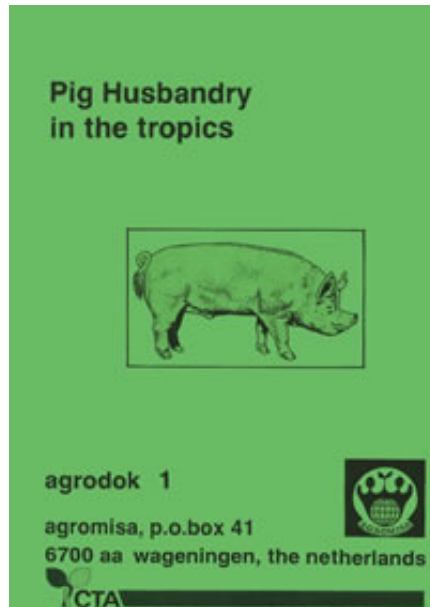




Pig Husbandry in the tropics



**Dick Muys and Geert
Westenbrink**

CTA/Agromisa

51pp, 1973 rev. 1984

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AGROMISA FOUNDATION

Agromisa is a volunteer organization of students and graduates

Agromisa is a volunteer organisation of students and graduates of the Agricultural University of Wageningen in the Netherlands. The organisation was established in 1934.

Agromisa aims at improving the position of socially and economically underprivileged groups in developing countries by transferring agricultural knowledge to those organisations and persons who are working for the benefit of such groups.

Another aim is to increase awareness among the Dutch people of the situation in developing countries.

This agricultural knowledge is transferred in the following ways:

- by supplying advice and recommendations in writing**
- by publishing a series of low priced, simple manuals on agricultural practices in the tropics**
- by co-publishing the quarterly on agriculture, technology and development A.T.SOURCE/SOURCE T.A. in English and French**

In order to transfer our knowledge in the most effective way, our advice should be adjusted to the local situation. Therefore, the information supplied must be appropriate and must relate to the local, social, cultural and economic conditions.

We are grateful to C.T.A. for financing the translation of this Agrodok

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CTA was established in 1983 in Ede/Wageningen, the Netherlands, under the Second Lomé Convention between 10 member States of the European Community and 63 states of Africa, the Caribbean and the Pacific (the ACP States).

The Convention was renewed in 1984; the number of the ACP signatories is now 66. CTA is at the disposal of the ACP States to provide them with better access to information on research, training and innovations in the spheres of agricultural and rural development and extension.

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FOREWORD

For many years Agromisa has been issuing documentary stencils to interested people to give them simple information about culture techniques in the tropics. These stencils are called 'Agrodoks' and they have expanded into booklets.

The first Agrodok appeared in 1973 and was called 'Pig keeping

in the tropics' compiled by Dick Muis and Geert Westenbrink. Many people contributed to this; among others, Dr. Montsma, Dr. Cop, Prof. Boer Iwema (Agric. Univ. Wageningen), Mr. Bloem (Barneveld College) and members of the tropical staff in Utrecht. Now that the book is being reprinted, it seems worthwhile to revise it slightly and expand it. Thanks to reactions from people working in the field, this was not a difficult task for Johan Meinderts. We should be very pleased to have comments from readers about this publication too.

Agromisa, august 1984

**Compiled 1973: Dick Muys and Geert Westenbrink Revised 1984 :
Johan Meinderts
Translated by Mrs. M Verheij**



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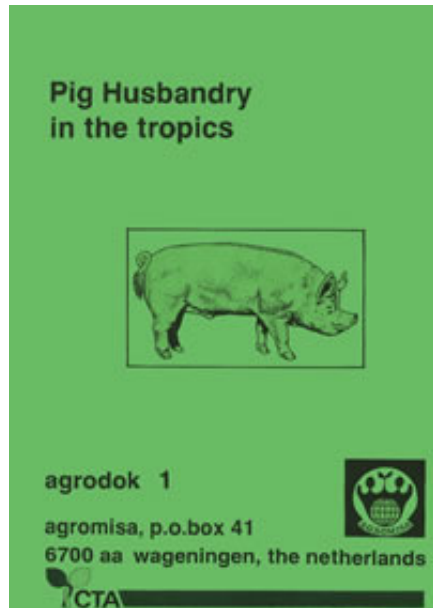
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I. INTRODUCTION

Pigs can be found nearly all over the world and in many areas are kept by small peasants. The function and economic importance of pig keeping for the small peasant can differ greatly, however, and this results in a variety of pig keeping methods. In many cases pig keeping may seem to play a relatively small role within the whole of the small peasants' farming system. For women (and children) however, pig keeping can be of great importance as an independent economic activity yielding a small amount of cash income which is used directly within the family.

