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Technology Implementation Procedure Fasciolosis of Cattle and Buffaloes and Its Control Measures



Prepared by

The Department of Agricultural Extension
in association with The Department of Animal Health and Production

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Foreword

The Ministry of Agriculture, Forestry and Fisheries (MAFF) receives funds from the Australian Agency for International Development (AusAID) for the Cambodia Australia Agricultural Extension Project II (CAAEP II – 2001 – 2007). CAAEP has the goal of strengthening the national institutional and extension systems in Cambodia through improving agricultural extension staff's capacity and agricultural extension planning in line with the Royal Government of Cambodia Decentralization & Deconcentration policy. Tools to help this process are Commune Agro-ecosystems Analysis and Technology Implementation Procedures (TIP).

TIPs are produced by local Subject Matter Specialists (SMS) and have been reviewed, and endorsed by a committee of stakeholders called the TIP Oversight Committee and by the relevant MAFF technical department. TIP terms of reference call for a manual based on *local best practice* with respect to information, technology, extension methodology, implementing procedure and cost analysis. The manuals are for farm advisers from district agricultural offices (DAO) and other development workers in the provinces using and working directly to train and transfer these technologies to Cambodia's farmers and producers who will experience increased potential in their different geographic locations in accordance with the local needs and socio-economic conditions.

TIPs are very important manuals to help provincial and district agricultural staff overcome many problems facing Cambodian farmers who are struggling to deal with a rapidly changing agricultural environment of production and diversification while at the same time ensuring food security, improving family income and reducing poverty, in line with the rectangular strategic of the Royal Government of Cambodia.

The Ministry of Agriculture, Forestry and Fisheries fully supports this series of manuals. They are the main resources for provincial and district agricultural staff, NGOs, and other development agencies and stakeholders who will spread their contents widely among Cambodia's farmers who will intern obtain the fruitful outcomes they expect.

Signed and sealed by

H.E Dr. Chan Sarun, Minister

Ministry of Agriculture, Forestry and Fisheries

Unofficial translation

Preface

The term TIP stands for ‘Technology Implementation Procedure’. TIPs explain how to implement improved agricultural technologies that help to solve important problems faced by farmers. They comprise the entire package of information, procedures and materials necessary for an extension worker to pass on the technology to farmers.

The TIP concept has been developed to facilitate extension across communes, districts and provinces throughout Cambodia. TIPs are intended for use by extension workers, NGOs and others working in agricultural development at the field level. As such, TIPs must be :

- Flexible – so that they can be replicated anywhere in Cambodia
- Simple – so that they can be used by anyone working at the field level
- Comprehensive – so that they provide all necessary information

TIP development is prioritized based on key farmer problems identified from a variety of sources, most importantly the Department of Agricultural Extension’s (DAE) Farming Systems Management Information System (FSMIS) database which contains information on major farmer problems identified by Commune Agro-ecosystems Analysis (CAEA) implemented across Cambodia. TIP topics are obtained from a variety of sources including:

- National research institutes
- Existing extension programs
- Innovative farmers
- Donor projects
- NGOs
- Private sector
- International research agencies

TIPs are commissioned by MAFF’s DAE, and are prepared by experienced subject matter specialists who are leaders in their respective fields in Cambodia. TIPs thus represent ‘current best practice’ for implementing any improved technology. Draft TIPs undergo a peer review before they are endorsed by MAFF and approved for field use.



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Introduction

In Cambodia, cattle and buffalo play a very important role because they provide draught power for ploughing and harrowing, produce manure for fertilizer, and serve as an animal bank for conversion to cash when money is required urgently. Cattle and buffalo production is constrained by low productivity, morbidity and mortality rates due to diseases, especially fasciolosis. Even though fasciolosis causes huge losses among cattle and buffalo in Cambodia, study of the disease began as recently as 1990. From then until 2002, scientists have collected epidemiological data and have accumulated much information about fasciolosis, its seasonal nature and spread and its impact on cattle and buffalo economics. Thus fasciolosis control measures have been devised for the Cambodian situation.

The recommendations on control measures against cattle and buffalo fasciolosis are not yet adequate. Experts and specialists on fasciolosis have introduced recommendations for control in high risk areas. Farmers, animal owners and stakeholders have been exposed to the effects of the disease, the control measures, and the costs incurred and benefits obtained from undertaking control measures. Information obtained by researchers on cost effectiveness and efficacy of control of fasciolosis confirms that the TIP on fasciolosis is technically sound and can be applied in Cambodia.

The fasciolosis control measures in this TIP have been tested successfully. The TIP was reviewed by the TIP oversight committee (TIPOC) comprising specialists and experienced and qualified staff from concerned institutions at national and provincial levels. This TIP may be used with confidence for education, training and extension for the purpose of control and eradication of fasciolosis which is spreading in parts of the region and in Cambodia.

It is hoped that this TIP will reduce cattle and buffalo mortality and morbidity rates. It is expected that productivity will increase and as a result farm incomes will improve.

