

## A T(R)ICKY PROBLEM SOLVED

Livestock represent a valuable resource for poor farmers throughout Asia, as a source of draft power, through the sale of young animals and for food security.

Animal diseases are a constant threat to the health of livestock.

Developing improved testing, monitoring and controls for animal health is the focus of a number of ACIAR-supported projects.

### PROJECT:

AS2/2000/098 Bovine babesiosis and anaplasmosis in the Philippines: developing a research and diagnostic capability

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**S**olving the mystery of what tick-borne diseases of cattle are present in the Philippines and their impact on the country's 2.4 million cattle has been the subject of investigations by researchers from that country and Australia.

In the Philippines, as elsewhere, ticks can be a nuisance. But the real problem is the diseases they can transmit with a single bite. In susceptible cattle, tick-borne diseases can cause dramatic losses in productivity and frequently death.

The impact of tick-borne diseases in the Philippines has not been as severe as elsewhere due to the inherent resistance of local breeds. That situation could change rapidly as the Philippine government embarks on a program to build more profitable beef and dairy industries through importation of better breeding stock.

But knowing where the diseases are present and how prevalent they are, especially when acute symptoms are rare in local cattle, is difficult. Developing the capacity for accurate testing and diagnosis is an urgent priority to support this expansion.

Helping speed up this process has been the focus of ACIAR-supported research by the Queensland Department of Primary Industries and Fisheries and the Bureau of Animal Health in the Philippines.

Prior to this research the types of tick-borne diseases, their distribution and prevalence were not known. The two diseases of major concern to Philippine authorities are babesiosis and anaplasmosis, collectively known as tick fever.

By introducing appropriate testing, survey methodologies and training of local researchers to the Philippines, these unknowns have all been addressed.

Centres of expertise in the diagnosis and

control of tick fever have been developed in the key laboratories in Manila and Davao that service the major cattle producing and cattle importing areas in the north and south of the Philippines.

These laboratories are now recognised reference centres for the rest of the country and models for establishing similar expertise in Regional Animal Disease Diagnostic Laboratories (RADDL) throughout the Philippines.

The completion of serological surveys has established that both diseases occur throughout the country. Serological tests for babesiosis and anaplasmosis are now in routine use in the Philippines, and DNA-based tests capable of differentiating between Australian and Philippine disease strains have been developed.

These research outcomes are vital in the ongoing development of a more substantial livestock industry in the Philippines, an important Government initiative that stands to benefit smallholder farmers particularly.

The greater the profitability of livestock industries, both through diversification such as into dairy cattle, and through healthier more productive cattle, the greater the opportunities for smallholders to reap increased returns.

The project has also contributed to the smooth operation of the live cattle trade between Australia and the Philippines, an outcome that is already paying dividends.

The project has shown that the introduction of Australian strains of *Babesia* and *Anaplasma* in imported cattle is not a problem, as the same parasites are already present throughout the Philippines.

The result should be an improved trading relationship between Australia and the Philippines with less likelihood of trade disputes as a result of tick fever outbreaks in imported cattle.

**Improved returns:** projects benefit smallholders in the Philippines.

**Photo: ACIAR**

# BID TO BEAT PARASITE GOES TO THE FARM



**C**ontrol of one of South-East Asia's most pervasive livestock diseases, fasciolosis, is about to enter a new phase as researchers begin to wrestle with the issue of translating science into new stock management practices on-farm.

Studies in Indonesia, the Philippines and Cambodia in recent years have brought the mystery condition in from the dark, in terms of understanding its epidemiology, but scientists say the next phase of the project – control and farm management – may be the biggest challenge.

Research has revealed that more than 50 percent of cattle and buffaloes are infected with the fasciolosis parasite, and the symptoms – weight loss, diarrhoea and animals becoming too weak to work, to the point that some die – have been prevalent for so long that farmers will be hard to convince that there is an answer.

In Cambodia, the research into the epidemiology as well as the coming work on developing effective extension services has been led by Dr Suon Sothoeun, who is now deputy director of the Department of Animal Health and Production (DAHP).

Fasciolosis was the subject of Dr Sothoeun's PhD in 1990, and it was a meeting four years later with ACIAR's research program manager, Dr John Copland, and Dr Bruce Copeman from James Cook University that led to Cambodia's involvement in the 1998-2002 project to fully establish the disease's epidemiology.