For this reason this introduction starts with a description of three pig keeping systems which can be found in developing countries.

Some attention will also be paid to the social and economic context of pig keeping. The description will of necessity be very general, but details can easily be added by contacting the peasants in your area.

The chapters following the introduction cover a number of improvements in housing, reproduction and feeding methods and in preventing and treating diseases. Together these improvements result in a blueprint for a small-scale commercial pig keeping unit suited for developing countries.

It should be emphasised, however, that for most of the small peasants it would not be relevant or economically feasible to start operating this type of pig unit. The importance of pig keeping for the local peasants will determine which improvements in pig keeping methods are necessary and possible. In many cases a small number of simple measures will be sufficient to yield reasonable results.

The second part of this introduction summarises a number of social and economic problems, which often occur when changing the way pigs are kept. This part is followed by a short description of the advantages and problems related to specific changes in the housing, reproduction, feeding and disease prevention and treatment measures.

Three systems of pig keeping in developing countries

1. Scavenging (untethered) pigs.

In this system the pigs themselves have to gather a large part of their food. Although this is often supplemented each day with kitchen refuse or agricultural waste products. Local breeds are often found in this system since these are more tolerant to low quality feeds and have a higher resistance against diseases. In general selection or other ways of controlling reproduction are not employed.

In most cases the pigs are not kept to provide protein for the daily family diet or as a regular source of cash income(if there is any cash income this results from other activities). The importance of such pigs is their use as 'a savings account' or 'insurance' i.e. they are only sold when extra cash is needed (e.g. for buying seeds or fertiliser, in case of illness or festivities in the family, to raise school fees, when the harvest is lost etc). In this way loans (with the associated problems of high interest rates and repayment) can be avoided. In some cases pigs are not bred on the farm: piglets are bought, fattened during a season when feedstuffs are abundant, and sold afterwards.

Pigs can also play a specific role in social life. At festivities, weddings and such, pigs are used as gifts (and sometimes eaten as well) since good relations with family members and/or other villagers are an important asset as these groups can be asked for support in times of hardship.

In many cases pigs are traditionally owned or kept by women (and children), meaning that the possible financial benefits will usually be used for family needs. Moreover, this strengthens the economic position of women.

Summarising, it can be said, that this system of pig keeping requires a minimum amount of money and time. The high piglet mortality or slow growth rate expected with this system cannot be characterised as real 'losses' since the financial risks involved are small.

2. Tethered pigs

Pigs which are tied to trees or poles or kept in pens etc. cannot gather their own food and are therefore completely dependent upon man. Once or twice a day water and feed, usually kitchen refuse or agricultural waste products have to be provided.

There are very practical reasons for keeping the animals tethered or enclosed; for example, to prevent crops from being eaten by the pigs or to prevent the pigs from being stolen. This system of pig keeping also opens up possibilities for better control of feeding, diseases etc. These can result in faster growing pigs, healthier pigs or larger litters (see the second part of this introduction).

In general, the most important function of keeping pigs by this

method is still the availability of a 'savings account' or 'insurance'. However, in areas where it is possible to sell pigs more regularly e.g. close to urban centres or a main highway, the small peasants (often women) will often have intensified their pig keeping by this method.

Although this system of pig keeping demands only low financial inputs, the small peasant will need more know-how, time, effort and perhaps some investments as well. A daily amount of different feedstuffs as well as water is needed; relocating the pens and/or cleaning the housing will also take time. For reproduction a boar has to be provided (sometimes against payment).

3. Small scale intensive, commercial pig keeping.

This is meant to provide a major source of income for a group or a family. In this system of pig keeping, kitchen refuse and agricultural waste products will generally not be sufficient to feed the stock, so that feeds will have to be bought. Losses as a result of diseases will have to be prevented by using commercial medicine. This means, that regular access to the market has to be ensured, which often implies dependence on a middleman. It will be clear that for this system of pig keeping the small peasant will need relatively large financial inputs, know how and a good administration as well as an optimal buying and selling policy.