1. Description

Summary of the TIP on fasciolosis and its control measures

a. Issues addressed by the TIP:

Farmers & animal owners in some parts of the country have observed that their cattle are in poor condition, have diarrhoea, that their coats are ragged and dull, that they demonstrate low fertility and have long inter-calving intervals, have insufficient strength for draught and in some cases, their animals have died. Examination of livers at the slaughter house reveals that some are damaged and swollen. Cutting bile duct canals is like cutting sand and cirrhosis is seen in the livers. Bile ducts are enlarged, have a bad smell and sticky, dark yellowish coloured fluid within is accompanied by the presence of flat leaf-shaped worms with a length of between 3.5 and 7.5 cm. In general, the price of live cattle infected with *Fasciola* is less than for uninfected animals.

b. Goals:

According to studies conducted by the Department of Animal Health and Production with participation of the Department of Agricultural Extension, the Office of Animal Health and Production, Kandal province, and the Australian Centre for International Agricultural Research (ACIAR), the problems can be resolved. Technology in this TIP on fasciolosis is based on these studies. By using the TIP for fasciolosis spread of the disease will be halted, animals will regain health, fertility will be restored and animals will be sold for a better price.

c. Methods:

Education, training and extension programs on fasciolosis such as “school-on-air” have been used for farmers, animal owners and stakeholders. Programs covering epidemiology of the disease and mode of spread, impacts, costs and benefits for control and methods for fasciolosis control and its eradication have been developed and tested. The effective measures for fasciolosis control include biological measures, grazing management and drugs.

d. Benefits for farmers, animal owners:

The TIP on fasciolosis will assist farmers & animal owners to understand the impact of fasciolosis in terms of economic losses and the benefits obtained from control. In the regions where prevalence of fasciolosis is higher than 30 percent, cattle are affected thus,

- Weight: 41 kg lighter than non-infected cattle;
- Reproduction: 10 percent lower pregnancy rate than in non-infected females;
- Liver damage: 2.50 kg of damage to the liver;
- Draught: not enough strength for draught; and
- Product quality: lower in infected than in non-infected cattle.

Analysis of the cumulative cost of the three (3) major impacts of fasciolosis is estimated at 109.00USD/head for castrated cattle and 80.00 USD/head for female. If fasciolosis control measures are implemented, farmers may expect a benefit which will amount to 76.00 USD/head.

Technical Suitability Criteria

Conditions required to exist in order that the TIP on fasciolosis will provide the outcomes expected:

- **Gender:** Women are eligible for involvement in implementation of the TIP on fasciolosis, and have a special role in implementation of biological control. Women collect cattle & buffalo dung and store it in a trench. This dung should be kept for a specific time before using it as fertilizer in the field. In addition, women as money controllers could make a decision to spend money preferentially for treatment of animals against fasciolosis.
- **Climate/water:** Fasciolosis occurs in wet areas where water lies continuously through rainy and dry seasons. Hot and dry weather could minimize the spread of the disease due to the fact that the intermediate host of *Fasciola*, the mollusc *Lymnea*, could not spread very far. Most of the molluscs and the *Fasciola* larvae (metacercariae) may die from desiccation.
- **Geography:** Implementation of the TIP on fasciolosis could be conducted in all parts of Cambodia where fasciolosis is present.
- **Labour requirement:** Men, women and boys aged from 16 year old can be involved in the implementation of the TIP.
- **Farmer/animal owner resources requirement:** Farmers/animal owners require funds to construct dung trench roof and fence. Trench size for dung storage is 7-9 m² for three cattle. Locally available construction materials should be used. In addition, around 50 000 riels is required for treatment of fasciolosis, 50 000 riels being the maximum cost of drugs for treatment of the disease.
- **Number of cattle per family:** The relevance of the TIP does not depend on the number of cattle in the family. The TIP can be implemented whatever the number.

Other recommendations

The use of combined methods for control of fasciolosis is more effective than the selection any single methods. Moreover, prompt implementation of control of fasciolosis by farmers & animal owners who live in the same region or village could reduce the spread of the disease and later, achieve eradication of fasciolosis effectively and sustainably.

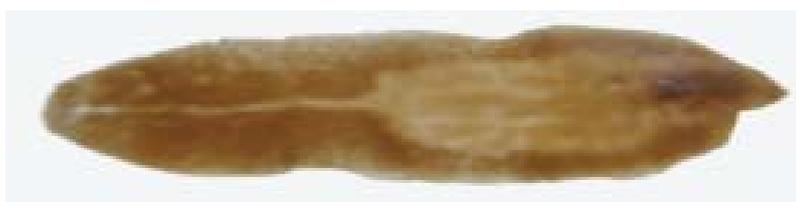
2. Technical guidelines

Fasciolosis of Cattle and Buffaloes and its Control Measures

Fasciolosis of cattle and buffaloes is caused by a trematode, family-Fasciolidea, genus-Fasciola. In Cambodia, the species *Fasciola gigantica* is found. Prevalence of fasciolosis in cattle and buffaloes is high in some parts of the provinces of Kandal, Prey Veng, Svay Rieng, Kampong Cham and Kampong Thom. Adult Fasciola live in bile ducts and gall bladders and young Fasciola locate in liver tissues. Effects of fasciolosis are seen in reduced weight gain, mortality, low and slow reproduction, liver damage, and lack of physical strength expressed as draught power.

