sustain food security, food safety, and the livelihoods of many households. The rising tide of resistant microbes, zoonoses and transboundary diseases has laid a foundation for pressure from key actors to restrict use of antimicrobial agents in the animal sector. It is, therefore, imperative that farmers and frontline veterinary practitioners demonstrate a responsible approach to the use of antimicrobial medicines in livestock production systems.

This is the first edition of the *Guidelines for Infection Prevention and Appropriate Antimicrobial Use in the Animal Sector*. It is envisaged that these guidelines will be widely disseminated and used, and that they will become a useful resource for farmers and frontline veterinary practitioners. They are written in a manner that allows easy and rapid access to vital information under three themes: infection prevention practices; appropriate antimicrobial use practices; and recordkeeping for farm animals and veterinary medical products on the farm.

These guidelines are intended to help create farming conditions that prevent or minimize the occurrence and spread of infections and to promote the effective and safe use of drugs. Appropriate antimicrobial use, also referred to as prudent or responsible use in the animal sector, is the scientific and technically directed use of these compounds which should form an integral part of good veterinary and animal husbandry practices. Recommendations and practical measures of infection prevention, such as vaccination and improvement in husbandry conditions, should be encouraged and prioritized as a core intervention to slow down the spread of antimicrobial resistance (AMR). Infection prevention, if well implemented, will reduce or even eliminate the use of antimicrobial agents, which in most cases are used as an alternative for deficient animal husbandry practices.

All the relevant government ministries, departments, and agencies—including the MAAIF, the National Drug Authority (NDA), the Uganda Wildlife Authority (UWA), and other parastatals—must apply and promote these

principles. Veterinarians and other veterinary practitioners, pharmaceutical actors, and livestock keepers are also expected to apply these principles.

It has been no small task to propose and develop this first edition of the guidelines by summarizing the most current and relevant literature. The MAAIF Directorate of Animal Resources is enormously grateful to the technical team of Dr. Dominic Mundrugo-ogo Lali, Dr. Patrick Vudriko, and Dr. Freddy Eric Kitutu, as well as Makerere University and the Medicines, Technologies, and Pharmaceutical Services (MTaPS) Program, implemented by Management Sciences for Health, for their work in producing this first edition.

These guidelines are one of many technical documents produced by MAAIF in line with global and national aspirations to optimize use of antimicrobial agents in the animal sector as a key strategy to slowing down the spread of AMR. These guidelines will be available as a downloadable PDF document. However, we are also aware that many people would rather have a book and flip through the pages to easily find the information they need. We want to ensure the dissemination of this crucial knowledge is inclusive.

Therefore, these guidelines will be available in both formats—as a hard copy and as an electronic version. The electronic version enables updates and additions to be made without the need to wait for the next edition to come to print. Thus, the guidelines will, in an “active sense,” inform farmers and veterinary practitioners and continue to play their part in reducing infections, reducing unnecessary antimicrobial use, and, consequently, slowing the spread of resistant microbes.



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We hereby thank the USAID/MTaPS program for their financial support in developing these guidelines. The MAAIF Department of Animal Health, Directorate of Animal Resources, gratefully acknowledges the technical assistance, guidance, and constructive comments provided by all stakeholders during the development process.

We also extend sincere gratitude to all other government agencies (UWA, NDA UWEC, and NARO) who cooperated extensively to make sure the development of these guidelines occurred comprehensively and ensured that the final guideline document is in line with national and international standards.

I participated in crafting the *Guidelines for Infection Prevention and Appropriate Antimicrobial Use in the Animal Sector* and had the pleasure of working with the following talented individuals, from inception to final editing.

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We also thank Makerere University College of Veterinary Medicine, Animal Resources, and Biosecurity (MakCOVAB) Makerere University School of Public Health (MakSPH), Pharmacy Department (MakPD), School of Health Sciences; Makerere University College of Health Sciences (MakCHS); the Uganda Veterinary Association (UVA) and Uganda Veterinary Board (UVB) for their tireless efforts in the review, finalization, and printing of the Guidelines for Infection Prevention and Appropriate Antimicrobial Use in the Animal Sector.



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ABBREVIATIONS

AMR	antimicrobial resistance
DVO	district veterinary officer
FAO	Food and Agriculture Organization
FVE	Federation of Veterinarians of Europe
ILRI	International Livestock Research Institute
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MSH	Management Sciences for Health
MTaPS	Medicines, Technologies, and Pharmaceutical Services
RUMA	Responsible Use of Medicines in Agriculture Alliance

DEFINITIONS

Administration: In medical terms, refers to giving medicine to an animal/fish.

Antimicrobial agent: Drugs, chemicals, or other substances that kill, inactivate, or slow the growth of microbes, including bacteria, viruses, fungi, and protozoa. Because of these properties, antimicrobial agents are used in treatment and infection prevention in animal health and production.

Antimicrobial resistance (AMR) The ability of microbes to grow in the presence of substances that previously used to kill them.

Appropriate medicine use: The selection of the proper drug to be administered according to a dosage regimen appropriate to the sick animal after due consideration of the potential benefits and risks of that therapy. This is also referred to as prudent or responsible medicine use. “Appropriate medicine use” is now the preferred term, replacing the previously common “rational medicine use.”

Biosecurity: The implementation of a series of basic management practices to prevent the introduction¹ and spread² of microbes and diseases within and between farm(s.)