For this reason this type of pig keeping system is, in most cases, not within reach of the small peasant, without outside assistance. A large number of the pig units operating in this way have started with (financial) assistance of extension services or development projects.

Problems when improving or changing pig keeping systems

Three pig keeping systems have been described, ranging from the extensive 'pig as a savings account' to the intensive commercial unit. This does not imply, however, that this development will have to take place in all cases. As will become clear in the following text, a lot of possible improvements in systems 1 and 2 demand none or only very small inputs. When changing to a more intensive, commercial unit large problems can be encountered:

- Although of small scale, a commercial pig unit can be a big risk for a small peasant. On the one hand good marketing transport and stable prices have to be ensured. Regular availability of feedstuffs, medicines, all at stable prices, are a necessity.**
- To operate the unit in an economically viable way approach to keeping pigs is necessary. The animals no longer function as a savings account, but have to be marketed at the economically most optimal time. In case of problems or calamities, (e.g. diseases) with the pigs,**

extra financial inputs are necessary to prevent the unit from going broke. This is certainly not customary with the traditional pig keeping methods. To obtain know-how and advice a local extension service has to be available.

- The amount of cash income earned by the different members of the family may change to the disadvantage of women or children. In many cases the introduction of commercial pig keeping will deteriorate the economic position of women (and children) i.e. exactly in those areas where women traditionally carry out this activity. This happens not only when the extension services are biased in favour of the men, but also when the women are required to depend upon their husband for obtaining credit, the use of a small parcel of land, assistance in providing housing, administration etc. In this way women often loose their right to decide for themselves what will be done with the animals and the cash income earned.

- When small commercial pig keeping units are introduced in large numbers, prices of inputs may rise while the market price of the pigs might decline. Keep in mind that in some cases it might in fact be more advisable to continue using pigs as a savings account and to use the available means of the small peasant (or his wife) for other improvements in the farming system. Moreover, it often turns out that as the amount of money, knowledge,

etc. needed for improvements gets larger, the number of small peasants joining a project will become proportionally smaller, and the others cannot or will not take the financial risk.

At the end of this introduction we will give a short description of a number of measures which will, with the help of a small extensional service, already yield improvements and which at the same time demand only small financial inputs. A lot of these activities could be undertaken on a communal base that will increase the participation of the small peasants and decrease their risks. Small improvements which have been brought about by the local people themselves, without lavish support by experts or external credit, will focus the people's attention on their own knowledge and possibilities, which is much more important than realising impressive increases in, e.g. piglet production.

Housing: as was already pointed out before, tethering or enclosing all or part of the pigs opens up possibilities to have more influence on reproduction, feeding and the prevention of diseases. However, more know-how and time will be needed, for example, to be able to supply a varying package of feedstuffs.

Reproduction: local breeds are often pointed out as a cause for low productivity (small litter size and slow growth rates). In general, however, these breeds are very

well adapted to the local circumstances; 'improved' breeds put rather high demands on feed quality and keeping methods before expressing their better characteristics. Still the small peasant can also improve the quality of his/her animals by choosing good animals to breed (selection). If nursing sows and their piglets are kept separated from the pigs, it is possible to select the stronger piglets for breeding. The remaining animals can be fattened for sale or slaughter. If all sows are tied up or enclosed it may be worthwhile to buy a good boar. This is a good project for a group of small peasants to perform together. Boars can also be exchanged with neighbouring villages (to prevent inbreeding). This form of selection, however, demands more know-how, experience and time, for example for administration, testing the sows for receptiveness ('being in heat') etc.

Feeding: in general the small peasant cannot afford to buy extra feed for his/her pigs; moreover, this type of investment is often not useful either. Buying extra feed to make the pig grow faster only makes sense if the animal can be marketed before the usual time or if heavier animals can be sold for much higher prices. The use of the daily available feeds can be improved by ensuring a better distribution. In the case of scavenging pigs, the largest and fattest animals will consume most of the food. If the pigs are tied up or enclosed one can make sure that the

best feed is given to pregnant and nursing sows (who provide for the future breeding stock) and to piglets that have just been weaned.

