

# TRADITIONAL PIG FARMING IN THE SOUTH PACIFIC: PROBLEMS AND OPPORTUNITIES FOR INCREASING PRODUCTIVITY

S. Ochetim<sup>1</sup>

School of Agriculture, University of the South Pacific  
Alafua Campus, Apia, Western Samoa

## Summary

The project was undertaken to provide information on the present system of traditional pig farming in the South Pacific region, to identify the problems currently limiting productivity of such pigs and to offer practical strategies which could be used for increasing productivity of the animals. The problems were identified by surveying some 220 subsistence pig farms in eleven island countries in the South Pacific region using a prepared questionnaire. The units were found to be generally small, consisting of about 2-4 sows per herd. The productivity of the units as assessed in terms of sow reproductive efficiency was rather low, being only about 7.5. Feed, housing, breeding, disease, marketing, lack of capital, technical know-how and existing social traditions were identified as current constraints. Based on three of the most limiting factors identified namely feed, housing and breeding, strategies for improvement were developed on the basis of better and more effective use of locally available feed resources, better housing and genetic improvement through crossbreeding programmes. These improvement strategies were tested as a package model on some ten farms in two of the island countries. The results of these on-farm trials indicated that using the improvement strategies increased sow reproductive efficiency by approximately 60 percent, to nearly 12. The significance of these findings in the overall management of traditionally raised pigs in the South Pacific region is discussed. (Key Words: Traditionally Raised Pigs, Limiting Factors, Improvements, South Pacific Region)

## Introduction

Pigs are by far the most important group of animals in the cultures of the peoples of the South Pacific region. They are the symbolic group of animals at virtually all traditional functions of significance such as weddings, funerals, family re-unions, bestowment of chiefly titles on individuals etc. (Ochetim, 1989). At such functions they may be consumed, given away or exchanged as gifts. Virtually all these pigs which are used at traditional functions are raised under the so-called traditional system of management (Ochetim, 1988). Although to date the supply of pigs from this system of production has managed to satisfy requirements for traditional functions, both in terms of numbers and sizes of animals expected, there is need to cater for increased future traditional needs if pigs are to

continue to play important roles in the cultures of the people of the region. There is therefore need to improve the productivity of these pigs. In order to achieve this knowledge will be required on the current system of rearing these pigs and on factors which are limiting productivity of the animals. Based on such information, strategies could then be developed to help improve the productivity of the animals using techniques which hopefully would be socially and technologically acceptable to the traditional pig farmers of the region. This project was therefore designed to provide information on the present system of traditional pig farming in the region, to identify the problems currently limiting productivity and to develop and test the efficacy of a model for improvement on the basis of on-farm trials.

## Materials and Methods

The project was carried out in two phases during the period between November of 1987 and November of 1991.

### Phase 1. Survey

<sup>1</sup>Address reprint requests to Dr. S. Ochetim, School of Agriculture, University of the South Pacific, Alafua Campus, Apia, Western Samoa.

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This phase was involved with data collection on the production features of traditional system of pig farming in the South Pacific region and the identification of factors currently limiting the productivity of such managed pigs.

Eleven island countries namely Cook Islands, Fiji, Kiribati, Niue, Papua New Guinea, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Western Samoa were involved. With the assistance of local agricultural staff in the countries involved, preliminary information was sought from the island countries in the following areas:

- number of traditional pig farms,
- average size of the sow herd per farm and
- how long such farms have been involved in pig farming.

Based on the information provided, 20 traditional pig farms were randomly selected from each of the island countries on the basis of having satisfied the following criteria:

- The farm must have been engaged in pig farming for at least five years. This was considered to be the minimum period required in order to be able to adequately complete the questionnaire.
- The size of the sow herd should be less than five. Nearly 95 percent of the traditional pig farms had each less than five sows per unit.

A preliminary questionnaire was developed and used in the survey of the pig farms selected. The questionnaire was pre-tested in Western Samoa and then modified accordingly for use in all the other island countries. The questionnaires were sent to agricultural extension workers who distributed them to the selected farmers in their countries. Farmers completed the questionnaires. In addition they were specifically asked to list and rank in order of priority, factors which they considered to be important in limiting the productivity of their pig units. The factors were ranked on a scale from 1 to 10 with 1 being least important and 10 being most important. The completed questionnaires were returned through the agricultural extension workers.

Data obtained in the survey were processed using a survey analysis programme (MicroCase, 1987).

## Phase 2. Improvement Strategies and On-Farm Trials

This phase was concerned firstly with the development of practical improvement strategies which were based on the three main limiting factors identified in Phase 1 and secondly with the testing of the developed strategies as a package model on some ten farms in two of the island countries namely Fiji and Western Samoa. Strategies for improving productivity of pigs were developed based on the three main limiting factors, namely feeds, housing and breeding. The on-farm trials were conducted between 1988 and 1991.

### Feed improvement strategy

Development on improved feeding strategy was based on better and more effective use of locally available feed resources. Agricultural extension workers in Fiji and Western Samoa assisted by providing information on the different types, availability and supply of local feed resources. Samples of these feed materials were collected and analysed for nutrient contents according to standard procedures (AOAC, 1984). Based on these analyses, simple realistic diets were formulated for use in the on-farm trials (tables 1 and 2).