Broodstock: Fish with well-developed sexual organs used for breeding purposes.

¹ Agriculture Victoria. A practical approach to beef herd biosecurity. Updated 2020 June 22 [cited 2020 June 27]. Available from: <https://agriculture.vic.gov.au/livestock-and-animals/beef/biosecurity/a-practical-approach-to-beef-herd-biosecurity>

² Mayega, L., Dione, M.M., Kawuma, B., et al. Pig management: Ensuring appropriate husbandry practices for profitability: Uganda smallholder pig value chain capacity development training manual. ILRI Manual 15. 2015.

Diagnosis: The art and science of identifying disease-causing germs and parasites by observation, examination, or use of medical devices and laboratory tests.

Disinfectant: Any substance which is mainly used on non-living objects/surfaces to kill microorganisms that cause infection and disease.

Disinfection: The process of cleaning a surface with a chemical (disinfectant) to destroy microorganisms.

Extra-label use: The use of drugs in ways that are not in accordance with the manufacturer's label and package insert. Extra-label use can only be authorized by a veterinary practitioner who takes full responsibility for such use. Veterinary practitioners must inform clients if a product is being used in such cases.

Footbath: A bath for disinfecting feet, placed at the entrance of the farm or other physically separated places.

Hatchery: A place where eggs of fish and birds (poultry) are hatched under artificial conditions.

Husbandry: The care, cultivation and breeding of crops and animals. These guidelines focus on animal husbandry where animals are raised for meat, fiber, milk, eggs, and other products.

Infection: When an organism (usually a microbe or germ) enters another organism's body (e.g., bird, fish, cow, or other animal) and causes disease.

Medicine: A natural or synthetic substance used to prevent or treat disease or maintain health in animals. This substance can be drenched, injected, applied, or smeared on any part of the animal.

Microbe: Disease-causing germs that cannot be seen with naked eyes. They are also referred to as microorganisms and include bacteria, fungi, viruses, and protozoa.

Parasite: An organism that lives and feeds on an animal. Parasites may cause physical injury and/or spread disease-causing microbes (germs).

Pest: A destructive arthropod or other animal that attacks livestock, including flies, ticks, mice, rats, and birds.

Vector: An organism that transmits a disease or parasite from one animal to another.

Quarantine: A state, period, or place of isolation or confinement in which animals are placed after transport from another place or after exposure to an infectious or contagious disease. It separates or restricts the movement of those animals to see if they become sick.

Veterinary pharmacy/drug shop: A place where medicinal products, medical devices and diagnostics for animals are sold. A licensed pharmacy or drug shop must have a valid license that is displayed where it can be seen.

Veterinary practitioner: A person who is licensed by the Uganda Veterinary Board to practice veterinary medicine in Uganda, e.g., a veterinary surgeon or doctor and veterinary paraprofessionals.

Withdrawal period: The minimum time required between the last treatment and the collection of meat or milk for human consumption.

1.0 INTRODUCTION

Aquaculture (fish farming) is one of the fastest growing agricultural sectors in Uganda. Fish farming is currently growing at 6% per annum, producing over 110,000 tonnes of fish from 3,000 cages and 20,000 ponds from an estimated 13,000 fish farmers.³ Increase in demand for fish both locally and in regional markets is the key driver for the growth of the sector.

Small-scale aquaculture also contributes to livelihood and household income. With a decline in natural fish capture across various water bodies in Uganda, aquaculture systems are growing to meet increased demand. Common aquaculture production systems include earthen ponds, cages, and tanks.

Intensive aquaculture production involves increased stocking densities per production cycle, which predisposes farmed fish to stress and diseases. This necessitates developing a farm strategy for disease prevention and treatment. However, the use of drugs for treatment should be done carefully to prevent contamination of fish (wild and farmed) and the environment with chemicals. It should be noted that close to 80% of the drugs and antimicrobials used in fish production end up in the environment.³ Antimicrobials, if used inappropriately, can lead to the emergence of antimicrobial resistance (AMR) by environmental and fish bacteria.

AMR presents challenges for global public health and is impacted by both human and animal antimicrobial usage. Ineffective antimicrobial agents endanger the effectiveness of many interventions in modern medicine. For instance, most treatment of common infections, prophylaxis for elective surgeries and transplantations, and cancer treatment are not possible with

³ FAO/OIE/WHO. Report of a joint FAO/OIE/WHO expert consultation on antimicrobial use in aquaculture and antimicrobial resistance. 2006 June [cited 2020 June 27]. https://www.who.int/topics/foodborne_diseases/aquaculture_rep_13_16june2006%20.pdf?ua=1

AMR. Widespread AMR, left unattended, compromises the achievement of multiple Sustainable Development Goals (SDGs), including ending poverty, ending hunger, ensuring healthy lives, reducing inequality, and revitalizing global development partnerships.

Economic growth is less likely to be achieved in sick populations, which in turn hinders poverty reduction efforts. And yet, poor people are more at risk of suffering from resistant infections and they are less able to prevent or treat them. In other words, AMR breeds poverty and poverty fuels AMR.

In the animal sector, AMR presents a grave danger to sustaining food production and the livelihood of farmers. Antimicrobial usage in animals threatens food safety and security and puts humans at greater risk of infection.

