THE BEST RECIPE FOR PIGS

Problem pigs: slow-growing and malnourished.

Dr Jusuf (left), a project sweet potato breeder, and an assistant check a crop's progress.

A project in Papua New Guinea and the Indonesian province of Papua is seeking to enhance a traditional village-based food production system, reports Roger Beckmann

Pigs have long played an important role in traditional New Guinea society, as valuable commodities and an important source of animal protein. Also important – both to villagers and pigs – are sweet potatoes. This vegetable together with pigs forms one of the fundamental village-based production systems.

In Papua New Guinea (PNG) and the Indonesian province of Papua, which makes up the western half of the island of New Guinea, the importance of pigs is increasing because they have the potential to be a source of income as well as meeting more immediate food needs. However, there are several problems with trying to expand the pig population. Traditional village pigs grow very slowly, their final weight is not great and their fertility is low. In terms of producing meat, the sweet potato/pigs system is very inefficient.

So the important question is how to improve production in a way that is sustainable, affordable, culturally acceptable and achievable within the context of remote Papuan villages.

To help find the answer, ACIAR has been funding a project to study all aspects of the sweet potato/pig production system in Papua. The project, managed by the CGIAR International Potato Center (CIP), falls into two broad parts – one connected with the nutritional value of the sweet potato and the other concerned with improving the husbandry and management of pig-raising.

Sweet potato is an important crop to the Dani people in Papua, but it seems little selective breeding to improve the plant has been carried out.

Sweet potatoes store starch and sugar in the edible underground tuber. The parts above ground – the vine and the leaves – are also edible, but they contain relatively little starch. Starch is a carbohydrate that when eaten becomes an energy source. Usually, carbohydrates are not in short supply in places where there is adequate rainfall, sunshine and soil for good plant growth. The nutrient that is most often limited in ecosystems and agricultural systems is protein. If the sweet potato plant contained more protein – and this would be mainly in the leaves and stems – then it would support faster pig growth. Of course, larger tubers with increased starch would also help, yielding more food for the time spent harvesting.

In earlier ACIAR-sponsored work, scientists studied sweet potato varieties and selection in Vietnam and material from that research will now be adapted to Papua. Another source of sweet potato knowledge comes from Indonesian scientists who developed new varieties of the plant for human consumption at the Research Institute for Legumes and Root Crops in Malang and the the CIP 's South-East Asia and Pacific office in Bogor.

Pig problems

To find out how to improve the village production system and why

AND SWEET POTATOES

Liem Mahalaya, project officer, the Dani project coordinator and villagers inspect new lalekens (small paddocks) planted with pasture.

Pigs feed on cooked sweet potato roots and vines, supplemented with forage grasses and banana trunks.

the animals grew so slowly, the team's scientists carried out a survey of pig health in Papua. The results showed that the pigs' problems extended beyond their diet.

Many of the animals were riddled with parasitic nematode worms, in fact almost every pig parasitic worm recorded in the literature was identified in the surveyed pigs. Worms were abundant in the intestine, but some species migrate around the animal and into the muscle (meat) and other organs. The scientists also found several pigs harbouring parasitic protozoa. Some of the nematode and protozoa species in the pigs could easily infect humans. In addition, the pigs were infested with mites and lice and local scientists have recorded diseases such as bacterial meningitis and pneumonia.

Together, the parasites and diseases constituted the principal reason for the slow growth of pigs, but infection was not the whole story. Some of the pigs were suffering from liver damage brought about by a class of chemicals called pyrrolizidine alkaloids. These occur in some of the plant species that grow naturally in the area.

The pigs were allowed to roam at will during the day and would browse on the toxic plants. The exact effects of the alkaloids are still not clear, and they may be responsible for the pigs' low fertility. Back in 1989, project team member Dr Colin Cargill, from the South Australian Research and Development Institute (SARDI) in Adelaide, and his co-workers noticed that if village sows in Tonga ate plants containing alkaloids they often died after giving birth.

A survey of local plants showed that several are non-toxic and high in protein. Some of these are grasses, but there are also tree species with protein-rich leaves. If pigs ate these plants rather than the leaves of the sweet potato, their dietary protein intake would increase, helping their growth rates.

Two fast-growing and relatively drought-resistant tree species are especially promising, not only as a protein source but as a good source of wood suitable for fence-building or for cooking fires. This is significant because other findings suggest that fences could play an important part in improving pig productivity.

Keeping them in

It was clear that confining pigs to areas where there are few, if any, toxic plants would help improve productivity. It could also help the parasite problem, as the animals' ability to acquire infection from elsewhere would be reduced. However, the important feature would be to prevent constant reinfection of worms between the pigs.

The typical system sees pigs kept within a family compound overnight and then let out in the morning. They roam free around the village, saving on food as the animals seek out material to eat.