In Western Samoa, fresh coconuts formed the basis of the feeds for all classes of pigs. Fresh coconuts were split into two using a bush knife. Fresh fish waste meal was obtained from a local fish canning factory. The meal was made up of minced reject fish, fish heads, guts, fins and skins. It was available in fresh, raw form. The fresh coconuts and fish waste meal were fed to the different classes of pigs according to the guidelines indicated in table 1. In order, however, to simplify the weighing of fresh fish waste, an old fish tin was used as a measuring device. The fish tin was initially calibrated in terms of weight content and then subsequently was used as the convenient measuring device for weighing the various amounts of fresh fish waste required. All pigs were provided with fresh green grass daily. Piglets, in addition, were provided with clean dug up soil. The soil, grass and creep feed for piglets were provided in a separate area of the farrowing pen called 'Creep Feed Area'. The rest of the other animals were fed together in pens on the basis of their groups.

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TABLE 1. FORMULATIONS AND FEEDING GUIDE FOR PIGS ON ON-FARM TRIAL IN WESTERN SAMOA

Pig group	Daily feed allowance per pig*	
	Fresh coconuts, numbers	Fresh fish waste, kg
Piglets and weaners**	2	1
Fattening pigs	3	1
Boar	4	1
Sow		
Dry and up to 3rd month of pregnancy	4	1
Last month of pregnancy	6	1.5
Lactating up to 5 weeks	8	2
Lactating from 6 weeks up to weaning at 8 weeks	4	1

\* Fresh green grass was provided to pigs at all times.

\*\* Clean dug up soil was provided to piglets.

In Fiji, fresh raw cassava formed the basis of the diets. Fresh raw unpeeled cassava was chopped into small chips using a bush knife daily and fed along with a supplement made up of coconut meal, mill mix and fish meal mixed in the ratios of 3:2:1 by weight, respectively. For each category of pigs, fresh chopped cassava was mixed with the supplement in the ratios shown in table 2 and then fed to pigs according to the guidelines indicated. For ease of weighing feed ingredients, convenient measuring devices similarly

calibrated as described for use in Western Samoa, were developed. Again, green fresh grass was offered to pigs daily and piglets were offered creep feed and clean soil in a separate compartment of the farrowing pen which was not accessible to their mother.

In both Western Samoa and Fiji, feed was either offered on the floor or in half-cut old car tyres. Where floor feeding was practised, the pens were cleaned prior to feeding pigs.

TABLE 2. FORMULATIONS AND FEEDING GUIDE FOR PIGS ON ON-FARM TRIAL IN FIJI

Pig group	Composition of feed on weight basis ratio	Daily allowance per animal*
	Fresh cassava:Supplement**	kg
Piglets and weaners***	2 : 1	<i>Ad libitum</i>
Fattening pigs	3 : 1	3
Boar	4 : 1	4
Sow		
Dry and up to 3rd month of pregnancy	4 : 1	4
Last month of pregnancy	6 : 1.5	6
Lactating up to 5th week	8 : 2	8
Lactating from 6th weeks up to weaning at 8 weeks	4 : 1	4

\*, \*\*\* See footnote on table 1.

\*\* Supplement was a concentrate made up by mixing coconut meal, mill mix and fish meal in the weight ratios of 3:2:1, respectively.

## Housing improvement strategy

Improvements in housing were designed to provide a simple basic structure which provided

for a concrete type of floor and a leak-proof roof. The shed was open-sided in nature.

To a large extent, locally available coral sand

from the sea coast was used in the construction of the floor. The roof was made mainly of old, on-farm abandoned aluminum sheets. Holes in the sheets were locally patched up. Pig wire was used in the construction of the sheds to ensure that the sheds were open-sided in nature and were pig-proof. The support construction stands were made of either local coconut timber material or some abandoned on-farm iron steel pipes.

In the farrowing pen, a special area designated as 'Creep Feed Area', was partitioned off using bamboo stems. It was in this area that clean soil and green grass were placed, in addition to the supplementary feed intended solely for use by piglets and not the sow.

The pig sty was connected to the water supply system of the household by a water hose. The unit was cleaned daily.

#### Breeding strategy

Improvements in genetic quality were achieved by mating crossbred boars obtained from government pig units to local sows within farmer unit. The boars used in Western Samoa were of Landrace  $\times$  Large White  $\times$  Duroc crosses, while in Fiji they were of Landrace  $\times$  Large White crosses. With special arrangement, each farm was provided with a breeding boar which was 12 - 15 months old. The ten farms used in the on-farm trials had each four sows, which had farrowed only twice and each sow was about two years old. The sows were divided into two groups with each group made up of two sows. The improved boar was used on two sows over three consecutive farrowings. The local unimproved boar which was being used by the farmers was similarly used for mating the other two sows, also over three consecutive farrowings. It was the responsibility of farmer to ensure that the boars and sows were not mixed up.