Global and national action plans have been developed and prioritized for implementation to mitigate the adverse effects of AMR. At the agricultural practice level, farmers and frontline veterinary practitioners must embrace evidence-based strategies and actions to meet this challenge. Farmers must seek to minimize the occurrence of infection through AMR control mechanisms, including proper feeding, avoiding stress to animals, improved sanitation and hygiene, and early disease detection, isolation, and treatment of sick animals. For all animal sickness, treatment should be based on the best available clinical judgement supported by veterinary expertise and/or laboratory investigation. Judicious use of antimicrobial agents cannot be over-emphasized. The guidelines propose concrete evidence-based steps and actions to aid farmers and frontline veterinary practitioners in achieving these aspirations.

These guidelines for infection prevention and appropriate antimicrobial use in the animal sector have been developed in line with the *Uganda AMR National Action Plan 2018-2023*. By following this plan, farmers and veterinary practitioners will contribute to reduction of infections in animals, resulting in more judicious use of antimicrobial agents in the

animal sector. This will reduce the development and spread of resistant microbes in animals and humans and reduce the presence of antimicrobial residues in food-producing animals.

These guidelines are for use in fish farming in Uganda. They are presented under the following themes:

- Infection prevention practices
- Appropriate medicine use practices
- Keeping animal and veterinary medical product records on the farm



Diseased catfish fingerlings



Diseased farmed tilapia



Caged farming systems where intensive farming is practiced

2.0 INFECTION PREVENTION PRACTICES

Fish are susceptible to many infections of viruses, bacteria, fungi and parasitic invasions. Prevention of infection and disease helps to reduce the overall use of antimicrobials, which in turn leads to reduced rate of development of AMR.

Infection prevention is also important for promoting the health and wellbeing of aquatic animals (for example, fish). Healthy fish are a prerequisite for efficient and sustainable food production⁴, thereby avoiding losses for the farmer.

The main causes of aquatic diseases are: Poor quality feeds, stressful water environment conditions, presence of toxic substances and infectious microbes (pathogens). You can prevent aquatic diseases by:

1. Ensuring good nutrition
2. providing good water quality
3. Implementing biosecurity measures and vaccination

⁴ Animal Health Europe. Preventing disease. [Cited 2020 June 27] Available from: <https://www.animalhealthurope.eu/our-contribution/67-prevention-protects.html>

2.1 BIOSECURITY MEASURES^{5,6}

2.1.1 WATER

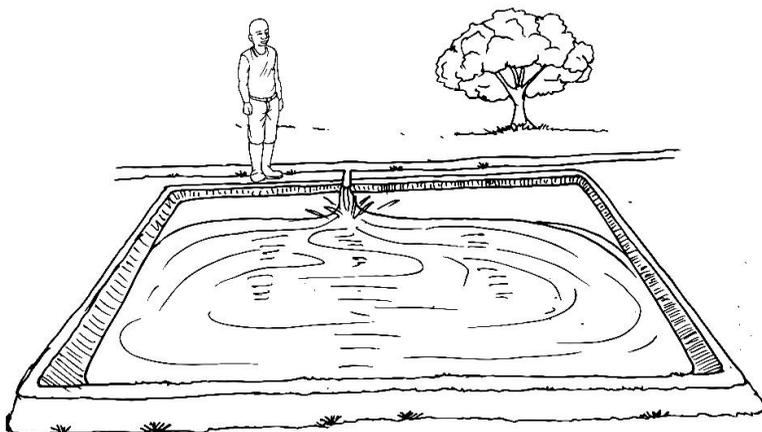


Illustration: Water flowing into a fish pond.

- Ensure that water used is obtained from an uncontaminated source.
- Water should be less turbid, free of pollutants, free from wild fish, and have adequate dissolved oxygen concentration. As much as possible, use clean spring or borehole water, especially for hatchery and nursery systems.
- In pond systems, water from one pond should not flow into another pond.
- If possible, ensure that water from each pond or reservoir is drained separately and should not flow into any other.

⁵ Somga, J, and Balio, D. Biosecurity in Aquaculture: Philippines. 2018.

⁶ Food and Agriculture Organization of the United Nations. Management of freshwater fish culture. Cited 2020 June 27. Available from: http://fao.org/fishery/static/FAO_Training/FAO_Training/General/x6709e/x6709e15.htm

River water is the least desirable source of water for fish farming because it is likely to contain pathogens not already present on the fish farm.

- If river water must be used, pump it through a fine filter and hold it in fish-free ponds for at least 21 days before using it. This will interrupt the life cycles of parasites that cannot survive without a suitable fish host, as well as give any bacterial or viral pathogens time to deteriorate in the absence of a suitable host.

2.1.2 POND ENVIRONMENT



Illustration: A farmer removing vegetation from a fish pond.

- Build a settling basin/pond near or along the feeder canal to the pond to remove silt and fine sand from water.⁷

⁷ Food and Agriculture Organization of the United Nations. Management of freshwater fish culture. Cited 2020 June 27. Available from: http://www.fao.org/fishery/static/FAO_Training/FAO_Training/General/x6708e/x6708e11.htm#HYPMR14

- Control the growth of aquatic vegetation by hand clearing. This can best be done in drained ponds just before they are refilled or by using a perforated scoop or hand rake.⁸
- Remove detached vegetation from the water to avoid re-sprouting and/or decomposition.
- Cut out plants which cannot be pulled by the roots as close to the ground as possible.
- Ensure that there is a healthy balance of phytoplankton and zooplankton.
- Allow water exchange into the pond when necessary.