2.1 Morphology

Fasciola gigantica-is leaf shaped, grayish-brown in color, and is 3.5-7.5 cm in length. The shoulder and tail are parallel and are 0.65-1.2 cm in width.



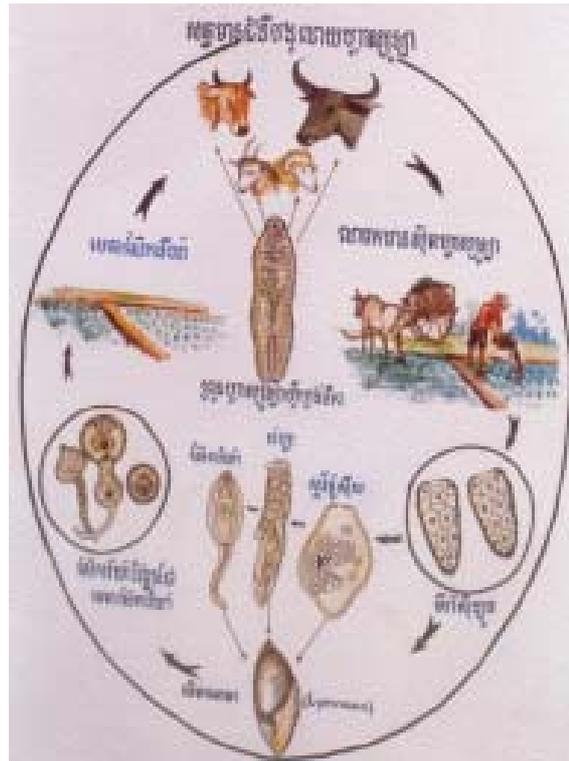
Fasciola gigantica

2.2 Life-cycle

Adult Fasciola lives in the bile ducts and gall bladder of the liver and young fluke lives in the liver tissues. The eggs of Fasciola enter the duodenum with the bile and leave the host in the faeces. The rate of development and the hatching of *F. gigantica* eggs depends on the surrounding environment's temperature, oxygen levels and humidity. At a temperature of 20-26 °C eggs hatch in about 10-12 days producing the first larval stage, the *miracidium*. At temperatures over 40 °C, eggs will die and in darkness, eggs develop well, though miracidia are not hatched out. A miracidium is about 0.15 mm in length, its head is covered with gland tissues for penetrating into the intermediate host snail and with cilia surrounding it is equipped for movement. In the outside environment, miracidia survive for 2-3 hours. In the event that miracidia do not penetrate into the intermediate host snail *Lymnea spp.*, they die. Following penetration, it casts off its ciliate covering and develops into the sporocysts, then rediae and cercariae. Development from miracidium to cercaria is 4-7 weeks. Cercariae leave the snail and within a few minutes to two hours the cercariae settle on blades of grass, water plants, rice stalks etc. just below water-level. Later, after casting off their tails, they secrete a covering from the cystogenous glands forming cysts at the surface of the water which sink to the bottom. The encysted cercaria is called a metacercaria which is now infective. Cattle and buffaloes became infected by ingesting grass, water plant, rice stalk, rice straw and etc. with metacercaria or swallow them in drinking water. In some cases, infection can occur from mother to the offspring via the placenta.

Following ingestion of the metacercariae into the intestine they become Fasciola larvae which migrate to liver through two routes:

- Larvae of Fasciola may migrate through the abdominal cavity and penetrate the liver capsule. They are later found moving through the liver parenchyma. Within three weeks, Fasciola larvae will reach the bile ducts;
- Excystation of larvae occurs in the duodenum through the bloodstream across the intestinal vein. They then proceed to the bile ducts of the liver. The development of larval Fasciola to adult Fasciola will take for 2,5-4 months. Fasciola may live for 3-5 years in an animal.



Life-cycle of Fasciola

Lymnea- intermediate host of Fasciola



Lymnea acuminata

The snail intermediate host of Fasciola is called Lymnea. Dr. Suon Sothoeun conducted a research study on the snail intermediate in Cambodia, collecting snail samples and sending them to the Institute of Zoology in the Ukraine for morphological study and taxonomy. Results of the study indicated that the mollusc which is the intermediate host of Fasciola is genus Lymnea, species acuminata. This snail is commonly found in clear, slow flowing water, with a pH range from 5.8-9.0. The snail size is 2.5-3.0 cm. The mollusc Lymnea likes to float on the water surface. At four (4) months the snail starts to lay eggs. Each laying can produce 12-96 eggs which are hatched after two (2) weeks. The hatching percentage is up to 100 percent. During the dry season, Lymnea will bury itself in the mud and survive for some months. Lymnea is common in all kinds of ponds be they natural ponds, man-made ponds or canals, drainage ditches, rice field paddy and in fallow fields.