#### On-Farm Trials

A total of ten subsistence farms selected from the farms involved in the surveys conducted in Fiji and Western Samoa were involved in the on-farm trials. The farms were selected on the basis of farmer willingness to participate in the project and to be able to provide records regularly on the performance of pigs in their units. The size of the farms selected was restricted to those with four sows each. Secondly, the sows

must have been about two years of age and not farrowed more than twice by the beginning of the on-farm trial. Unfortunately, despite the enthusiastic response by farmers to get involved in the trial, only five farms each from Fiji and Western Samoa could be accommodated due to constraints in terms of time and funds.

The trials were conducted on the selected farms over three successive farrowing cycles. On each of the adopted farms, the sow herd was divided into two groups. One group of two sows was managed together with the improved crossbred boar in the improved facilities and fed on the developed feeds. The other two sows were raised with the boar that had been on the farm before and were managed just in the same way as was practised on the farm before. Except for the three areas of improvement adopted, there were no other differences in the management practices between the improved and unimproved groups.

Data were collected on each of the ten farms mainly in the area of reproductive performance. Such information included data on litter size and weight at birth and weaning, mortality to weaning, number of days between farrowings, number of farrowings per sow per year and body condition of sows. Body condition was assessed on the basis of a score from 1 to 4; with 1 being very good, 2 being good, 3 being poor and 4 most undesirable. These data were analysed by least squares method (Steel and Torrie, 1980), to indicate the effects of the improvement strategies developed on sow reproductive efficiency.

### Results and Discussion

All the 220 questionnaires sent to farmers were filled and returned through the office of agricultural extension officers.

#### Herd characteristics

Data are presented on the characteristics of the herds surveyed in the eleven island countries (table 3). Of the units surveyed, only about three percent had one sow per unit and five percent had five sows each. The majority of the farms, 92 percent, had between two and four sows each. In general, the bigger island countries such as Fiji, Papua New Guinea, Western Samoa and Tonga had numerically more sows per herd, about

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TABLE 3. HERD CHARACTERISTICS OF FARMS SURVEYED

Parameter	No. of farms	Percent of total farms
Sow herd size per unit		
0-1	7	3.2
2-4	202	91.8
5	11	5.0
Type of pigs		
Local × Exotic crossbreds	198	90.0
Exotic crossbreds	22	10
Boars		
Farms with boars	198	90
Farms without boars	22	10
Selected from within unit	154	70
Selected from other subsistence unit	44	10
Selected from commercial farm	22	20
Housing		
No. of housing provided	55	25
Housing provided	165	75
Farms with housing but no special farrowing pens	99	45
Farms with housing with special farrowing pens	66	30

4 sows, compared with the smaller island nations such as Niue, Kiribati, Tuvalu and Tokelau which had about 2 sows per unit.

The majority of pigs raised on the farms were crossbreds, made up mainly of crosses between the so-called local pigs with exotic pigs. On ninety percent of the farms surveyed, the predominant group of pigs raised were made up of crosses between the indigenous and imported breeds. Only on ten percent of the farms surveyed were pigs purely of exotic breeding stock. Most of these farms were in Fiji, and used mainly Landrace × Large White crossbred exotic pigs.

There was a breeding boar on 90 percent of the farms surveyed. However, on some ten percent of the farms, there was not breeding boar. On these farms which did not own a breeding boar, there existed a programme of boar sharing within the local community. Under such a system, a farm with a breeding boar would allow other farmers, and usually no more than two farms, to share the boar. The boar sharing practice was more commonly followed in the smaller atoll countries such as Cook Islands, Kiribati, Niue and Tokelau, where the size of the sow herd

tended to be smaller than on the bigger volcanic island countries such as Fiji, Tonga and Western Samoa.

Seventy percent of the farms indicated that they obtained their breeding boar from within their units. Twenty percent of the farms obtained their breeding boars from other subsistence farmers within the local community. Only ten percent of the farms surveyed indicated that they obtained their breeding boars from commercial pig farms.

## Housing

There were some variations in the manner in which pigs were housed. On some 25 percent of the farms surveyed, there was no housing provided for pigs. The animals usually roamed about the homestead and slept in convenient places such as under trees, under human dwelling quarters etc. On some 75 percent of the farms, some form of shelter was intentionally provided for pigs. These shelters however, varied enormously in terms of design, construction and their effectiveness in controlling environmental factors such as rain water, heat and wind, and in rest-

rioting the movements of animals within the sheds. On 60 percent of the of farms where housing was provided, there was only one type of pen design which was used to house all different types of pigs. However, on some 40 percent of the farms, there were at least two types of pen designs; one to cater for farrowing and for raising a sow and her litter and the other type for weaners, fatteners and breeding boars and sows. Weaners and fattening pigs were often penned separately from boars and sows.

### Feeding

On farms where no housing facilities existed, pigs were allowed to free-range around the home-stead in search of feeds which often took the form of various types of locally available feed resources such as fresh coconuts, rejected crops, crop residues, grass, insects, soil etc. Such free-ranging pigs were, however, once in a while offered with some supplementary feeds such as family kitchen left-overs, cassava roots, coconuts, cassava and sweet potato peelings, breadfruits etc. The actual amounts of these feed materials offered varied depending on the availability and supply of the materials, as well as on the availability and willingness on the part of family labour to collect and offer these feed ingredients to pigs. A common system of supplementary feeding practised in the region was the feeding of split fresh coconut. Nuts would be split using an axe or a bush knife and pigs would be expected to scoop out the fresh coconut meat out of the shell.