Dr Sothoeun says fasciolosis is caused by the parasitic liver fluke *Fasciola gigantica* and has now been shown to be the most important parasitic disease of cattle and buffalo in the humid wet tropics.

Aside from making animals too weak to pull a plough, he says infected animals suffer serious liver damage and also

become less fertile. "The average liver weighs six kilograms. The liver of an animal with fasciolosis weighs just 3.7 kilograms on average, so you can see the extent of the damage. In fact, to explain to farmers that it was a disease caused by a parasite we started showing them livers from the abattoir. We've sometimes found over 700 flukes in a single liver."

Dr Sothoeun says four years were spent building up scientists' knowledge of the epidemiology – when the animals are infected, where they are infected and how they are infected. "We learned that infections occur in specific months – from November to April-May, and there are no infections from June to October."

The initial four-year study produced several recommendations based on the following findings:

- a high prevalence (more than 50 percent);
- November to April-May being the infection period;
- the practice by farmers to sell and replace infected animals as a way of trying to stay ahead of the mystery disease;
- the significant liver damage; and
- a 50 percent drop in fertility rates. Instead of producing an offspring every year, inter-cowling among infected animals stretched out to 24 to 25 months.

These factors have led to new livestock management recommendations that now have to be incorporated into effective extension and education programs.

Dr Sothoeun says this will need further research, but in the meantime researchers have developed a proposed control calendar. The calendar is based on the knowledge that infection peaks in April and is slightly different in three distinct categories of grazing:

- grazing out in the fields;

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# SUCCESS WILL BE NO FLUKE

By JANET LAWRENCE

A “fluke” can be a lucky accident or coincidence. Another Oxford Dictionary definition of fluke is “any parasitic flatworm of the Class Digenea or Monogenea, including liver flukes and blood flukes”.

For the team of scientists dedicated to the study of the large parasitic flatworm *Fasciola gigantica*, success has been no lucky accident. It has come from years of dedicated, painstaking investigation to uncover the life cycle of this parasite and to determine ways to control the disease fasciolosis that results from its invasion of cattle and buffalo in the wet tropics.

Fasciolosis causes huge losses in animal production. The scientists involved in early ACIAR research in Indonesia in the mid-1980s examined the effect of the condition on the work output of large ruminants in Indonesia. They concluded that its presence caused up to \$A100 million annual loss in production.

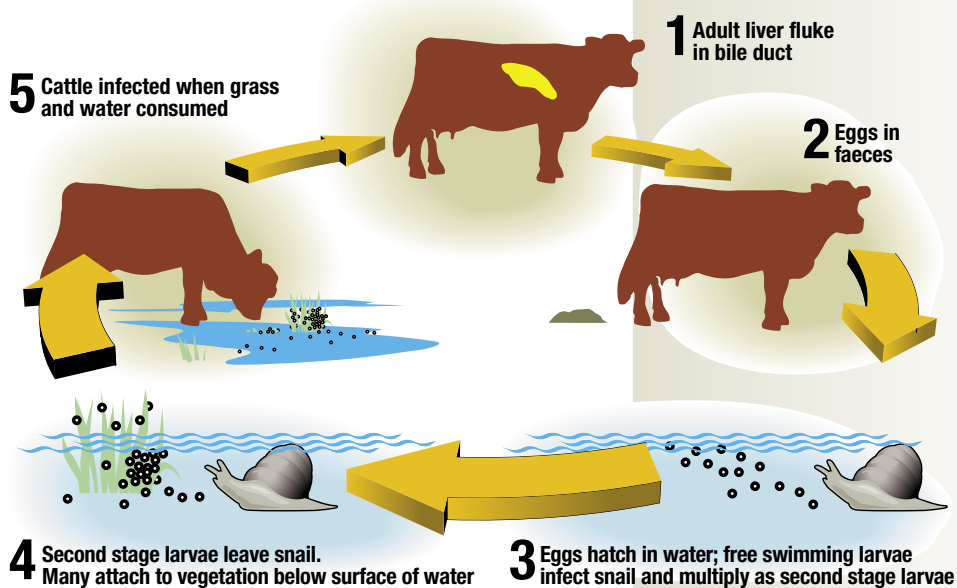
Infected animals are anaemic and, compared to healthy counterparts, are slow growing and achieve a lower final weight and size. As well as lowering meat and milk production, such animals produce fewer calves. They also have reduced working capacity, which is especially significant in countries where farmers rely on cattle and buffalo to cultivate the land. But when a disease is so common and unspectacular, farmers have a certain resignation about it and the poor condition of animals is considered normal.