2.3 Symptoms

Clinical signs are not distinct and are similar to other diseases. In severe cases, the most characteristic signs are:

- Diarrhoea, characterised by dark brown faeces spotting the rump of the animal. The faeces have an offensive odour;
- Dry, unkempt and dull coat;
- Reduced weight gain, wasted physical condition;
- Oedema of mucous membranes and accompanying pale colour;
- Oedema may be seen in the jaw and chest areas;
- Panting & breathlessness; animal foundering and in some cases, death.

2.4 Pathology

Lymphatic nodes of the liver are swollen, bile ducts are enlarged containing a foul smelling, sticky, dark yellowish coloured fluid in the presence of the fluke, Fasciola. Cutting bile duct canals gives an impression of cutting through sand and cirrhosis is evident in the liver. In cases where few flukes are present, there are few changes in the liver. However, with severe and chronic infection, it is noted that the liver is swollen and haemorrhaging. Autopsy of such livers reveals immature flukes, the small, white, round and leaf-shaped larvae of Fasciola, sized between 0.3 and 1.1 cm. At the same time, adult flukes may be found.

2.5 Diagnosis

Diagnosis is obtained from clinical symptoms, disease epidemiology, faecal examination for Fasciola eggs and from examination of the liver. Diagnosis could be made by serological tests however these serum tests are not available in Cambodia. Liver examination is conducted to detect Fasciola and to record changes in the liver.

a. Sample collection

The hand should be wrapped in a thin, soft plastic bag (preferably lubricated with paraffin) to take about 100g faeces directly from the anus. If a plastic glove is used, after taking the faecal sample from an animal the plastic glove must be washed or rinsed with water to wash away any eggs of Fasciola that might stick to the glove. Cleaning the glove is to prevent contamination of samples and passing of infection from one animal to another. Use of a plastic bag is easy, cheap and comfortable. After taking the faecal sample the plastic bag is

sealed and marked for identification. If faeces cannot be collected from the anus, the upper part of a dung pad could be sampled, again 100g, if it was passed by the animal not more than 24 hours prior to sampling.

b. Faecal sample preservation

For faeces preservation for submission to the laboratory, faeces have to be stored at not more than 10 °C in an ice box.

c. Sending faecal sample

Faecal samples should be sent to the laboratory as soon as possible. The sample should be accompanied by a form containing the following information:

- Name of the animal owner
- Address (village, commune, district and province)
- Date collection of sample
- Animal species
- Age of animal
- Animal identification.

2.6 Control measures and eradication

The three (3) measures provided below could control and eradicate fasciolosis successfully and sustainably. These measures which have been implemented in Cambodia, are drawn from the results of the research study on epidemiology of fasciolosis; on animal husbandry management practices; their appropriateness to the situations of Cambodian farmers and the experiences of farmers. It is true that for the control and eradication of fasciolosis there are other methods which could be used. However, it is contended that they could not be used effectively and sustainably in Cambodia in comparison to these selected methods. The control measures and eradication recommendations are as follows:

- a. Biological control: collection and storage of cattle and buffalo faeces in a trench;
- b. Cattle/buffalo grazing management;
- c. Treatment/control: use of drugs and schedule for drug use.

a. Biological control

Collection and storage of cattle and buffalo faeces in a trench reduces the spread of fasciolosis. Fasciola eggs leave the infected host or sick animal in the faeces. After storage for two months the Fasciola eggs will have succumbed to high temperatures prevailing in the trench. The trench should be located away from run-off water, above the water table and away from animal access.

Size of trench

- Length: 3.50 m
- Width: 2.50 m
- Depth: 1.50 m

Roof and fence for the trench:

The trench requires proper roof and fence to protect dung from rain and sun light which will cause it to lose value as a fertilizer. In addition, the trench should be fenced for human and animal safety and to prevent loss of dung. The roof is made of local materials.



Trench for dung storage

Dung shelter

Duration of dung storage

Dung is stored in the trench for two months before using it as a fertilizer. During this period, Fasciola eggs in the faeces will die at temperatures of around 60 °C in the dung mass.

b. Cattle & buffalo grazing management and feeding

Grazing management

- Dry season rice area: cattle and buffalo may become infected in the dry season rice field by ingestion of metacercariae with water, grasses, water plants or rice stalks in drainage ditches or in rice fields. Infection occurs from January to April. Infection can be circumvented by grazing animals away from these areas in the January to April period.
- Orchards: cattle and buffalo may similarly be infected in orchards by ingestion of metacercariae in water and from grasses, water plants, man-made ponds or drainage ditches. Infection occurs from September to December. For the prevention of infection, cattle & buffalo should graze in other places during this period.
- Household area: cattle & buffalo could be infected in the household area again by ingestion of metacercariae with water, grasses, water plants, man-made ponds or drainage ditches. Infection occurs from September to April. For the prevention of the infection, cattle & buffalo should graze in other places during this period.