Diseases: for most diseases and infections the organisms causing the disease (bacteria, worms etc.) are always or very regularly present in the animal's environment. A lot of pigs are infected but have enough natural resistance to stay alive and even grow. This equilibrium can be disturbed by all kinds of causes with the result that the pigs become sick or die. Some of these causes are: change of season (in the wet season parasites are often present in larger numbers), shortages of feeds (which weaken the animals) and changes in the pig keeping system. The latter is especially true when too many pigs are confined to the same area, so that bacteria and parasites increase rapidly. It will often be necessary to study the local situation for some time to obtain a complete picture of the incidence of diseases in a certain area. Preventive measures aim at increasing the resistance of the animals, e.g. by improving feed quality and/or at decreasing the infection pressure, e.g. by keeping a smaller number of animals in the same area and by good hygiene (providing dry and clean housing, relocating pens etc.)

Some critical remarks on the use of medicines to cure or de-worm:

The effect of most medicines is to kill or greatly reduce in number the organisms causing the disease in the animal (e.g. bacteria). However, these organisms remain present in the animal's environment, and will continually cause re-infection. This often implies that, without taking extra hygienic measures, repeated treatment with medicines will be necessary. These repeated treatments reduce the natural resistance of the animals. Because of this, losses are much worse than in circumstances when the animals cannot be treated with medicines (no money, not available).

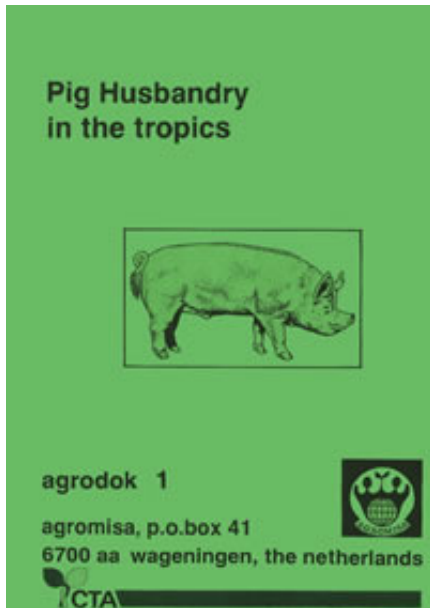
Therefore, before using these medicines it is useful to have an idea of the severity of losses due to the disease or infection on the one hand, as well as of the effectiveness of the treatment and the possibilities of repeating this on the other hand.

In some cases it can be useful to treat animals only once and only in specific situations, for example newly bought animals, animals which are weakened by some cause, pregnant sows when enclosing these for farrowing, etc.



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II. ASPECTS OF CLIMATE

Every living animal produces heat, this is released by the conversion of food. The more an animal eats, the faster it grows, but then more heat will be produced too. Heat is also released when an animal is active (for example, when walking).

The warm-blooded animals (birds and mammals) can partly use this heat to keep up their body temperature. The normal inner body temperature of a pig is about 38.5°C. A healthy animal will try to maintain this temperature as far as possible. Great deviations from this may result in death, because all body processes are geared to work at this temperature.

In a sick animal, the temperature may rise to above 40° C, as a

result of disturbance in the temperature regulating mechanism; if the temperature rises above this, the animal will die. The same applies if the temperature drops too much. Especially in the tropics animals usually produce more heat than is necessary to maintain the optimal body temperature. To prevent the body temperature rising too much, the animal will have to get rid of its superfluous body heat in one way or the other. One way of heat dissipation is the evaporation of moisture, of which 'sweating' is an example. However, pigs do not have sweat glands so are unable to do this. Evaporation can also take place through the mouth. In very hot weather a pig can often be observed panting, by breathing more quickly, more air pours through the mouth cavity and air channels, whereby more water can be evaporated. Heat release by means of evaporation through the skin is also possible if there are puddles and pools that the animals can lie and roll in; moisture evaporates from the wet skin to release excess heat from the body. If the water is cooler than the body temperature, then of course the heat will be transmitted to the cooler surroundings. It cannot do any harm, therefore, to provide the animals with a pool of water, provided that the water is clean and not a disease hazard. If the animal is unable to get rid of excess heat in one way or another, then it will try to maintain its body temperature by producing less heat, that is to say, by eating less and therefore not growing so quickly. If cold, the animal tries to prevent cooling down by generating more heat, for example by exercising its muscles (shivering). This occurs at the

cost of growth. To protect itself from the outside world the animal has a skin. One of the protective functions of the skin is to help regulate temperature changes whereby the skin serves as an insulating layer between the internal parts and the outside. A cow has a very hairy skin which is one of the ways it protects itself against the cold. A pig does not have an insulating layer of hair (fur), but forms a layer of subcutaneous fat underneath the skin.

