

Healthy livestock help

A partnership between Laos and Australia is helping smallholder farmers protect livestock against infectious viruses

BY GIO BRAIDOTTI

Village-raised pigs add substantially to the income of Lao farmers, but pig production is under pressure from the endemic presence of infectious diseases. With an eye to alleviating this, Australia and Laos have been cooperating since 2003 to strengthen disease-control options at the village level.

Of particular concern are two viral diseases—the often-lethal classical swine fever (CSF) and foot-and-mouth disease (FMD). These two diseases disproportionately hurt Laos's most vulnerable farmers, for whom pigs can generate up to 60% of household cash income. Also affected are farmers taking the step up from subsistence level to more intensive production.

With more than 85% of the country's population located in rural areas, sales of livestock are vital to people's living standards and to poverty reduction.

To help smallholder villagers, ACIAR has been funding Australian and Lao scientists to develop methods to detect the diseases and manage them at a village level.


The original three-year project was undertaken by CSIRO scientists based at the Australian Animal Health Laboratory in Geelong, Victoria. The project was initially designed by Dr Laurence Gleeson, who has many decades of veterinary experience in Indochina.

From the start, he placed a strong emphasis on understanding the social conditions that promote transmission of livestock viruses. His project design succeeded in fostering two-way partnerships between the scientists and villagers, veterinary village workers and national disease initiatives in the Mekong region. →



PHOTO: BRAD COLLIS

push against poverty



Pigs can generate up to 60% of household cash income for some of Laos's most vulnerable farmers.

Laying the foundations with foot and mouth

A new strain of foot-and-mouth disease (FMD), coupled with important developments in diagnostics, was the catalyst for an evolution in animal-health research in South-East Asia that began in the 1980s.

The two events also triggered the application of epidemiology in research across the region, which helped to better manage and control animal diseases, says Australia's Dr Laurie Gleeson—one of the leaders of ACIAR's projects to research and develop FMD diagnostic methods and control FMD.

The ACIAR-funded work began in Thailand in the mid-1980s when a new strain of FMD struck. Although Thailand had an FMD vaccine-producing facility—at Pak Chong, 200 kilometres north-east of Bangkok—the new strain was causing substantial damage to livestock production, especially pigs.

FMD is one of the most important animal-health issues in South-East Asia, inflicting substantial economic losses because of reduced animal growth rates and work output. It also retards trade in livestock and livestock products, reducing farmers' returns from animal production.

Dr Gleeson, formerly with CSIRO Animal Health and now with the UN's Food and Agriculture Organization (FAO) in Bangkok, says Thailand's vaccine, produced at Thailand's Department of Livestock Development (DLD) facility and used since the 1950s, was not controlling the new strain of FMD type A.

"At the same time, CSIRO staff had developed a new diagnostic test for FMD and needed to validate it, using field samples."

He says it made sense to establish a project to validate the test and diagnose the new FMD strain, providing insight into why the vaccine was not working.

This work, which in various project guises lasted for more than eight years, was very successful, Dr Gleeson says. "The test eventually became the standard test for FMD and helped control FMD in Thailand."

The projects also helped in the development of more accurate diagnostics for detecting different strains of FMD and led to a better understanding of the relevance of certain FMD strains and their impact on vaccine performance.

"There have been many spin-offs from this work," he says. "DLD with technical advice from CSIRO established a bio-containment facility—a regional reference laboratory that can safely conduct studies on new strains of FMD from around the region. And the whole process has increased engagement with regional and international bodies."

He says one of the most important achievements from a research and development perspective—and one that has had effects on other animal-health projects—has been the increasing use of epidemiology to better understand and control disease.

Dr Gleeson says that, even now, his avian influenza work with FAO is based on this. "Even though I've moved from four-legged animals to two-legged ones, it is based on the increasing use of epidemiology and the FMD work we started in Thailand in the 1980s."

– REBECCA THYER



Leadership of the project has since shifted to CSIRO's Dr Axel Colling, but it has retained and strengthened its collaborative nature.

"The project was designed on the understanding obtained from going out in the field and interviewing people who helped us properly contextualise the livestock disease issues," Dr Colling says. "The information included how piglets are bought and sold at village markets, since mixing of animals provides a perfect opportunity for infectious material to spread."

A wealth of information was obtained in the process, which is helping to break the disease cycle, sometimes in simple ways that do not necessarily rely on sophisticated, laboratory-based technology. "For instance, we found that in the early stages of a CSF outbreak, farmers frequently decided to sell piglets, without realising that the disease

may be infectious," Dr Colling says.