Watering

Underground water from wells or water from a river should be used for cattle or buffalo to avoid the possible fasciolosis infection.

Feeding

Feeding cattle & buffalo should be avoided from places where infection is likely and as described above under *grazing management*. Grass should be cut about 5 cm above water level because metacercariae encyst on these plants close to the water surface.

c. Treatment/control: use of drugs and schedule for drug use

The drugs listed below are for the treatment and control of fasciolosis in cattle and buffalo to reduce prevalence, mortality and morbidity rates, improve animal health, improve strength and enhance reproductivity.

- 1 Triclabendazole/Fasinex. Australian.
- Genesis Pour On. Australian.
- Albendazole/Farmbazan. French.
- Dovenix-25%; Nitroxinile. French.



Fasinex

Farmbazan



Genesis Pour On

Dovenix

Schedule for drug use

These four drugs are highly effective for the treatment and control of cattle and buffalo fasciolosis. While they are effective, the timing their use is equally as important as their efficacy. The best time for treatment for control of fasciolosis is when it is assessed that animals might be free from infection as the occurrence of fasciolosis is seasonal. Thus the recommended schedule for drug use is as follows:

- Triclabendazole/Fasinex: use once/year in May;
- Genesis Pour On: use once/year in May;
- Albendazole/Farmbazan: use twice/year:
 - First time: May
 - Second time: July
- Dovenix-25%; Nitroxinile: use twice/year:
 - First time: May
 - Second time: July

2.7 Economic benefits

2.7.1 Impact

Fasciolosis has considerable impact on national economy as young animals can die, suffer reduced weight gain, become physically weak and have reduced reproductive rate, have low productivity and low quality of product demonstrated by reduction of protein, fatty acids and mineral content in meat and liver. In addition, there is discharge from the liver due to liver damage..

In places where the prevalence of fasciolosis is higher than 30 percent, specific effects of the disease are:

- Reduced weight gain: female cow-21.3 kg/head and male-41.0 kg/head
- Reproduction: 10 percent lower pregnancy rate than in non-infected females
- Liver damage: 2.5 kg of damaged organ in each liver
- Weakness: insufficient strength for draught. The strength is reduced by about 40 percent
- Quality of product: reduced nutritional value in meat and liver and the water content of these products is high
- Some animal die
- Sale price of live infected animals is low.

2.7.2 Costs and benefits for control

Research work on fasciolosis in Cambodia has been conducted by an expert and specialists from the Department of Animal Health and Production and has involved staff of the Department of Agricultural Extension, officers of the Offices of Animal Health and Production of Kampong Cham and Kandal together with staff of the Saang District Agricultural Office. The fasciolosis study measures the costs and benefits of the control program. Based on this pioneering work the technology implementation procedure (TIP) on fasciolosis could be used as a model for the fasciolosis control program in other places where it is a threat. Below are the costs and benefits of the fasciolosis control program.

a. Costs of control by farmers

- Trench with roof for dung storage-60 000 riels (20 000-60 000 riels). The trench could be used at least for two years. In this case the cost is 30 000 riels (a range of 10 000-30 000 riels).
- Drug/control-20 000 riels (a range of 10 000-20 000 riels)/head/year.
- Total costs: 50 000 riels (a range of 20 000 riels-35 000 riels)/year/head

Costs and benefits for fasciolosis control (animal/year)

Effect	Gain per cow/Y	Minimum cost	Maximum cost	Average cost
Female				
Weight	21.3 Kg/head	170 -400 riels	213 000 riels	191 700 riels
Pregnancy	10 %	60 000 riels	80 000 riels	70 000 riels
Liver for sale	2.5 Kg	15 000 riels	25 000 riels	20 000 riels
	Total	245 400 riels	318 000 riels	281 700 riels
Male				
Weight	41.0 Kg/head	328 000 riels	410 000 riels	369 000 riels
Liver for sale	2.5 Kg	15 000 riels	25 000 riels	20 000 riels
Strength	40 %	-	-	-
	Total	343 000 riels	435 000 riels	389 000 riels
Control costs				
Dung shelter		10 000 riels	30 000 riels	20 000 riels
Drug		10 000 riels	20 000 riels	15 000 riels
	Total	20 000 riels	50 000 riels	35 000 riels
Benefits				
Female		225 400 riels	268 000 riels	246 700 riels
Male		323 000 riels	385 000 riels	354 000 riels
	Average	274 200 riels	326 500 riels	300 350 riels

- Note:** ■ Average price of calf sold after two years divided by number of years of investment.
- Male of two years old: 1 200 000 riels; one year old: 600 000 riels
 - Female of two years old: 1 600 000 riels; one year old: 800 000 riels
 - Price of live cow per Kg: 8 000 riels-10 000 riels; average: 9 000 riels
 - Liver per Kg: 6 000 riels-10 000 riels; average: 8 000 riels
 - Liver damage per animal: 2.5 Kg/liver

b. Benefits

Female

- Average benefits: 246 700 riels/head/year (225 400-268 000 riels)