2.1.3 PREVENTION OF VECTORS AND PESTS

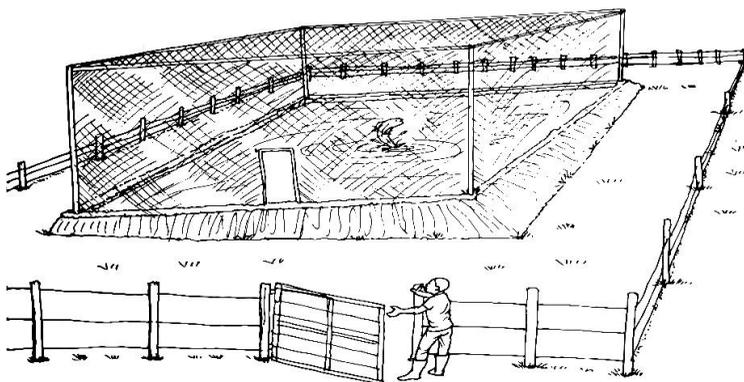


Illustration: A fish pond can be caged and fenced to keep out birds, predators, and other mammals.

⁸ Food and Agriculture Organization of the United Nations. Management of freshwater fish culture. Cited 2020 June 27. Available from: http://www.fao.org/fishery/static/FAO_Training/FAO_Training/General/x6709/x6709e04.htm#MR148

- Use filters and screens to prevent wild fish and stray fish from other farms from entering the pond(s).
- Remove wild fish and other pests from the canals and ponds after each complete harvest or before restocking.
- Use protective nets to prevent birds and mammals from accessing the ponds.
- Prevent and control snails from accessing ponds by placing nets in the inflow water, drying the bottom of the pond periodically, or using chemical and biological methods.

2.1.4 ENTRY TO THE HATCHERY AND NURSERY

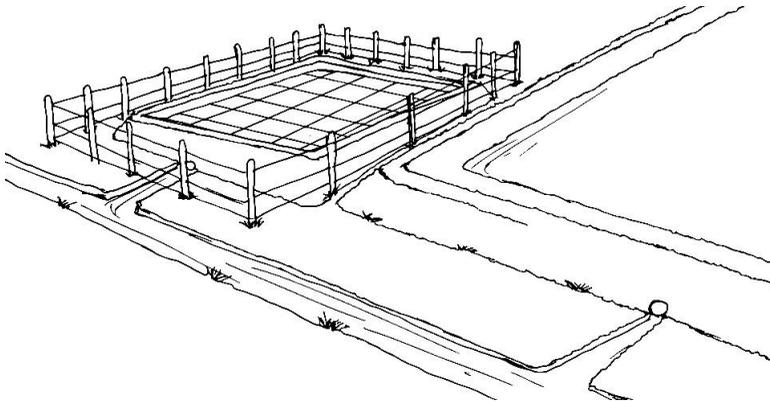


Illustration: An enclosed hatchery with foot baths for disinfecting prior to accessing the pond.

- Enclose the hatchery and nursery areas with a fence to limit access.
- Avail farm specific boots to workers and visitors.
- Use a chlorine-treated footbath for all personnel who enter the hatchery or nursery.
- Clean and disinfect vehicles (chlorine-treated tire bath can do) at the entrances.

- Ensure that all personnel wash and disinfect their hands before entry.

2.1.5 VEHICLES AND VISITORS⁹

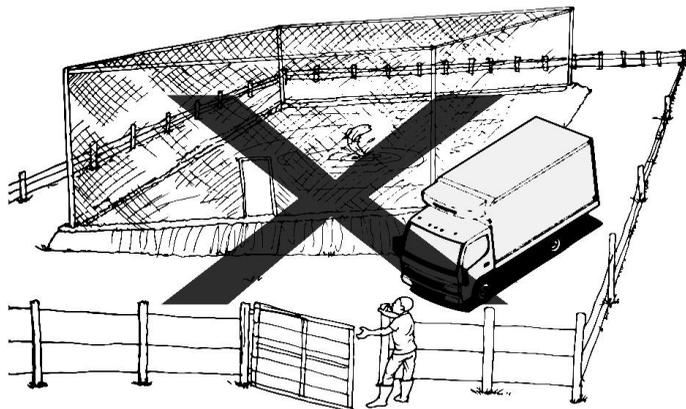


Illustration: Vehicles should not be allowed beyond the fish pond's fence. This will help prevent the spread of infections to the fish farm.

- Visitors and vehicles should not be routinely allowed on site.
- Ensure that visitors and vehicles clean and disinfect with footbath or tyre bath before entry onto the farm.

2.1.6 DISINFECTION OF EQUIPMENT

- Clean and disinfect all equipment before use in another pond.
- Disinfect all equipment that has come into contact with dead or diseased fish before next use.
- Purchase separate equipment for handling small and large fish if possible.