On some farms, pigs were tethered to avoid animals destroying crops in the field. With this system of management it was always the responsibility of the farmer to provide feeds to the tethered animals. The feed resources used were similar to those used in supplementary feeding of free-ranging pigs. It was also the responsibility of the farmer to provide water to such pigs. Tethering was a common practice especially in Cook Islands.

For farmers who raised their animals indoors, the animals were fed daily on local feeds which were available on the farm. In some situations small amounts of commercial feeds were offered. Many of these commercial feed materials were not complete feeds but rather single feed ingredients such as grains, meat and bone meal, fish

meal, mill mix (mill run) etc. However, the supply of these feed materials was very erratic and the amounts offered depended very much on the quantity that the farmer could afford, let alone find.

There were no special feeds given to young pigs, piglets and weaners. Rather all animals were offered the same type of feed which happened to be available. Even worse still, animals were nearly always fed as a group irrespective of size or age of animals which belonged to a group. Thus, for example, a sow and her litter would be fed together on the same type of feed.

### Health

According to the survey farmers expressed some degree of concern over the health of their animals. However, when specifically asked what they did to minimise and control disease problems, the response was highly variable. In most cases farmers would only take note of the fact that animals were sick. However, in some cases treatments involving the use of some local materials against some diseases and parasite conditions were being followed on some farms. Thus, for example in Fiji, leaves of guava plant were used in some situations in the control of scouring and worm related problems. Tar was used to control external parasites such as mange, lice etc. The use of modern medicine was however extremely restricted. Many farmers complained that such drugs were often very expensive, and too often very scarce. Secondly, they indicated that it was often very difficult to get hold of local veterinary officers to help diagnose the disease problems and prescribe the type of drug required. The charges by the veterinary officers were also considered to be too high.

Despite the ambiguity in the health area, the main features of concern appeared to be worms, external parasites and malnutrition. Scouring was more commonly noticed in piglets and weaners. Poor body condition was quite common especially amongst lactating and dry sows. The incidence of abortion was negligible, as was the case of still births. The highest rate of mortality occurred in piglets between farrowing and weaning time. Apart from the high mortality rate which occurred during the first week of farrowing, there was another rather high incidence of mortality during the fourth and fifth weeks. This was

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associated with poor body condition and scouring.

### Marketing

The major market outlet for these pigs is the traditional market where the animals are either consumed, given away or exchanged as gifts. In general, there are two desired sizes for market pigs, at the young age when pigs are still relatively small and the old age when the animals are big. The small size, the so-called suckling pig, is more popular in Western Samoa, Tonga and Tokelau. These pigs are mainly used at relatively less important traditional functions such as family get together, White Sunday, Mothers Day etc. At such gatherings, usually there are few people and many of these people would be members of the immediate family. The pig would be prepared and consumed all at one meal.

Big pigs are more symbolic of the more important traditional functions such as weddings, funerals, bestowment of titles on important individuals etc. At weddings for examples, such pigs may be exchanged for fine mats between the families of the bride and the groom. These functions involve a lot of people and usually everybody is expected to bring a gift and in return receive a piece of pork.

Considering the demand for the two desired market sizes of pigs, there is greater demand both in terms of numbers and frequency for small pigs compared to big pigs. In fact, nearly 80 percent of the pigs in some of the island countries such as Western Samoa, Tonga, Niue are consumed at the young early stage.

Only a small proportion of pigs are usually raised to the big, old age stage. Raising of such big pigs, although is considered to be a social insurance act for satisfying traditional needs for pigs, can be an expensive undertaking. This is because the time when these pigs may be required is not precisely known. Therefore in order to reduce the cost of production there is need to cut down on the number of such animals which may be raised. On the other hand, it is worth to note that such big animals usually fetch a very high cash value on the traditional market. They may be sold for 2-4 times the amount commercial abattoirs are usually prepared to pay. Thus, as long as the cost producing these animals is kept very low, raising such animals may not only be socially desirable but may also be economically

rewarding.

### Farm Productivity Index

The productivity of the farms was assessed in term of sow reproductive efficiency (SRE), which was measured as the number of pigs weaned per sow per annum. Number of pigs weaned rather than marketed per sow per annum was used in the assessment of the productivity of the units as this was felt to be more convenient and more appropriate. To have used number of pigs marketed would have been rather complicated in view of the observed differences in age and weight at which animals are marketed and also because of the unpredictability of marketing time.

Data on the productivity of the units surveyed are presented in table 4. On the average total litter size at birth was 6.5. Of this total, 6.2 were piglets born alive and 0.3 piglets were born dead. Thus, the incidence of stillbirth was very low; less than five percent of piglets at birth were born dead. Average birth weight was slightly low, about 1.0 kg. Mortality between farrowing and weaning time tended to be high, nearly 20 percent. The incidence of mortality appeared to be higher shortly after farrowing on farms without housing facilities. Units with housing facilities had a lower incidence of mortality during the first three weeks following farrowing; however after this time the incidence of mortality appeared to be rather high. Based on these mortality levels, the average number of pigs weaned per sow per farrowing was five and the average pig weight at weaning time at eight weeks of age was 8.7 kg. Body condition of sows at weaning time was rated to be rather poor. The interval between farrowings was calculated to be about 242 days. This translated to approximately 1.5 farrowings per sow per annum. With an average of five pigs weaned per sow per farrowing, the SRE of the units was calculated to be 7.5. This is a rather low value.