Male

- Average benefits: 354 000 riels/head/year (323 000-385 000 riels)

Average benefits from fasciolosis control

- Average benefits: 300 350 riels/head/year (274 200 riels-326 500 riels)

2.7.3 Environmental effects

Technology introduced for the implementation in this program “fasciolosis in cattle and buffalo and its control measures”, especially the introduction of the biological control measure improves hygiene at household level. The health of the farm family is protected by placing a control on a source of possible infection. An added benefit is that farmers will have manure in greater quantity and it will be of better quality. Farm incomes are accordingly raised and living standards positively impacted.

3. Extension guidelines

3.1 Objectives

Extension on the control and eradication of cattle and buffalo fasciolosis has the following objectives:

- To improve understanding and knowledge of fasciolosis (epidemiology, mode of spread) and its control measures among staff of the Department of Animal Health and Production and staff of the Offices of Animal Health and Production. They must have the capacity and capability to teach other stakeholders, especially farmers about control and eradication of fasciolosis;
- To improve knowledge and understanding of fasciolosis (epidemiology, mode of spread) and its control measures among extension workers and village livestock agents so that they have the capacity to conduct extension work for stakeholders, and farmers as well as deepening their own knowledge of treatment and control of the disease;
- To put in place among animal owners & farmers and stakeholders a good working knowledge and understanding of fasciolosis (epidemiology, mode of spread) and its control measures;
- To establish among staff of the Department of Animal Health and Production, staff of the Offices of Animal Health and Production, extension workers, village livestock agents, animal owners-farmers and stakeholders a good working knowledge of costs and benefits associated with fasciolosis control.

3.2 Extension methodology

Extension methods:

- Awareness of fasciolosis is obtained by the program “school-on-air” to stakeholders, animal owners and farmers. The extension & training activity is in three modules, each module lasting for two days. Each module starts three months after the previous one. It includes theory and practice, game play and responding to questions.
- Meetings with farmers and stakeholders. Farmers and stakeholders’ are interviewed on fasciolosis and its control measures, and their attitude for the fasciolosis control program is assessed.
- Pilot demonstration and display of posters and written extension material.
- Distribution of extension materials.
- Extension via television and radio.

3.3 Site selection

The site(s) being selected for the implementation of TIP on fasciolosis are those areas where prevalence of fasciolosis is higher than 30 percent.

3.4 Farmers/stakeholders selection

Participants to be selected as recipients of training, education and extension should meet the following criteria:

- Those who have cattle & buffalo in an area where fasciolosis is a risk.
- Aged from 16 to 55 years.
- Has a duty to take care of cattle & buffalo and be responsible for their feeding.

Local authorities such as commune and village leaders are invited to participate in the education and extension training courses.

The recommended size of the group of farmers and stakeholders for training is 30. The group is divided into six groups of five for discussion, to play the games and do the presentations which will test that they have fully understood the theory provided during the course. Practical work, games and presentations during the course are specific to each course.

3.5 Equipment and extension materials

Equipment and extension materials for training, education and extension activities comprise leaflets on fasciolosis, posters, banners, radio spots and teaching materials.. Teaching materials are drawings, pictures, fresh, and dried and preserved specimens of the snail identified as the mollusc *Lymnea*, the intermediate host of *Fasciola*. They include different kinds of drugs for treatment of fasciolosis, antibiotics and vitamins, a chart life-cycle of *Fasciola gigantica* and pictures of domesticated animals to demonstrate aspects of the training. Teaching materials also include flip charts and kits for group presentations from plenary sessions and discussions.



Leaflet and signboard on fasciolosis



Banner



Mollusk Lymnaea



Triclabendazole/Fasinex



Genesis Ultra



Dovenix-25%/Nitroxinile



Farmbazan



Genta-Tylosin



Septotryl 24%



Drugs for participants' selection



Pictures display for participants' playing games

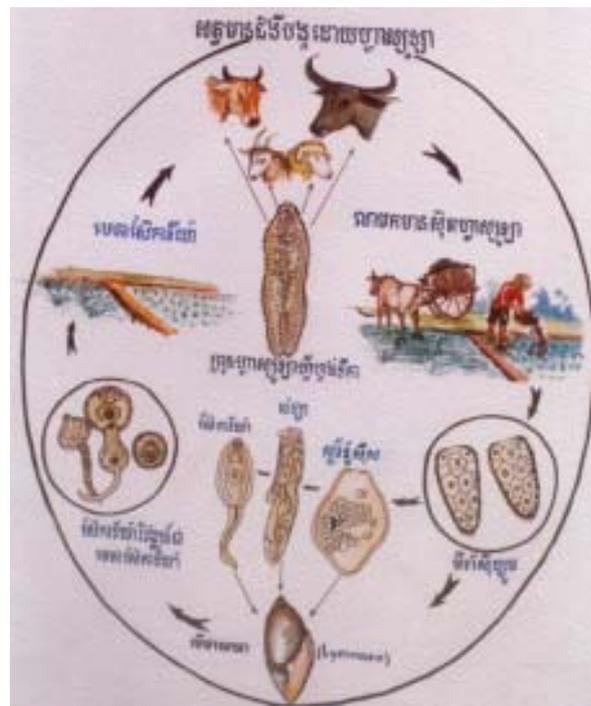


Chart life-cycle for fasciolosis

3.6 Education, Training and extension

The training, education and extension program for the farmers and stakeholders on fasciolosis and its control measures consists of three modules:

Module I

This module, participants are introduced to facts about fasciolosis:

a. Theory

- Morphology of Fasciola
- Life-cycle of fasciolosis, the relationship between susceptible animals and intermediate host of Fasciola mollusk Lymnea, how the disease is spread and infection occurs,
- Symptoms,
- Fasciolosis effects.
- Treatment and prevention.

b. Practices and playing games

Game 1: What are the susceptible animals for fasciolosis? 45 minutes.

- Individual participants select animal pictures which s/he thinks is of an animal susceptible to fasciolosis (different animal species are displayed for selection).
- Participants report to the groups explaining why s/he came to the conclusion that the animal is susceptible.
- The trainer provides an explanation of the correctness or otherwise of the answers.

Game 2: Which snail/mollusc is the intermediate host of Fasciola? What is the name of the snail/mollusc? Where is its habitat? 45 minutes.

- Individual participants select the snail species s/he thinks is the intermediate host of Fasciola. Different snail/mollusc species collected from the field are displayed for participants' selection. The exhibits could be live or dried & preserved snails or sometimes pictures of snails. The participant inspects the exhibits and draws his/her conclusions.
- Participants report their conclusions to the groups and explain how he or she reached that conclusion. Participants report to the group about the characteristics of the snail's habitat.
- The trainer confirms participant responses and provides further information.

Game 3: Matching the pictures from stages of the life-cycle of Fasciola. 45 minutes.

- Participants are asked to match pictures of the life-cycle of *Fasciola gigantica*.
- Pictures are cut separately: provided are pictures of cattle & buffalo; dung; miracidium, sporocysts, rediae, cercariae, metacercariae, snail/mollusk Lymnea etc.
- The trainers provide comment to the group on participant responses and provide additional explanations.

Module 2

In this module participants are taken through aspects of control of fasciolosis

a. Theory

- Revision module 1
- Information about fasciolosis control measures:
 - Biological control: collection and storage cattle/buffalo dung in a trench
 - Grazing management: safe & unsafe grazing zones, disease occurrence, grazing management
 - Use of anthelmintics

Game 1: To avoid infection with fasciolosis, where should animals be grazed? Draw on the map, zone(s) of fasciolosis risk and indicate periods when infection might occur. 45 minutes.

- Participant draws on the map, marking zone(s) of fasciolosis risk and indicates the time of high infection risk.
- S/he reports to the group
- The trainer confirms accuracy of participant answers and provides additional explanations.

Game 2: By which method could one expect to reduce the spread of Fasciola infection, by storing cattle/buffalo dung in a trench or by leaving it uncollected?

- Participant select picture(s), prepared for the game and
- Report to the group about his or her decision
- The trainer comments to the group on the answers and provides additional explanations.

Game 3: Which drug(s) can be used for treatment & control of fasciolosis? 45 minutes.

- Different kinds of drug as presented in the veterinary pharmacy in manufacturers' containers including drugs against fasciolosis, vitamins, and antibiotics are displayed for participant selection.
- Participants select any drugs they think could be used for treatment of fasciolosis. S/he explains to the group his/ her choice.
- The trainer confirms or denies participant answers and provides additional explanations.

Game 4: Schedules for drug use against fasciolosis. 45 minutes.

- Participants select drugs for treatment against fasciolosis and report to the group the timing of the schedule for treatment.
- The trainer confirms or denies responses from the group and provides additional explanations.

Module 3

In the third module, training on the control measures against fasciolosis and eradication of the disease is reinforced:

a. Theory

- Revision of the effects of fasciolosis

- Control measures against fasciolosis and eradication of the disease:
 - Biological control: collection and storage cattle/buffalo dung in a trench
 - Grazing management: safe and unsafe grazing zones, disease occurrence, grazing management to avoid infection
 - Use of anthelmintics: use of drugs and time/schedule for drugs use.

b. Practices and playing games

Question 1: What are impacts, caused by fasciolosis?

- Participants work in small groups. A representative from each group responds to the question.
- The trainer confirms or rejects participant answers and provides additional explanations.

Question 2: How many methods are there for control and prevention of fasciolosis?

- Participants work in small groups. A representative from each group responds to the question.
- The trainer confirms or rejects participant answers and provides additional explanations.

Question 3: What measures have to be taken to avoid fasciolosis infection?