⁹ RUMA. Responsible use of antimicrobials in fish production. 2007 [cited 2020 June 27]. Available from: <https://www.ruma.org.uk/fish/responsible-use-antimicrobials-fish-production>

2.1.7 DISINFECTION OF THE POND

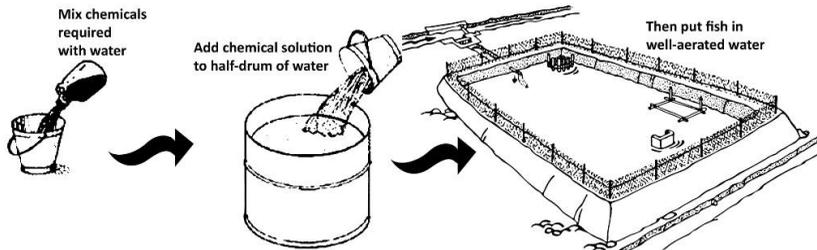


Illustration: A fish pond should be disinfected with recommended agricultural chemicals at the end of the cycle or before restocking with fish.

- Disinfect the pond(s) on a regular basis, for example after each complete harvest or before restocking the ponds.
- You can disinfect the pond(s) physically by drying it out for between 24 hours to one month and/or chemically using quicklime or agricultural lime ($10\text{kg}/100\text{m}^2$) depending on the alkalinity of the environment/bottom soils.
- Disinfecting ponds effectively takes more than 24 hours because the pond bottom must be completely dry until it cracks.
- Check the pH in the pond and only restock only when pH is at 7; otherwise, there will be mass mortality.

2.1.8 DISINFECTION OF FISH SEED STOCKS

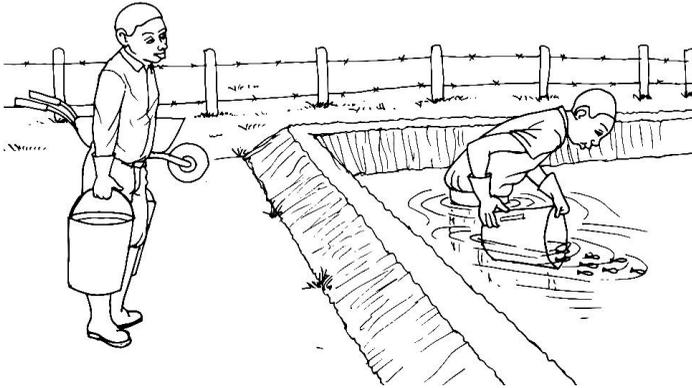


Illustration: A farmer disinfecting a fish pond with iodophore.

- Disinfect all fish seed stocks imported from outside your farm with an iodophore chemical (eggs) or potassium permanganate and formalin, salt on fingerlings, juveniles, and broodstock fish.

2.1.9 CONDITION OF FISH

- Ensure that there is no overstocking or exceeding the carrying capacity of production system.
- Where necessary, keep fish of different sizes or sexes separately to control fighting.
- Ensure that there is good food supply for the fish.
- Handle fish properly especially during harvesting and sorting/grading.
- Ensure that fish are well cared for during harvesting and transport.

2.1.10 STOCKING OF FISH

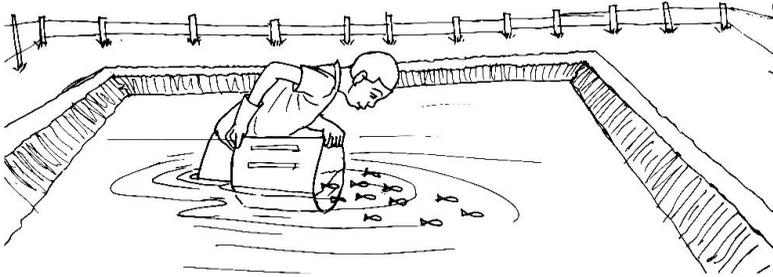


Illustration: A farmer introducing fish into the fish pond.

- Do not transport fish of unknown health status. Fish farmers should purchase healthy fry with health certificates from reputable suppliers.
- Isolate all new/incoming brood stock for at least 20 days.
- Examine fish to establish that they are free of disease; then treat them in medicinal baths if they are sick, before stocking them into ponds and fish culture units.

2.1.11 QUARANTINE

Quarantine is confining aquatic animals that are introduced from outside and they are with unknown health status before introducing to the stock.

- New fish arrivals should be stocked in an isolation unit.
- The isolated fish should be monitored for at least 20 days.
- Any sick fish should be immediately removed.
- A fish disease expert or fish veterinary practitioner should be called immediately to assess the health of the fish and institute appropriate treatment.
- No fish or water should be allowed to escape from quarantine facilities.

- The equipment used in quarantine facilities should not be moved to non-quarantined areas until it has been disinfected.

2.1.12 DISPOSAL OF DEAD FISH



Illustration: A farmer disposing of dead fish. Bury the fish following recommended biosecurity measures.

- Remove dead or dying fish from ponds as quickly as possible, at least on a daily basis.
- Bury diseased/dead fish with quicklime at least 20 m away from the ponds.
- Cover the burial pit with about 60-80 cm of soil.