### Factors limiting productivity

The factors limiting productivity of the units surveyed are indicated in table 5. Also indicated in this table is the percentage level response by farmers to each of the factors listed.

The three most important factors identified in order of importance were feed, housing and breed (type of animals being used). Other factors

TABLE 4. PRODUCTIVITY OF FARMS SURVEYED

Parameter	Productivity	Standard deviation
Number of farms	220	
Average litter size at birth	6.5	0.2
Pigs born alive	6.2	0.2
Pigs born dead	0.3	0.01
Average piglet weight at birth (kg)	1.0	0.08
Number of piglets dead per litter from farrowing to weaning	1.2	0.09
Pre-weaning mortality rate on farms with housing, % of total mortality		
from 0-3 weeks	40	4.2
from 4-8 weeks	60	5.1
Pre-weaning mortality rate on farms without housing, % of total mortality		
from 0-3 weeks	70	5.8
from 4-8 weeks	30	4.0
Number of piglets weaned per litter	5.0	0.3
Average piglet weight at weaning time (kg)	8.7	0.7
Body condition score of sows at weaning time*	3.5	0.3
Interval between farrowings, days	242	11
Number of farrowings per sow per year	1.5	0.3
SRE***	7.5	0.9

\* Body condition rated on scale of 1 to 4, with 1 being very good, 2 is good, 3 is poor and 4 is most undesirable.

\*\*\* SRE, Sow reproductive efficiency. Number of pigs weaned per sow per annum.

TABLE 5. LIMITING FACTORS AND THEIR RELATIVE SIGNIFICANCE

Factor	Weighted percentage response
Feeds	100
Housing	80
Type of animal	75
Social traditions	40
Capital	30
Technical know-how	30
Labour	30
Disease	20
Marketing	10

identified included lack of capital, technical know-how, disease, marketing, labour and existing traditional cultural practices.

All the farms surveyed indicated that feed was the most important constraining factor for increased productivity in their units. On virtually all farms, the initial concern was not so much on quality of feed but rather on the ability to provide enough feed for animals to consume. There were available locally some feed resources; however, the supply of these feed materials tended to be erratic in the course of the year. While farmers contended that there were a number of materials available on the farm, they indicated that due to lack of knowledge, they were unable to make use of such materials in their feeding



programmes. They provided, on their own request late in 1991, a list of such locally available feed materials and requested for advice on how such materials could be most effectively made use of in pig feeding within the frame work of available resources, including of course existing on-farm technology and social set up. The list, although variable, consisted mainly of crop residues such as taro leaves, stems and unsuitable planting materials, cocoa pods, banana leaves etc, as well as green grass and leaves of trees. These requests have been used as the basis for developing improvements in feeding strategy in the new project proposal submitted to International Foundation for Science (IFS).

Housing was cited as being next to feed in terms of constraining productivity of the farms surveyed. Eighty percent of the farms responded this way. Most farmers reckoned that if they had either houses or better designed units which offered protection to the animals from adverse climatic conditions, death losses would be reduced and therefore their units would be more productive. Since the major period of mortality occurred during pre-weaning stage, farmers focussed their housing concern on better housing/pen design in farrowing units. However, farmers were not only interested in housing, they also wanted the houses to be built using cheap local materials.

Seventy five percent of the farms surveyed reckoned that the poor productivity of their units was due to the type of animals they were using. In particular, concern was expressed on the rather low productivity of indigenous pigs. Litter size of these pigs tended to be small and such pigs were also slow at growing. Many of these remarks were made by farmers who compared performance of their farms with those of other farms where exotic pigs were raised. This of course had to be expected because exotic pigs have been bred and selected over the years for important performance traits such as litter size and growth rate.

The relative significance of the other factors as constraints to increasing productivity of the pig units varied widely according to the response given by farmers. Thus for example, lack of capital was cited by 30 percent of the farmers while only 10 percent of the farmers were concerned about marketing. In general, farmers who were concerned over lack of capital also tended to be same farmers who expressed concern over

problems of technical know-how and labour. These farmers were generally in those countries where there existed commercial markets for slaughtered and processed pig meat. Such was the case in Fiji, Cook Islands and to some extent Tonga and Western Samoa. In the other island countries for example Tokelau, Tuvalu and Vanuatu where virtually all pigs are consumed at traditional functions, farmers seemed to be contended with the existing traditional cultural markets where all such pigs were disposed off. The greater concern for these farmers was, however, for increased litter size and lowered mortality from farrowing to weaning time. In other words, these farmers were more interested in ensuring that as many pigs as possible were produced and raised in order to satisfy demands for traditional functions.

#### On-farm trials and improvement strategies

Data on the analysis of the feed ingredients and the diets used in both Western Samoa and Fiji are presented in table 6. The data presented on the diets indicated that the rations so formulated contained acceptable levels of nutrients (NAS-NRC, 1979). Based on the feeding guidelines presented in tables 1 and 2, animals were expected to have received reasonable levels of nutrients.