The team also found that market animals were often dehydrated, hungry and stressed—conditions that help spread infectious diseases between animals and from animals to humans, as in the case of SARS and avian influenza.

As the project progressed, regional workshops were held and educational material was developed for use by interested parties, such as veterinary village workers. Indeed, the job of raising awareness on how the cycle of CSF infection is being maintained at the village level is viewed as equally important as the more technical work on rapid diagnostics and vaccines.

"Smallholders now realise they are better off confining new pigs separately for a few weeks and mixing them with village pigs only if they remain healthy," Dr Colling says. "They have started to understand the principle of preventative medicine based

on an understanding of how microbes spread diseases. These farmers are very clever and they have an enormous capacity to cooperate and communicate. So when a village sees the benefits of disease control—in terms of healthy piglets—the methods tend to be rapidly adopted and copied."

Since the critical end-users are mostly women, who make up the bulk of pig farmers, the Lao Women's Union is playing a critical role facilitating information transfer through their extensive village-based network.

On a more technical front, a need was identified for rapid diagnostic capability that could be deployed at the village level, rather than relying exclusively on sending samples to the national testing facility in the capital, Vientiane. Such a tool could also help in assessing and refining the performance of CSF vaccines that are under development in Laos.



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Classical swine fever

- Highly contagious viral infection of swine that is often fatal.
- Most often spread by movement of infected pigs and ingestion of contaminated feed or garbage.
- Outbreaks have occurred throughout much of the world. The disease is present in some European countries, South America and Asia.
- Symptoms usually appear five to 10 days after infection. Acute symptoms include persistent high fever, weakness, lethargy, uncoordination, huddling, anorexia, conjunctivitis, constipation and/or diarrhoea, and reddish/purplish discolouration of the skin of the abdomen, inner thighs and ears.

Foot-and-mouth disease

- Highly contagious and sometimes fatal viral disease of cloven-hoofed domestic animals, primarily cattle, pigs, sheep and goats.
- Occurs throughout much of the world with endemic areas in Asia, Africa and parts of South America.
- Spreads rapidly by contact with infected animals and transmission on clothing and vehicles, and through the air.
- Principal symptoms are dullness, loss of appetite, fall in milk production, fever, excessive drooling, and severe lameness or reluctance to walk.



PARTNER COUNTRIES: Laos, Cambodia, Thailand, Vietnam, Indonesia

PROJECTS: AH/2003/001: Management of CSF and FMD at the village level in Laos PRD; AH/2006/025: Understanding livestock movement and the risk of spread of trans-boundary animal diseases; and AH/2004/020: The development of a national surveillance system for classic swine fever and foot-and-mouth disease in Indonesia

DESCRIPTION: ACIAR is funding key projects in animal health to eradicate or control trans-boundary animal diseases, through a greater understanding of livestock movements, plus better surveillance and diagnostic techniques

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While a laboratory-based diagnostic technique called ELISA (enzyme-linked immuno-sorbent assay) already exists for CSF and FMD, the technique relies on attaching virus-detecting antibodies to specialised plastic trays—trays that require expensive equipment to process. To make the diagnostic assay workable in laboratories closer to the smallholders meant somehow decoupling the assay from its need for elaborate support equipment.

The breakthrough came when Jamie Conlan, who spent many years in Laos doing experimental work for his Master of Science degree, came up with the idea of attaching the antibodies not to plastic trays but to magnetic beads. That innovation allows a hand-held magnet to substitute for the equipment normally needed to perform the assay. The resulting diagnostic tool has been dubbed the IMB-ELISA (immuno-magnetic bead ELISA).

“Despite needing less sophisticated laboratory support, we found that the new test’s performance characteristics are similar to the established and more sophisticated technique,” Dr Colling says. “So the test is an ideal candidate for the diagnostic needs of smallholders in Laos.”

So far, the new system has been set up at four provincial laboratories, where it is now possible to arrive at a preliminary diagnosis within 35 minutes of receiving a sample.

If positive for CSF, the case is further

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– DR AXEL COLLING

examined for an outbreak and biosecurity options may be recommended, such as putting the affected animals under quarantine or even culling. This is done with the understanding and cooperation of the smallholder, once again emphasising the importance of the education and training efforts that preceded the introduction of the diagnostic tool.

“Irrespective of whether samples are positive or negative, they should be forwarded to the central animal health laboratory in Vientiane for further testing as soon as possible,” Dr Colling says. “It is important to understand that the use of hand-held testing devices is useful as an additional and rapid diagnostic tool but should never be regarded as a replacement for other laboratory-based tests.”