2.1.13 CONTROLLING STRESS

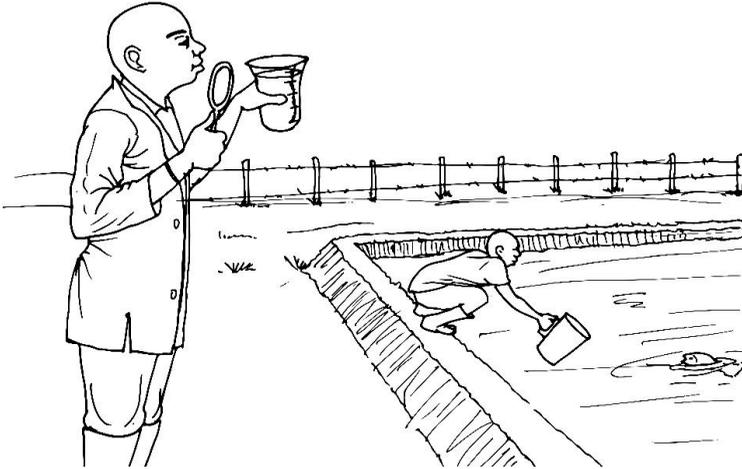


Illustration: Follow procedures that minimize stress when handling fish, for example, during sampling, treatment, and harvesting.

- Do not feed the fish on the day before handling exercise.
- Handle fish during morning hours when temperatures are cool during sampling, sorting, grading or harvesting of fish.
- Ensure that fish have sufficient dissolved oxygen.
- Use open buckets with clean water, and can carry a few fish at time.

2.2 VACCINATION¹⁰

- If required, develop a vaccination plan for fish together with your veterinary practitioner or aquatic animal health specialist.
- Ensure that the vaccination teams observe good hygiene.

¹⁰ RUMA. Responsible use of antimicrobials in fish production. 2007 [cited 2020 June 27]. <https://www.ruma.org.uk/fish/responsible-use-antimicrobials-fish-production>

- Arrange vaccination methods so as to minimize handling stress to the fish.

2.3 NUTRITION

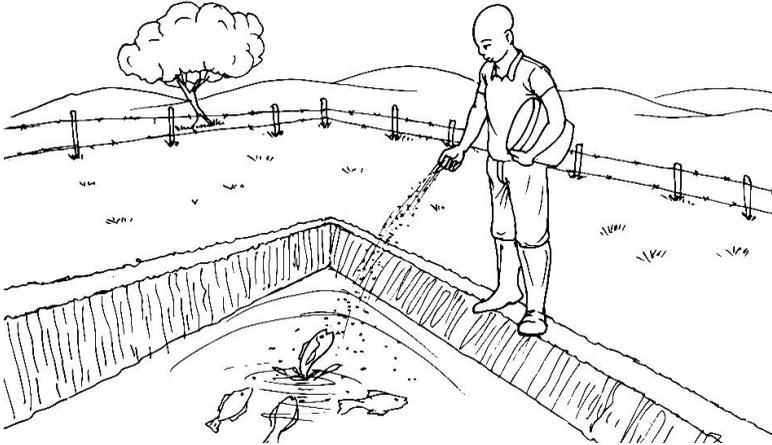


Illustration: A farmer feeding fish in a fish pond.

- In pond systems with tilapia, ensure sufficient growth of natural food sources (plankton).
- Provide fish feeds with complete diets to the fish. These are now available on market.
- Ensure that feed is obtained from trustworthy sources and is free of chemicals, fungal toxins, and pesticide residues.
- Use dry pellet feed, which is hygienic, nutritious, and low in bacteria. Dry pellet feed added with vitamins and minerals can further strengthen fish immunity.
- Where trash fish and wastes are used as supplementary feed, boil the raw material for at least 30 minutes where possible.

- Store the dry pellet feed properly, keep pellets in a cool, dry and covered place to prevent massive bacterial growth.
- Store trash fish properly. Pathogens may proliferate in improperly preserved trash fish. Such feed may introduce large quantities of pathogens to the water. Some pathogens can be eliminated by deep freezing. Never use trash fish that are not clean or fresh.

3.0 APPROPRIATE ANTIMICROBIAL USE PRACTICES

3.1 PURPOSE OF THE GUIDELINES

These antimicrobial use guidelines work in two main ways: first, they help create farm conditions that prevent or minimize the occurrence and spread of infections; second, they promote the effective and safe use of these drugs. Taken together, these two approaches broadly would minimize the selection of antimicrobial resistant bacteria in animals.

The underlying purpose is to conserve and sustain the effectiveness of available antimicrobial agents intended for use in animals so as to:

- Enable farmers to comply with the moral obligation and economical need to keep animals and fish healthy.
- Protect consumer health by ensuring the safety of food of animal origin.
- Prevent or reduce the transfer of resistant microbes within animal populations to maintain the efficacy of antimicrobial agents used in livestock.
- Prevent or reduce the transfer of resistant microbes or their resistance genes from animals to humans, so as to maintain the efficacy of antimicrobial agents used in human medicine.
- Prevent the contamination of animal-derived food with antimicrobial residues that may have a detrimental effect on human health.

3.2 GENERAL PRINCIPLES TO GUIDE DECISIONS ON THE USE OF ANTIMICROBIAL AGENTS IN ANIMALS

- Use of antimicrobial agents in veterinary medicine is guided by the law which outlines licensed persons who can trade in, prescribe, and/or administer these medicines. Only a qualified veterinary practitioner is authorized to prescribe their use.
- Antimicrobial agents used for therapy should be used for as long as needed, but for as short a duration as possible and using the appropriate dosage regimen.
- Label instructions as provided by the manufacturer should be carefully followed. Due attention must be paid to species and disease indications and contraindications, dosage regimens, and storage instructions. Extra-label use of the antimicrobial agent should be exceptional, and always under the professional responsibility of a veterinary practitioner.
- Records of all veterinary medicinal products administered to animals and those available on the farm should be kept in a retrievable form. Additionally, there should be an effective system of stock control.
- Use of vaccines and strict adherence to the proposed infection prevention measures are effective and have been proven as better alternatives to reduce or completely eliminate antimicrobial use in the animal sector.
- Antimicrobial agents should be used under supervision of a veterinary practitioner.
 - Therapeutic antimicrobials should be used when it is known or suspected that an infectious agent is present which will be susceptible to therapy.
 - It is the responsibility of the veterinary practitioner to choose the antimicrobial product based on his/her informed professional

judgement, balancing the risks and benefits for humans and animals.