The results of the on-farm trials which were conducted both in Fiji and Western Samoa and were aimed at testing the combined effects of improvement strategies based on feed, housing and breed improvements on the performance of the pigs in the region are indicated in table 7.

In both countries, the developed strategies resulted in increased litter size and the birth of heavier piglets. The average litter size at birth for live piglets in Western Samoa increased from 6.8 to 8.3, while in Fiji the increase was from 6.9 to 8.4. The level of increase represented 1.5 extra piglets per birth in both countries. In addition pigs were heavier at birth. Average birth weights were 1.1 vs 1.0 and 1.2 vs 1.0 kg in Western Samoa and Fiji, respectively with improved and unimproved management strategies.

Pre-weaning mortality per litter was reduced from 1.7 to 1.3 and from 1.5 to 1.2 in Western Samoa and Fiji, respectively. This indicated that the mortality rate between farrowing and weaning time declined from 26 percent with unimproved

TABLE 6. NUTRIENT CONTENTS OF FEED INGREDIENTS AND DIETS USED IN ON-FARM TRIALS

	DM (%)	CP (%)	EE (%)	Fiber (%)	Ca (%)	P (%)	DE* Kcal/kg
<b>Western Samoa</b>							
<b>Ingredients**</b>							
Fresh coconut meat	50	7.4	36	3.0	0.03	0.26	5,140
Fresh raw fish	40	20.1	3.0	0.5	3.9	1.1	1,400
<b>Diets***</b>							
Piglet and weaner feed	90	18.5	10.1	5.8	1.3	0.8	3,550
Fattening pig feed	90	16.5	14.1	1.3	1.0	0.6	3,360
Boar and sow feed	90	14.5	16.5	7.1	0.7	0.5	3,290
<b>Fiji</b>							
<b>Ingredients**</b>							
Fresh raw cassava	65	1.3	0.3	1.5	ND	nd	1,300
Coconut meal	11	17.9	7.1	13.3	0.2	0.6	2,800
Mill mix	11	13.8	2.8	15.1	0.1	0.7	2,600
Fish meal	12	47.6	12.8	1.0	8.6	4.7	2,900
<b>Diets***</b>							
Piglet and weaner feed	90	18.2	5.2	5.6	1.2	0.8	3,490
Fattening pig feed	90	16.1	5.3	5.9	1.0	0.6	3,320
Boar and sow feed	90	14.3	5.0	6.2	0.8	0.5	3,260

\* Calculated digestible energy level.

\*\* Nutrient level as is in feed formulations.

\*\*\* Diets: On 90 percent dry matter basis.

ND : Not determined.

management to 16 percent with improvement management strategies in Western Samoa. In Fiji, the reduction in mortality rate was from about 22 to 15 percent during the same period from farrowing to weaning.

The number of pigs weaned per sow per farrowing increased to 7.0 and 7.1 in Western Samoa and Fiji, respectively with the improved management strategy approach. Corresponding litter sizes at weaning time under unimproved management practice were 5.1 and 5.4 in Western Samoa and Fiji, respectively. The result of these effects was an increase by about two additional pigs being weaned per sow per farrowing in both Western Samoa and Fiji.

The improvement strategy adopted also increased piglet weight at weaning time. In Western Samoa, average weaning weight increased from 8.5 to 10.2 kg, and in Fiji the increase was from 8.6 to 10.5 kg. Other beneficial effects of the improvement strategy in management adopted were improvement in body condition of sows at

weaning time from generally poor to good, and the reduction in the interval between farrowings. In Western Samoa, farrowing interval was reduced from 242 to 220 days, while in Fiji, the corresponding figures were from 238 to 210 days. These reductions in farrowing intervals resulted in increased number of farrowings per sow per annum. In Western Samoa, the number of farrowings per sow per annum increased from about 1.51 to 1.66 while in Fiji, the increase was from 1.53 to 1.73.

The overall combined effects of the improvements in management strategies adopted was a marked increase in the SRE of sows. In Western Samoa, SRE increased from 7.7 to 11.6. In Fiji, the corresponding increase was from 8.3 to 12.3. In general, the effects of the improvements in the management strategy adopted increased the number of pigs weaned per sow per annum by almost four pigs. This represents an increase of approximately 50 percent in the productivity of sows. With the average sow herd size of 2-

# TRADITIONAL PIG FARMING IN THE SOUTH PACIFIC

TABLE 7. EFFECTS OF IMPROVED MANAGEMENT STRATEGIES ON PRODUCTIVITY OF UNITS INVOLVED IN ON-FARM TRIALS

	Western samoa		SE*	Fiji		SE*
	Unimproved	Improved		Unimproved	Improved	
Average little size at birth total	7.0	8.5	(0.2)	7.1	8.6	(0.2)
live piglets	6.8	8.3	(0.2)	6.8	8.4	(0.2)
dead piglets	0.2	0.2	(0.01)	0.2	0.2	(0.01)
Average weight of piglet at birth (kg)	1.0	1.1	(0.09)	1.0	1.2	(0.09)
Average number of piglets dead per litter to weaning	1.7	1.3	(0.10)	1.5	1.2	(0.11)
Average number of piglets weaned per litter	5.1	7.0	(0.13)	5.4	7.1	(0.14)
Average weight of pigs at weaning time (kg)	8.5	10.2	(0.41)	8.6	10.5	(0.43)
Body score of sows at weaning time**	3.5	1.5	(0.27)	3.5	1.5	(0.22)
Interval between farrowing (days)	242	220	(13)	238	210	(12)
Number of farrowings per sow per year	1.5	1.66	(0.06)	1.53	1.73	(0.05)
SRE	7.7	11.6	(0.41)	8.3	12.3	(0.40)

\* SE: Standard error of paired treatment means.