In the next stage of the project, preparations are under way to support the assay’s introduction across the region →

The importance of surveillance

Reducing animal diseases to a manageable level ultimately requires a surveillance system that can track their presence. A project to build such a system has just started in Indonesia, funded by ACIAR.

The project is headed by Associate Professor Ian Robertson from the Australian Biosecurity Cooperative Research Centre for Emerging Infectious Diseases at Murdoch University, in Western Australia.

"Monitoring the prevalence of endemic and emerging diseases is a vital part of evaluating the effectiveness of new and established disease-control programs," Associate Professor Robertson says. "The ACIAR project started in 2006 and will help Indonesia strengthen its surveillance system for animal diseases, particularly in the eastern part of the country, where recent outbreaks of major pandemic livestock diseases have included highly pathogenic avian influenza (HPAI) and classical swine fever (CSF)."

As in Laos, CSF has a serious effect on animal productivity and is now widespread in the eastern islands. HPAI has led to the death and destruction of large numbers of poultry in Indonesia (see page 4).

Associate Professor Robertson says risks from these diseases can be reduced by targeted active surveillance and an increased awareness of the disease. Indeed, Indonesia has already been successful in eradicating foot-and-mouth disease (FMD), an important move for improved productivity and for growth of livestock exports.



PHOTO: BRAD COLLIS

in a way that ensures uniformly high performance levels.

"There is no test anywhere in the world that perpetually gives correct results, given that over time different reagents and testing conditions are used to target different populations," Dr Colling says.

Support is being provided to Laos in the form of a standard operating procedure that encompasses the use of internal controls to better recognise false-positive and false-negative results, and that acts as a means to ensure testing procedures, reagents and operator proficiency remain effective.

The availability of the assay is also affecting efforts to refine the performance of CSF vaccines under development in Laos. The CSIRO team has identified issues regarding the quality of vaccine production, storage and application to animals. Ms Tess Vitesnick has spent almost a year in Laos working on these issues under the Australian Youth Ambassador for Development Program.

"If it is too difficult to improve the quality of locally produced vaccine, there is always the option of using good quality-controlled vaccines originating from neighbouring countries," Dr Colling says, stressing that any compromise on vaccine quality can

boomerang on a program. If farmers do not see the preventive effect, they start to question the entire principle, with devastating consequences.

"These are issues that need to be worked on at the ministry and policy level, but we are working on all these levels and talking to everybody concerned."

With strengthened disease-control measures taking form, interest is gathering for a region-wide control program from neighbouring countries such as Laos, Cambodia, Vietnam and Thailand.

"The Asian Development Bank has given an enormous amount of money over the next few years for concerted control programs," Dr Colling says. "ACIAR has seen these developments and is targeting research efforts accordingly."

Of critical importance is the spread of diseases across borders, and a new ACIAR project headed by Dr Chris Hawkins is specifically looking at this issue. It is being undertaken in partnership with the World Organisation for Animal Health (OIE) working through its Regional Coordination Unit in Bangkok and the Australian Department of Agriculture, Fisheries and Forestry.

Dr Hawkins, a senior veterinary epidemiologist, based at the Department of Agriculture and Food, Western Australia (DAFWA), says that national borders do not mean much when it comes to infectious disease. As a consequence, understanding livestock movement patterns can provide essential information to control efforts.

"A detailed, quantitative understanding of these patterns and their influence on the spread of disease is critical," Dr Hawkins says. "It allows the identification of high-risk livestock movements so that preventative action can be taken. It also serves as a platform to develop novel strategies to minimise the risk of disease spreading."

Dr Hawkins cautions that the move by South-East Asian countries to manage and eradicate animal diseases could lead to increases in quarantine controls. If not done carefully, these measures can reduce producers' incomes and potentially lead to financial hardship.

"There tends to be a certain volume of unregulated or informal movement across borders, which can lead to the further spread of disease. That's why working with producers and traders to make these movements safe will benefit all South-East Asian countries."

Australia also stands to benefit given the volume of tourism to the region. "The risks of inadvertently bringing unwanted organisms back to Australia should be diminished by this kind of project."

Dr Hawkins and the team, which will collaborate with Cambodian and Lao veterinary services, Australian partners Murdoch University and AusVet Animal Health Services, while maintaining close links with the Bangkok regional office of the Food and Agriculture Organization of the United Nations, will start surveying and mapping animal movements by gathering information from livestock traders, marketers and buyers. The researchers will also attempt to follow consignments in the target areas in Cambodia and Laos.

"We aim to empower veterinary services and collaborating projects to improve disease control through a better understanding of movement patterns and drivers," he says. "Any decrease in trans-boundary diseases will have positive effects on poverty alleviation, trade and reducing the cost of remedial measures." ■