Young piglets do not yet have such a fat layer so in the first few days after birth, the temperature regulating mechanism does not function well. Therefore, the temperature of the surroundings should be raised to the required level, so that the piglets do not get too cold. As the piglets get older, the optimal temperature of the surroundings gradually falls. The average optimal temperature, that is to say, the temperature at which an optimal growth and food conversion is achieved, for pigs in the different weight categories, is as follows:

- piglets one day old 30°C**
- piglets up to 14 days 25°C**
- piglets up to about 8 weeks 20°C**
- animals up to 90 kg 20-14°C**
- animals above 90 kg \pm 12°C**

Based on this, it is not advisable to fatten animals for meat production to more than about 90 kg. Above this weight, animals

in hot areas grow more slowly, because they cannot get rid of all heat. The weights given apply, however, to western pig breeds, indigenous breeds are usually unable to reach this weight. Many indigenous breeds are not heavier than ± 50 kg, and some of these, even at this weight, get much too fat if they are fed well.

A pig is very sensitive to sudden changes in temperature. It cannot stand a heavy downpour of rain or drought. Therefore pigs kept for optimal production should be protected against these climatic effects. This is possible by seeing that the animals are well housed. Also, strong sunlight is bad for the pigs, causing the skin to dry out. Albino pigs especially cannot endure the sun because they have no pigment in the skin, which can result in scorching. These two factors illustrate the necessity of shade.

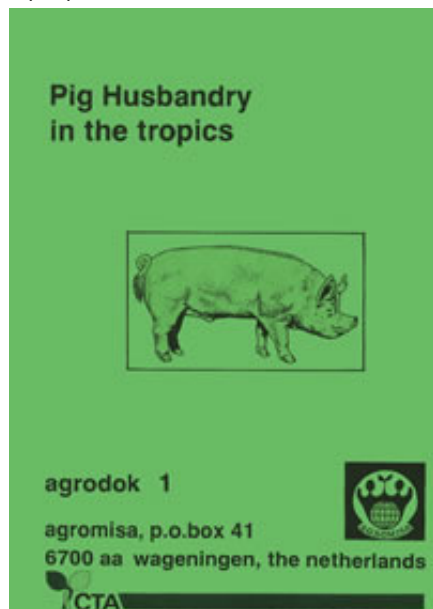
How the accommodation for the pigs is constructed, will depend upon the climate and the requirements. Besides, one has to take into account what is possible in a particular area and what the inhabitants can cope with








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III. HOUSING AND CARE

1. The first steps towards productive pig keeping

The first transition from the roaming village pig to a more organised pig enterprise is the bringing together of the animals within a fenced piece of land. Naturally, available materials such as bamboo, thorny shrubs, tree trunks etc. can be used for fencing, also strong wire netting will suffice. The construction should be so that even the small piglets cannot creep out. Food for the pigs may be provided by the root crops, if any, growing on the piece of land and their normal green-fodder, as well as any village refuse, of course. At the same time there should be an adequate supply of fresh drinking water continually and there should be shade. If there are no trees, or anything to provide shade, then this

must be remedied by making a small shade roof (illustration 1). The animals can also shelter under it when it rains hard. Such a shelter can be simply made with four slender tree trunks with a roof on top.

A serious problem associated with keeping pigs outside is the prevalence of parasites for which the wet tropics provide an ideal environment. These parasites are usually worms. The adult worms live in the pig, here they lay eggs that are excreted to the soil and at the correct temperature and humidity, the larvae emerge from the eggs to be eaten again by the pig or even penetrate through the skin. Inside the pig, they grow into mature worms. Through drying out and the sun's rays, the eggs and the larvae in the soil may die out after a while. To prevent a too serious parasite infection the grazing area should be changed, that is to say, as far as possible the animals are given a fresh piece of ground about every 14 days; in dry periods the animals can stay longer in the same field because the worms are not developing so quickly. After grazing, the used field is left empty for a while, when a large part of the larvae will die. In the wet season it is better not to come back to the same field for about 2½ to 3 months; in the dry season when the larvae and eggs die more quickly, the field can be used again after 2 months.