Indonesian and Australian scientists were looking for ways to lift farm productivity and improve the lot of the smallholder, and recognised that reducing the effects of fasciolosis would have major benefits. They set out to unravel the life cycle of the fluke, which spends its adult life in the body of the animal and an intermediate phase in a water snail. This early work was reported by Robert Lehane in *Partners* No. 11 in 1998 (see chart, right).

The team, led by Dr Bruce Copeman from James Cook University and Dr Suhardono of Indonesia’s Research Institute for Veterinary Science, discovered that the main source of infection for animals was recently harvested rice fields when the animals graze on the stubble.

They recognised that village rice farming provides the ideal environment for proliferation of tropical liver fluke, with a strong link between the cycle of infection and the agricultural and husbandry practices of the smallholders.

Their studies produced two promising outcomes. The first was the determination that a single dose of the medication triclabendazole dispensed to animals in July completely eliminated *Fasciola* eggs from their faeces for at



least nine months. Such a straightforward treatment could have a major impact on transmission of the parasite.

The second line of research revealed that the immature phases of *Echinostoma revolutum*, a fluke that commonly infects village ducks and chickens, could aggressively displace *Fasciola gigantica* in the intermediate host snail when the two were present together. The scientists recognised the potential for an inexpensive, practical control procedure.

The knowledge gained from the Indonesian work gave new hope for control of the problem in Indonesia and other South-East Asian countries. In July 1998 a four-year ACIAR project commenced, focusing on Indonesia, the Philippines and Cambodia. The project’s main purpose was to extend the work of the earlier project, developing suitable, cost-effective strategies for the control of the parasites, and combating the problem on a regional rather than country-specific basis.

In the new project, the scientists extended their study to measure benefits of control of fasciolosis. Extension to promote control of fasciolosis was also an important component of the project.

Abattoir surveys in Cambodia and the Philippines produced basic biological statistics about seasonal and regional prevalence, parasite load and host conditions. Problems associated with biological control using ducks were investigated.

Scientists had discovered that a second parasite infecting the ducks, a blood parasite called a schistosome, had a free-living stage in the water that burrowed into human skin, causing an itchy, unpleasant dermatitis – a major deterrent in the campaign to encourage farmers to keep ducks! The solution was to use village chickens instead of ducks.

The overall output of the project was to demonstrate that the application of a scientifically-based fasciolosis control program can alleviate poverty through increased animal production.

The initial impact of the research was restricted to the sites where the research took place, but animal owners who participated in the research learnt how to

## LIFE CYCLE OF *FASCIOLA GIGANTICA*

The tropical liver fluke’s life cycle begins when worms lodged in the bile duct of an infected animal produce eggs that pass out in the faeces.

The eggs hatch in water, producing free-swimming larvae that proceed to infect water snails. About six weeks later the snails deposit the larvae (cercariae) in the water of a rice field and the larvae become small cysts (known as metacercariae). These float in the water, sink into the mud or attach themselves to the stalks of the rice plants below water level. Livestock are infected when they eat the vegetation or drink the water.

## ANIMAL HEALTH

- increase the income they derived from animal production.

The scientists developed options for fasciolosis control that required minimal use of anthelmintic medications. The control program is based on the following five elements:

1. prevent animals grazing in rice fields adjacent to a village or cattle pen for up to a month after harvest, to reduce their risk of ingesting the infective metacercariae;
2. feed only the top two-thirds of freshly cut rice stalks, cut 20 to 30 centimetres above ground level, to avoid feeding the metacercariae;
3. kill metacercariae on the lower third of the rice stalks by exposing them to sunlight for three days before feeding to cattle;
4. before using cattle or buffalo dung as fertiliser in rice fields, mix it with duck or chicken manure that has been naturally infected with the poultry fluke *Echinostoma revolutum*; and
5. treat cattle with triclabendazole about six weeks after harvesting the second seasonal rice crop.

These recommendations are now being made available to extension services in Indonesia, Cambodia, the Philippines and through representative networks to Vietnam, Thailand and Laos.