- Participants work in small groups. A representative from each group responds to the question.
- The trainer confirms or rejects participant answers and provides additional explanations.

3.7 Monitoring and evaluation

Farmers, animal owners and stakeholders are taught about fasciolosis and its control measures. Education and training consists of three modules for implementation over six months. Extension staff have a responsibility to conduct evaluation of results. A recommended procedure for monitoring and evaluation of the extension program is as follows:

- Conduct meetings with farmers, animal owners and stakeholders to explain and inform them of the importance of the fasciolosis program and obtain commitment by stimulating their interest;
- Prior to implementation of the program, conduct a survey of farmers', animal owners' and stakeholders' knowledge and understanding of fasciolosis and its control program, especially concerning changes in animal productivity. Some 10-15 percent of farmers/animal owners/stakeholders from the target area should be selected for the survey and interview. The survey should be conducted both halves of one year so that animal performance in the main seasons can be assessed;
- Implement the planned extension program on fasciolosis
- After the extension activity monitor the target group every three months. Collect information from them on outcomes including any changes in their attitudes to control of fasciolosis;
- Continue to monitor the results of program beyond the first three months. The introduction of control measures takes not fewer than nine months. And the animal production response will take longer.

3.8 Work plan and budget

This TIP on fasciolosis and its control measures could be applied any time of the year without limitation however, considering the training and extension course should be organised to be at the most convenient time for farmers.

The work plan and budget for the TIP on fasciolosis is as follows:

Costs for fasciolosis control/head/year

Activity/Control methods	Cost/Head/Year/Range	Total (average)
Drugs	20 000 riels (10 000-20 000)	20 000 riels
Extension materials	12 000 riels (8 000-12 000)	12 000 riels
Education, training, extension to farmers, animal owners, stakeholders	20 000 riels (10 000-20 000)	20 000 riels
Dung storage house	30 000 riels (10 000-30 000)	30 000 riels
Meetings with farmers, animal owners, stakeholders	16 000 riels (8 000-16 000)	16 000 riels
Training extension staff	12 000 riels (8 000-12 000)	12 000 riels
	110 000 riels (59 000-110 000)	110 000 riels

Expenses for the TIP on fasciolosis is 110 000 riels (59 000-110 000 riels) for one animal for one year. The total costs included:

- Farmer, animal owner will spend 50 000 riels (20 000-50 000) for drug against fasciolosis and dung storage shelter;
- The program will spend 60 000 riels (39 000-60 000) for costs of meetings, education, training and extension, survey, monitoring and evaluation.

Work plan and budget for implementation of TIP on fasciolosis and its control measures (12 months)

Activity	Unit	Quantity	Unit price	Total
Extension materials	-	-	-	720 000 riels
Education, training, extension to farmers, animal owners, stakeholders	Time	3	400 000 riels	1 200 000 riels
Meetings with farmers, animal owners, stakeholders, survey, monitoring and evaluation:				960 000 riels
• Meetings with farmers, stakeholders	Time	3	200 000 riels	600 000 riels
• Survey	Time	3	60 000 riels	180 000 riels
• Monitoring and evaluation	Time	3	60 000 riels	180 000 riels
Training extension staff				720 000 riels
Total				3 600 000 riels

3.9 Resources materials

A DAHP researcher has conducted a study of fasciolosis and its control since 1990. After 1998, the researcher and others from the Department of Animal Health and Production have continued the fasciolosis research study with project support from the Australian Centre for International Agricultural Research (ACIAR). The relevant research studies on fasciolosis are as follows:

- Control of Fasciolosis in Cattle and Buffalo in Cambodia, Indonesia and the Philippines; ACIAR, AS1/96/160;
- Development of a Model for the Control of Fasciolosis in Cattle and Buffaloes in the Kingdom of Cambodia; ACIAR/2002/099.

These projects produced fasciolosis reports, research and laboratory protocols, and survey and research study formats. The projects also produced extension materials such as leaflets, posters, banners, radio spots, and TV spots and other education and training materials.

All information on fasciolosis can be found at the Department of Animal Health and Production.

**THE CALENDER OF TREATMENT, ANIMAL GRAZING MANAGEMENT AND FEEDING
FOR THE CONTROL OF FASCIOSIS IN CATTLE IN SAANG DISTRICT KANDAL PROVINCE**

The control method	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun	July	Aug.
Infected period												
Infected place												
1. Dry season rice field								Dry season rice area				
2. Chamcar												
3. Household												
4. Treatment:												
Triclabendasole (12mg./kg. body weight)									*			
Albendasole (15mg./Kg. body weight)									*		*	
Dovenix (10mg./Kg. body weight)									*		*	

Notice :

1. Dry season rice area: Grass, rice stem (after harvest) and water with metaceccaria were sources of infection
2. Chamcar area: Grass, water from man made ponds and canals for water stock with metaceccaria were main sources of infection
3. Household area: Drinking water from man made ponds and canals and grass with metaceccaria were main sources of infection
4. * : Treatment month

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