Usually, domesticated pigs will not defecate in their own sleeping area overnight. Instead, they release their dung when first let out in

SWEET POTATO DIAGNOTES

A CD and internet resource for sweet potato crop management

ACIAR has recently released a new software product for sweet potato farmers, extensionists and researchers.

Sweet Potato DiagNotes contains an interactive diagnostic key allowing more than 80 problem-causing agents (diseases, insect pests, nematodes, nutritional disorders and environmental factors) to be identified from the symptoms and signs observed on the crop. For each problem, there is a detailed fact sheet providing photographs and information on identification, importance and management of the problem.

There are also fact sheets on other aspects of sweet potato production and soil fertility management.

This is the most comprehensive publication yet produced on sweet potato management and will provide a valuable reference tool for those working with this crop.

Sweet Potato DiagNotes is the product of a collaboration between the University of Queensland, the International Potato Center (CIP) and the Philippine Root Crop Research and Training Center (Philrootcrops), funded by ACIAR. The product has taken more than four years to develop and brought together the expertise of crop pathologists, entomologists, nutritionists and nematologists from around the world.

The interactive key utilises Lucid™ software, a University of Queensland product that has been extensively used for taxonomic keys. Its application in diagnostic keys (expert systems) is a more recent development and *Sweet Potato DiagNotes* breaks new ground in its scale and user-friendly features.

The product can be accessed free at www.lucidcentral.org/keys/sweetpotato or a CD can be ordered from ACIAR by emailing comms@aciar.gov.au. No charge will be made for Papua New Guinea users.

This is a new type of product for ACIAR and feedback from users is welcome. Please email feedback to both comms@aciar.gov.au and Dr Jane O'Sullivan at j.osullivan@uq.edu.au.

PARTNER COUNTRIES: Indonesia, Vietnam
PROJECT: AH/1998/054: Poverty alleviation and food security through improving the sweet potato-pig systems in Indonesia and Vietnam DESCRIPTION: The project set out to improve sweet potato-based production as a stable food and feed supply
CONTACT: Dr Colin Cargill, cargill.colin@saugov.sa.gov.au

Local veterinarian and project officer Liem Mahalaya prepares to tag pigs.

the morning in the same areas where children play and dogs roam. As a result, many pigs become infected with human or dog tapeworms, acquired from eating faeces, and children can acquire pig infections by playing in the dirt where the animals have defecated.

In collaboration with villagers, the scientists have suggested that pigs be let out into a specialised dunging area first. These areas would have stony ground on which the animals would defecate. The stony ground prevents pigs from eating earthworms, which are secondary hosts for some of the parasites. Periodically, these dunging areas would be cleaned out, the dung composted and later put on the fields for use in crop growth – however not where pigs would roam.

After their morning dunging, the pigs would be moved into fenced paddocks sown with high-protein plants and trees. Each pasture area would be used until about 50 per cent of the foliage had been eaten. Then the villagers would send the pigs to another area, allowing the initial pasture to recover. This rotational idea fits well with the traditional systems of agriculture familiar to villagers. Interestingly, villagers had previously used a similar system decades before, but Dutch missionaries encouraged them to let the pigs roam free in an attempt to save on the amount of food used to feed the animals.

Of course, the pigs still need supplementary feed and scientists are studying what should be included in this diet. Sweet potatoes are included, but they contain compounds known as trypsin inhibitors that inhibit the action of protein-digesting enzymes in the gut. These compounds can be inactivated by heat treatment. However, as cooking uses fuel, an alternative method is fermenting. Fermented silage containing a mixture of different, locally available food sources is the ideal.

With a good diet the pigs grow faster, and with treatment to remove parasites the situation is even better. The scientists demonstrated this to farmers. Untreated pigs in the village grew on average 30 grams per day. With treatment, parasite-free pigs fed on the usual village diet grew at 60gm a day. However, parasite-free pigs on an optimum diet (with good levels of high-quality protein) grew at the rate of 130 to 230gm per day. Achieving the best diet may require the addition of animal protein, as plant proteins can be deficient in certain amino acids. Scientists used available fish offal.

The work has stimulated great interest among the village farmers, who now discuss the issues amongst themselves as well as with the local scientists. An important part of the project has been to encourage participation, and it was the diet trials that caused excitement among the farmers.

Pig productivity will never equal that found in the developed world, due partly to the type of pig. Native pigs can only grow to a maximum weight of 80 or 100 kilograms. The types of pig commonly used in farming in Australia usually reach a weight of about 200kg, and frequently grow by about 600gm to 700gm a day.

But these figures are not what the team is aiming for at the moment. Instead, the scientists and the villagers are more than happy to improve their existing system and get the most out of what is already available. ◂

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