It is a good idea to use the pig fields occasionally for gardening. This soil will be fairly fertile because of the pig manure and moreover this has a purifying effect on the parasites; after using the soil for horticulture for a year, the soil will be completely clear again. Pigs kept in this way will not grow quickly, but because of the better supervisions, they will produce more than when they wander freely in the villages.

It is even better if the animals can be separated from each other. The pregnant sows can be brought inside just before farrowing, so that they can deliver inside. If the accommodation is suitable, a greater number of piglets will thrive.

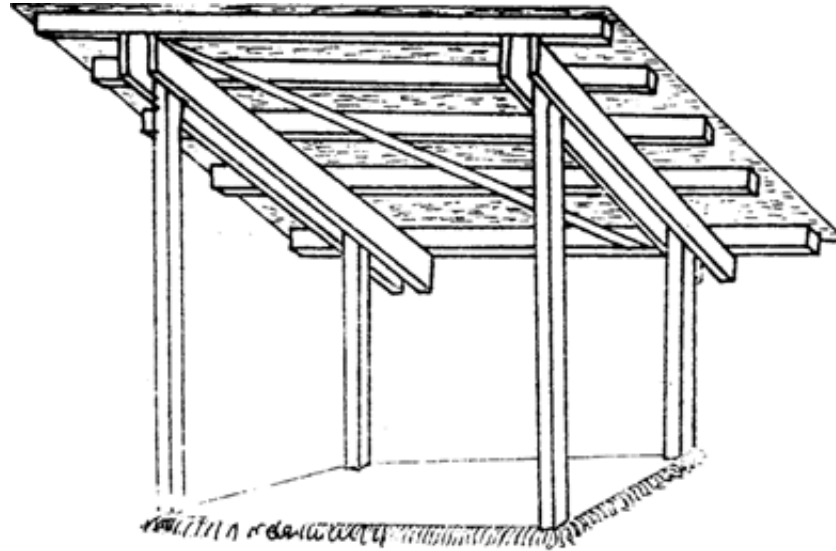


Figure I. Pig Shelter

The animals that are not needed for further breeding, the fattening pigs, can also be kept inside. For these animals, rapid growth is important. By caring for them well in a pen, a more rapid growth rate is possible than when the animals are left to roam outside. The young breeding sows and the older breeding animals and boars can be left outside. Breeding sows kept outside, will always be slightly contaminated with worms some contamination in older animals is not serious, usually these animals are somewhat resistant. To prevent the young piglets from being infected directly after birth when they are most susceptible, the sow can be dewormed about 1 week before delivery (a cure which drives out all the

worms).

To prevent re-contamination, the pen should be well cleaned every day. After de-worming, the sows can be washed, to ensure that worm eggs are not clinging to the animal. All this being done, the young pig has a chance of being born into worm-free environment. By ensuring that the pen is always kept clean, the chance of infection is small, and as a fattening pig can grow more quickly than animals that are heavily contaminated with worms.

The most intensive system in which all the animals are housed, that is to say kept in pens, with or without pig-run. Here, all the feed and water should be supplied and the dung and liquid manure removed daily. In this way, higher yields will be achieved but the costs will be higher too.

2. Housing

In hot damp areas, cooling down and shade are important factors. Everything should be as light and airy as possible. The walls of the pen should be so constructed that the wind blows freely through for good ventilation. Animals should be protected against temporary cooling down in some areas, by ensuring that the heat can be retained.

A few important requisites of the pen are:

- it should be easy to keep clean
- it should not be draughty
- bright sunshine and heavy rain should not come into the pen

- the pen should guarantee a constant temperature

A pen which satisfies these requirements is conducive to good health, a lower piglet mortality, faster growth and an improved feed-utilization.

The most suitable pen in tropical regions for less intensive holdings, is a walled covered part in addition to a run. In the covered part the bedding material is provided and in the run the trough is installed and space can be allocated for a large water tank. (see further on).

When building a pen the most favourable place should be chosen. In hot areas, the pen could be built under the shade of a group of trees. This can absorb a good deal of heat. It is convenient to build the pen near a water supply, so that water is readily available for the animals, and the pen can be cleaned easily. Preferably the floor of the pen should be raised above the surroundings so that it does not get under water in heavy showers. It is also advisable to let the floor slope slightly in such a way that the covered part lies above the run. This enables the liquid manure to run off more easily.