The extension will be assisted by the availability of pamphlets and other material and the production of a laboratory manual that will provide technical support for researchers and extension workers. Publishing a monograph will complement the publication of research results in scientific journals and will make all the results of this project available in one convenient document.

Three scientists associated with the research received ACIAR John Allwright Fellowships to undertake postgraduate studies in Australia. Elizabeth Molina is undertaking pathology studies on cattle and buffaloes in the Philippines. Her work will help to build up a comparative picture of the fluke resistance in these species. The study is being completed by analysis of the samples at James Cook University.

Another John Allwright Scholar studying at James Cook University, Tum Sothyra, has used Geographic Information Systems (GIS) technology to construct a map showing the risk of fasciolosis in Cambodia. GIS technology holds the promise of saving resources through better targeting the high-risk areas for application of control measures.

The third scholar, Eny Martindah, is a PhD candidate at the University of Queensland, studying extension theory based on control of fasciolosis in Indonesia.

The stated aim of the project was to develop extension programs to introduce the control measures in South-East Asian countries. Project reviewers found that a great deal of trust had been established between extension workers and the animal owners. It was therefore the basis for successful fasciolosis control, and also an opportunity to introduce other animal health measures.

A fasciolosis control network of researchers is now well established, giving a region-wide perspective to the research effort. For instance, the project supported an international workshop to standardise laboratory procedures for research into fasciolosis.



**No fluke:** research leader Dr Suon Sothoeun.

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- grazing in areas adjacent to households; and
- grazing in the immediate household area.

It has been shown that January to April is the infection period for 'in-the-field' grazing, September to December for 'near households' and September to April for animals grazing inside household enclosures.

"So we can now recommend corresponding treatments," he says. "For in-the-field cattle, we recommend treating with triclabendazole in May when we have four months during which infection won't occur. For cattle grazing adjacent to households we are recommending albendazole in May and again in July. Both triclabendazole and albendazole are oral treatments.

"For cattle around households we are recommending dovenil by injection, also in May and July."

However, before farmers will accept the cost of these controls they will need to fully understand the disease and the costs they are already incurring because of the disease.

Dr Sothoeun says a cost-benefit study will be an essential part of the new program. "We have to prove to farmers and to the government that fasciolosis is the problem that we say it is so that we can get government support for a national control program.

"We also have to test farmers attitudes to the controls we are proposing and to determine which extension methods will be the most effective – farmer meetings, or TV/radio?"

Dr Sothoeun says this next phase will be an interesting challenge – turning science into on-farm change.

ACIAR support is continuing through this two-year small project in Cambodia. Researchers will refine and validate a GIS-based risk model for fasciolosis in that country, and also implement and evaluate an extension program.

This will involve production of extension materials in the Khmer language. Dr Lee Skerratt is the Australian project leader, and Tum Sothyra, a John Allwright Scholar, is playing a pivotal role in the project's implementation in Cambodia.

This new project will help fulfill the initial research intentions of problem solving, capacity building and extension to farmers.

### PROJECT:

AS1/2002/099 Development of a model for the control of fasciolosis in cattle and buffaloes in the Kingdom of Cambodia

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# PRACTICAL TOOLS FOR SURVEYING ANIMAL DISEASES

When thinking of toolboxes, images of spanners, wrenches and screwdrivers spring to mind, but for many scientists throughout Asia and the Pacific the image they have may be very different.

Chances are that when the term toolbox is mentioned they think of one of two books: the *Survey Toolbox for Livestock Diseases* and the *Survey Toolbox for Aquatic Animal Diseases*. Both books introduce readers to methods for surveillance of animal diseases, developed specifically for developing country contexts. At the beginning of each is a guide offering two options.

For those already familiar with animal health surveillance, there is the option to carry out a survey, including for disease prevalence, impacts on production, disease incidence and detection.

For workers unfamiliar with this methodology, the option to learn more exists, directing the reader to the appropriate chapters, prior to embarking on a survey. Both books also include software support on CD-ROM.

The surveillance techniques behind the *Survey Toolbox for Livestock Diseases* were developed during two ACIAR projects on animal health and diseases, the first in Thailand between 1994 and 1996, the second in Laos from 1996 to 1998. The author of both *Toolboxes*, Angus Cameron, was involved in both projects as an Australian Volunteers International (then known as Australia's Overseas Service Bureau).