- Antimicrobial agents should only be used when necessary and then selected rationally and used appropriately.
- When antimicrobials need to be used for therapy, bacteriological diagnosis with sensitivity testing should, whenever possible, be part of the informed professional judgement.

3.3 CONSULTATION WITH HEALTH PROFESSIONALS TO PROMOTE APPROPRIATE ANTIMICROBIAL USE

Only professionals trained to the level of a veterinary surgeon or higher have the requisite knowledge, expertise and experience to prescribe antimicrobial medicines.

Each case provides a different set of considerations as explained below.

1. Drug factors, such as dosage, dose, dosage interval, route of administration, duration of treatment, mechanism of action, combined use, adverse drug reactions.
2. Microbial infection factors, including objective evidence of infection, susceptibility of the causative organism(s), stage of infection, locality of infection, and microenvironment at the site of infection.
3. Animal factors, such as type, age, condition and sex of animal, disease condition, type of husbandry, and feeding of animals.
4. Animal farmer factors, such as agreement between farmer and veterinary practitioner on treatment policy, level of training, and experience of farmer.

3.4 KEY POINTS FOR FARMERS IN DIAGNOSIS OF COMMON CONDITIONS¹¹

In all animal species, “prevention is better than cure”.¹² However, sometimes animals become sick regardless of good prevention strategies and proper care. When this happens, early recognition and treatment is essential to protect animal welfare and promote the responsible use of medicines.

- Identify symptoms of sick fish, such as dead/dying fish, unusual behaviour, or physical signs.
1. If many fish show distress (gasping at the surface, gaping mouths) or die suddenly, the cause is usually stress due to
 - a. Rough or poor handling or transport;
 - b. Bad water quality because of low dissolved oxygen or presence of a toxic material.
 2. If only a few fish are dead while some show distress, or a few fish die over a period of several weeks and some show signs of distress, this could be due to:
 - a. Poor quality feeds and improper feeding;
 - b. Development of some disease organism.

In scenario 2:

- Closely observe the swimming behavior and feeding response of the fish.

¹¹ Food and Agriculture Organization of the United Nations. Management of freshwater fish culture. Cited 2020 June 27. Available from:

http://fao.org/fishery/static/FAO_Training/FAO_Training/General/x6709e/x6709e15.htm

¹² Federation of Veterinarians of Europe. Antimicrobial use in food-producing animals. 2016 February 29 [cited on 2020 June 27]. Available from:

https://www.ema.europa.eu/en/documents/report/annex-replies-efsa/ema-questions-use-antimicrobials-food-producing-animals-eu-possible-measures-reduce-antimicrobial_en.pdf

- Catch a few suspect fish with a net and look for visible signs of disease; you can use a magnifying glass if you have one.
- Call your veterinary practitioner or aquatic animal health expert if you are unsure of what to do.
- In case the veterinary practitioner wants to take samples of diseased, dead or even clinically healthy fish, allow him/her to do so.



Illustration: Laboratory technician examining samples under a microscope.

3.5 APPROPRIATE APPROACH TO TREATMENT¹³

- Do not delay in initiating therapy when it is needed as this can cause further health problems and may eventually lead to increased use of medicine.

¹³ RUMA. Responsible use of antimicrobials in fish production. 2007 [cited 2020 June 27]. Available from: <https://www.ruma.org.uk/fish/responsible-use-antimicrobials-fish-production>

- Do not start treatment with an antimicrobial unless it has been approved by a veterinary practitioner.
- Obtain clear instructions about the medication, dosage, and administration of medicine from your vet or the instruction leaflet.

3.5.1 OBTAINING VETERINARY MEDICINES



Illustration: A farmer receiving instructions on use of medicines from a trained veterinary practitioner.

- DO NOT use illegally obtained medicines on the farm since their safety and efficacy cannot be ascertained.
- Purchase all medicines from licensed outlets. (The license should be clearly displayed in the veterinary pharmacy or drug shop.)
- Do not buy medicines from persons who market medicines that you or your veterinary practitioner have not ordered for.
- Do not borrow or move medicines between farms.
- Check expiry date and ensure that medicines and other products are not expired before buying them for use on the farm.

3.5.2 ADMINISTRATION OF MEDICINES TO FISH

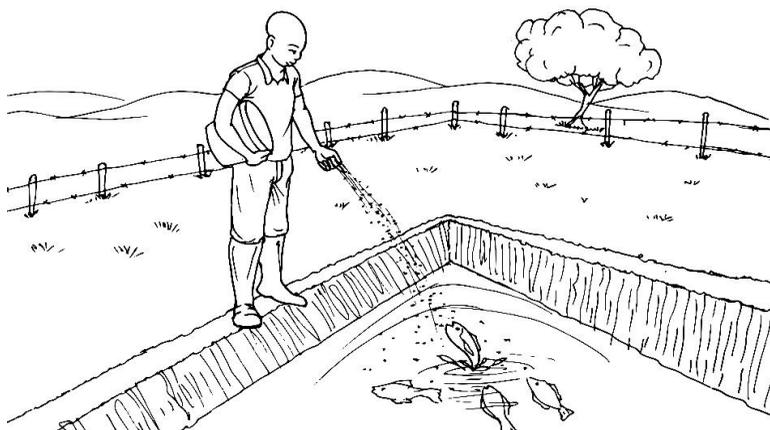


Illustration: A farmer administering medicines to fish in a fish pond.