\*\* See foot note in table 4.

4 per household, this improvement in sow productivity represents an additional 8-16 pigs to the household per annum. Such an increase in number of available pigs would go a long way towards satisfying the ever increasing demand of pigs for traditional functions by the household, and indeed the local community in the region as a whole.

The result of these findings and analysis are interesting and indicate that in the South Pacific region the majority of pigs are raised on small-holdings under traditional system of management. The household pig units are generally small, usually comprising of 2-4 sows each. The productivity of the units as measured in terms of SRE is also rather low; being about 7.5.

The main factor controlling the features of the traditional system of production is the nature of the market where pigs are disposed. In the South Pacific region the main reason for raising pigs is to fulfill the demands for traditional

obligations (Ochetim, 1989). With this objective in mind, emphasis in pig farming has always been on the ability to raise enough animals so that when a need arises as demanded by social traditions, a household can quickly revert to its local supply instead of having to spend large sums of money to buy a pig from an outside source. It is common knowledge in the region that the price requested for a pig for traditional function is quite high, nearly 2-4 times the price commercial butchers would offer to pay. This high price of pigs on the traditional market makes it relatively uneconomical for subsistence farmers, who are the majority of households in the region, to depend on buying pigs. They must raise their own pigs. In any case, status in the South Pacific is not quite complete and that respectable without the ability of an individual to be able to produce and supply the number and types of pigs which may be required for traditional functions. Against this background, pig farming may be looked upon

not only as an insurance system of production for satisfying traditional functions, but also as a way of gaining status within the social community. Social standing is still perhaps the most important factor of significance of according respect to individuals in the South Pacific region.

As has earlier been noted, the main market for pigs in the region is the traditional market where such pigs may be consumed, exchanged or given away (Ochetim, 1989). Unfortunately, this traditional market tends to be very unpredictable and this factor has tended to influence the manner in which pigs are raised. In essence, because nobody knows exactly when a pig may be required on such a market, the tendency has been to try to raise pigs on nearly as little cost basis as possible. To a large extent animals should be able to survive, reproduce and literally raise themselves with little inputs from the farmer. It is these considerations which have made farmers adopt the use of hardy, well adapted animals under the South Pacific environmental conditions. These animals are capable of performing fairly reasonably satisfactorily without too much management inputs from the farmer. Such well adapted animals, the so-called local island pigs, are therefore usually allowed to roam around the homestead in search of food and other basic needs for their survival. This is the so-called traditional system of management. Any additional inputs such as supplementary feeding, provision of shelter, disease control, labour use etc, must of necessity be nearly as cost-free as possible. Thus for example, except in very rare cases, farmers would not be expected to buy feeds or drugs for their animals, and labour would not be used in pig management if there is better opportunity cost for it. Opportunity cost for leisure may even at times be much higher than attending to pigs.

The consequences of following this nearly zero input system of production, coupled with the use of low-grade highly inbred indigenous island pigs, are the major reasons for the observed low productivity of pigs reported in the survey data. The three major constraints according to farmers were feed, housing and quality of breeding stock being used. Other factors, however, were also implicated according to the reports of farmers.

Confirmation of the sentiments expressed by

farmers that feed, housing and quality of breeding animals being used were constraints to increased productivity was provided by the results obtained with on-farm trials conducted in both Western Samoa and Fiji. The improvement approach which was developed on the basis of the combined effects of the three main limiting factors identified by farmers resulted in increased productivity of the pig units. An assessment based on SRE indicated an increase in sow reproductivity from about 7.7 to nearly 12. The magnitude of increase in productivity of the units indicated that nearly half as many more additional pigs could be produced per household unit.

Although it was difficult to single out the contributions of each of the three factors in the realised increased productivity, nonetheless the improvements in productivity appeared to have been associated with some rather specific features of sow productive efficiency. Litter size and weight improved both at birth and weaning time; mortality was reduced between farrowings and weaning; the interval between farrowings was reduced; the number of farrowings per sow per year increased; and sows were in much improved body condition during lactation and at weaning time. These findings are in agreement with earlier reports which have often shown the beneficial effects of upgrading the performance of indigenous pigs by using quality exotic boars when used in association with improved management practices.

Carlo and Arcelay (1965) working in Puerto Rico reported that crosses between Duroc and Landrace pigs performed better than native pigs in terms of litter size and weight at birth and weaning time. Ratarasarn and Koshi (1965) similarly reported that reproductive performance was higher amongst exotic  $\times$  native crossbreeds than native pigs. The improvement in the performance of exotic  $\times$  native crossbreeds over native pigs has been attributed to the effects of heterosis (Rigor and Kroeske, 1972; Sellier 1976; Cunningham, 1982). Undoubtedly, heterosis must also have played a role in the observed improvement in litter size in our on-farm trials. The extent of heterosis appeared to have been about 20 percent.