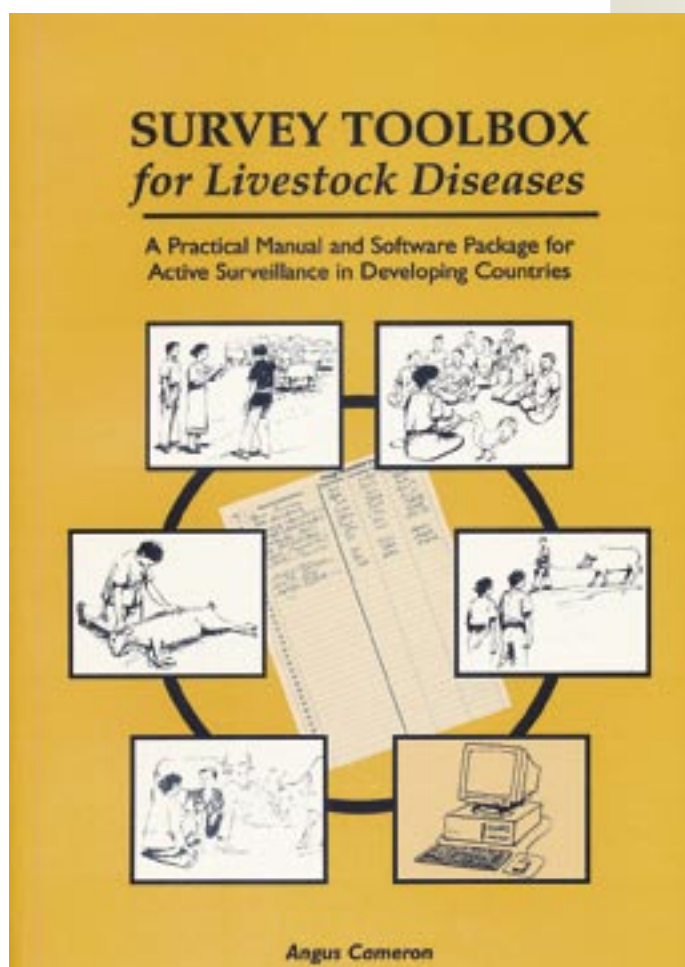
Angus worked in the mid-1990s with the ACIAR project at the Northern Veterinary Research and Diagnostic Centre in Lampang, northern Thailand. An epidemiologist, Angus joined a team working to better diagnose, track and manage stock diseases in both Thailand and Australia.

Animal health officers need accurate information on the diseases, their spread and their impact to ensure the effectiveness of the control programs that are in place.

During his time in Thailand, Angus worked on new epidemiological techniques suited to developing countries. This included developing practical, more affordable survey techniques that are appropriate for Thailand and other developing countries.

Angus recalls the challenges and rewards of working in Thailand at the time: "I was often astounded by the remoteness and beauty of villages that we surveyed. Catching a glimpse of the lives of these farmers was a privilege, and their hospitality at times overwhelming – too much of the local rice whiskey at lunchtime makes it difficult to collect blood from angry buffaloes in the afternoon."

He then moved on to Laos to take up a second posting with the OSB. His research led to the awarding of a PhD from the University of Queensland.



Angus used the knowledge and skills gained from working in Thailand, Laos and other Asian countries to write about active surveillance for livestock diseases, published as the *Survey Toolbox for Livestock Diseases*.

It has been widely acclaimed and is now available in several languages.

"The books are designed to be easily understood and practical. I tried to distil key information, offer relevant examples and illustrations. One of my greatest satisfactions is seeing the completed translations (for instance in Spanish, Japanese, Lao and Indonesian), with much of the work done voluntarily by enthusiastic epidemiologists in different countries."

The FAO has adopted it as a reference publication.

Today Angus is a director of AusVet Animal Health Services, a specialist epidemiology consulting company, providing services to clients in Australia and internationally, working across a wide range of species, including livestock, aquatic animals, wildlife, plant and human health.

Angus continues to be involved with disease control authorities in South-East Asia. He has recently been working with the Thai Department of Fisheries on a surveillance system for Thailand using the *Toolbox* as a resource, and in the Philippines conducting training on foot and mouth disease control and surveillance, again using the *Toolbox*.

'CATCHING A GLIMPSE OF THE LIVES OF THESE FARMERS WAS A PRIVILEGE.'