- Pretest any unfamiliar product on healthy fish of the similar characteristics to diseased fish.
- Administer treatment either in the early morning or in the evening, when the temperature is as low as possible.
- Ensure that dissolved oxygen content remains sufficient during treatment.
- Follow the manufacturer's instruction or your veterinary practitioner's instruction.
- Ensure that the chemical for treatment is thoroughly mixed with the water mass being treated.
- Keep a close watch on fish during treatment so that you are able to identify any signs of distress such as coming to the water surface, gasping for air, erratic swimming, etc.
- If the fish develop distress during treatment, stop the treatment immediately and provide clean, well aerated water to the fish.

- Keep a close watch on the fish for 24 hours after treatment so as to identify any side effects.
- Repeat treatment after two to three days of ending treatment, only if it is absolutely necessary.

3.5.3 STORAGE OF VETERINARY MEDICINES

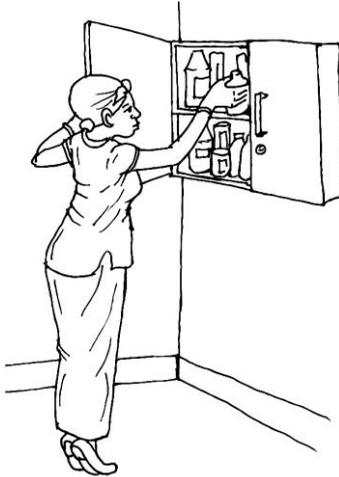


Illustration: A farmer picking medicine from the storage cabin on the farm's medicine store.

- Store medicines as indicated on the medicine label.
- Store medicines in a clean, cool, dry place.
- Store medicines away from direct sunlight, dust, animals, birds and insects.
- Store medicines that should be refrigerated at temperatures between 2 °C and 8 °C.
- Keep medicines locked away from the reach of children and unauthorized persons.

3.5.4 DISPOSAL OF UNUSED OR EXPIRED MEDICINES

- Dispose of unused, out-of-date medicines when the treatment for which they were intended is completed.
- Follow manufacturer's advice as written on medicine label.
- Return unused medicines to the prescribing veterinary practitioner or supplier for disposal.

3.6 WITHDRAWAL PERIODS

A withdrawal period is the minimum time required between the last treatment and the slaughter of fish for human consumption.

The withdrawal period ensures that the fish for human consumption do not contain harmful residues.

- Identify production systems (cages, tanks and ponds) of treated fish to ensure that withdrawal times are observed.
- Strictly adhere to the appropriate withdrawal period before catching treated fish for human consumption.
- The withdrawal period is usually indicated on the prescription, or on the label of the medicine, or may be given by the veterinary practitioner.
- Observe a withdrawal time of at least 500 degree-days (calculated by multiplying the water temperature in degree centigrade by number of days after the end of treatment)¹⁴

¹⁴ RUMA. Responsible use of antimicrobials in fish production. 2007 [cited 2020 June 27]. Available from: <https://www.ruma.org.uk/fish/responsible-use-antimicrobials-fish-production>

4.0 KEEPING RECORDS FOR ANIMALS AND VETERINARY MEDICAL PRODUCTS



Illustration: A farmer reviewing farm records.

- Keep a record of medicine use on the farm. You can use a durable book, files, or an electronic system.
- If using an electronic system, ensure that the information is backed up in a retrievable form (e.g. on an external hard drive).

4.1 FISH INFORMATION

- Information includes:
 - Disease information
 - Type and identity of fish (this also includes the specific ponds, tanks, and cages)
 - History of disease
 - Symptoms of disease
 - Diagnosis
 - Treatment given
 - Name of veterinary practitioner who treated fish

Example of fish farm register

Health Record	
Animal species	Date
Animal Name	Identity/No/Tag
Breed	Age
Case history	
Clinical exam	
Laboratory test	
Diagnosis	
Treatment/Vaccine given	
Withdrawal for each medicine	
Veterinarian	
Name	Contact
Signature	Date

4.2 RECORDS FOR VETERINARY MEDICINE USED IN FISH

- Upon purchase of a medicine, record:
 - Name of the prescribing veterinary surgeon
 - Name of veterinary medicine
 - Batch number
 - Date of expiry
 - Date of purchase
 - Quantity obtained
 - Name and address of the supplier

- At the time of administration, record:
 - Name of veterinary medicine
 - Name and identity of the animal
 - Date of administration
 - Quantity administered
 - Withdrawal period
 - Identity of the animal(s) treated

- In case you dispose of the medicine without using it, record:
 - Name of medicine
 - Date of disposal
 - Quantity of product
 - How veterinary medicinal product was disposed of
 - Where product was disposed of

- Ensure that all records are kept for at least five years.

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Notes