Improvements in the productivity of the units were also to be expected from the improved feeding practices adopted as well as from housing. According to Wilkins and Martinez (1983), a sufficient and continuous supply of feedstuff and

proper housing are basic requirements for improvement in the productivity of pigs. These are important pre-requisites especially where farmers plan to adopt the use of modern high yielding exotic pigs. In our trial, continuous supply of reasonably good quality feeds was effected by providing feeds which were formulated on the basis of the determined chemical composition of locally available feed materials (AOAC, 1984; Ochetim, 1992). The quantities of the feed offered to the various categories of pigs were calculated to meet the requirements of the animals, at least in terms of energy, protein and macro minerals (NAS-NRC, 1979). Efforts were specifically made to improve the nutrition of sows during pregnancy and lactation periods and for piglets. These efforts were rewarded in that sows had much better body condition at weaning time and this might have contributed to an earlier successful conception following weaning. Proper nutrition is essential for successful early rebreeding of sows (Pond and Maner, 1984). The consequence of such reduced weaning to conception time would have reflected itself through the reported reduced interval between farrowings and therefore the subsequent increased number of farrowings per sow per year.

Piglets were specifically provided with additional feed from the end of the second week up until weaning at eight weeks of age. This additional feed, called creep feed, was provided in a separate area of the farrowing pen which had been partitioned off using local timber such that only piglets and not the sow could get into the area. It was also in this area where clean soil and green grass were provided daily for piglets in order to minimise possible occurrence of anaemia (Pond and Maner, 1984).

The consequences of the improved nutrition of sows and piglets could also have contributed to the observed increased weights of piglets at birth and weaning time, and to the reduction in mortality rate. According to NAS-NRC (1979), adequate nutrition of sows which ensures sufficient level of milk production for piglets, and the proper feeding of piglets by providing them with supplementary feed, are crucial factors in the survival and good growth of piglets. Indeed, it has been well established that piglets on a high plane of nutrition tend to have a higher survival rate than those on a low plane of nutrition (Dyck, 1991). The unimproved system of manage-

ment catered little in terms of nutrition of piglets above what they received in the form of milk from sows, unlike under the improved system of management whereby piglets were specifically provided with extra feed. Sow milk production peaks approximately during the third week of lactation. In the unimproved system of management, piglets would be competing for rather fixed amount of nutrients from sow's milk. However, the amount of milk produced could also have been limited since such sows were on a poor plane of nutrition. Further exacerbating the situation would be the increase in daily nutrient requirements as piglets became older. Thus, because available nutrients to piglets in the form of milk were fixed and inadequate, it was conceivable that beyond the third week piglets on unimproved system of management were receiving smaller daily amount of total nutrients than did those on the improved nutrition management group. These differences in nutritional levels could have been in part responsible for the observed differences in body condition and weaning weights of piglets reported in this study.

The beneficial effects of using a high quality breeding boar and improved nutrition were effected mainly because of the ease in management following confinement rearing of animals in sheds. For example, it was easy to offer creep feed to the intended piglets. The shelters provided offered some degree of control over adverse environmental factors such as rain, direct sunlight etc., and this must have contributed to the better well-being of the animals. However, it was difficult to pin point the extent to which housing contributed to the observed performance of animals. Nonetheless, what transpired with improved housing, especially with the provision of farrowing pens was a decrease in mortality rate in the farrowing units. The incidence of piglets dying during the first week from overlaying was reduced. Most farmers involved in the on-farm trial reckoned that death loss due to overlaying was reduced by nearly 40 percent by using farrowing units.

In light of the marked improvement in SRE following the adoption of better management techniques based on three most limiting factors identified, it does seem desirable to try to quantify the effects of each of the factors considered. There is especially the need to identify the contribution of feeds as it was considered to be the

most important overriding factor. This need is even more urgent as the majority of farmers have specifically asked for more information on simple types of feeding guides as the ones tested on the on-farm trials. The expressed desire is mainly on how to make the best use of locally abundant taro crop residues which exist at all times on farms.

### Conclusions

Based on the results of the farm survey conducted in eleven island countries of the South Pacific region, it is concluded that the majority of pig farms in the region are small, usually with only 2-4 sows each. The productivity of these units as measured in terms of SRE is also rather low, being only about 7.5. Although there were a number of factors contributing to this low SRE, the three most important factors according to farmers were feeds, housing and the use of low quality indigenous stock. Opportunities, however, do exist for increasing the productivity of the units through appropriate manipulation of some of the factors of production. On-farm trials conducted in two of the island countries compared the effects of improvements in feeds, housing and the use of exotic crossbred boars over unimproved traditional system of production. The results obtained indicated that such improvement package strategy increased the SRE by approximately 50 percent from 7.7 to about 12. This increase in SRE represents a substantial increase in the number of pigs available for traditional functions at the household level. This is important especially when one considers the role of pigs in the traditional cultures of the indigenous peoples of the South Pacific region.

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