If a drain is fixed on the lowest side of the pen, the manure can be collected into a pit. Pig manure is a good fertilizer so it is worthwhile to collect it. The floor can be made of compacted soil or loam; it should be so firm that it is easy to keep clean. The pigs can be ringed to stop them rooting in the soil. In Europe special pig 'rings' (small pieces of iron) are on the market which are pinched into the upper part of the nose with special pincers. Wooden floors are not advisable because the crevices

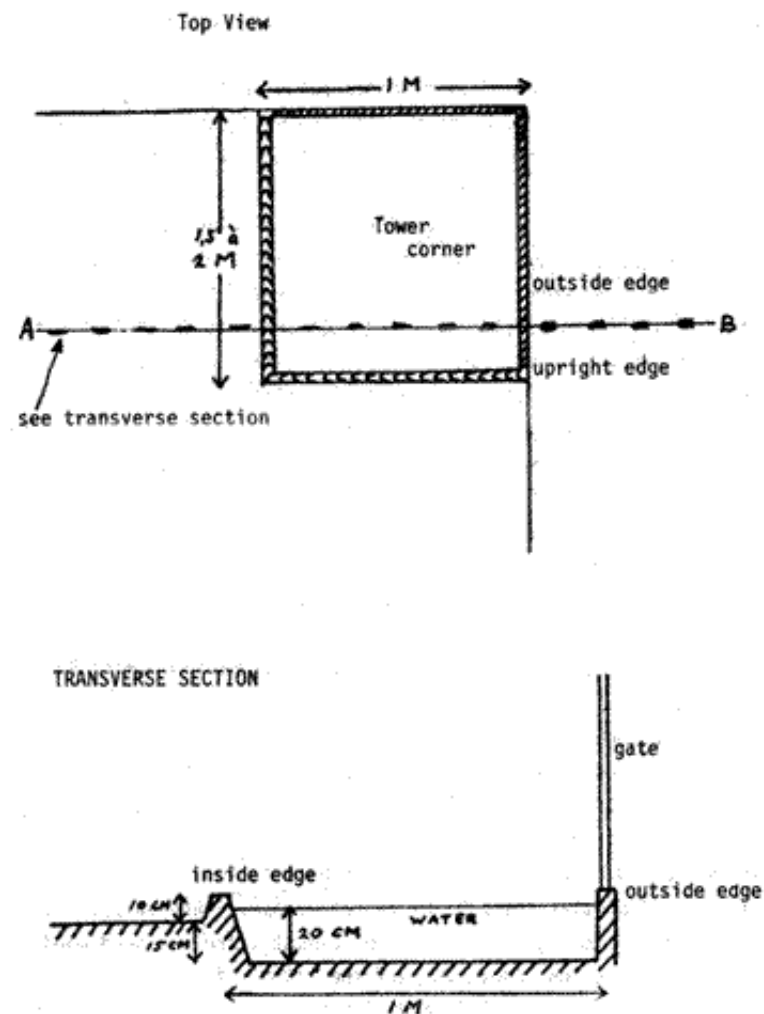
make it difficult to keep clean, moreover the pigs bite into it and wood when damp is susceptible to rotting. If cement is available then a concrete floor is a possibility. A disadvantage of concrete is that it is a bad insulator. In hot weather it is advantageous for the animals to lie on the cold concrete, but in cold weather too much heat will flow from the body and the animals will get too cold. In young animals, this increases the risk of disease, such as pneumonia, for example. The coldness of the concrete floor can be alleviated by seeing that the animals have bedding material in the pen. For this, various materials can be used, such as rice straw, sawdust, dry leaves etc. As a precaution it is better not to use parts of plants, or seeds that are poisonous when eaten. Pigs have a habit of finely biting the bedding material and sometimes eat part of it. This cannot do any harm provided the animal does not eat harmful plants. For example, the leaves of the Wonder Oil Plant (*Ricinus communis*) should not be given. This has poisonous seeds which could get between the leaves. Bedding material should regularly be changed to keep the pen clean and prevent parasites from developing. This mixture of bedding with dung and urine makes an excellent fertiliser for the field. A concrete floor should not be too rough because the animals can easily be injured. A too shiny floor is also dangerous because the animals may slip, causing serious dislocations. To remedy a floor that is either too rough or too shiny a few shovels of soil can be thrown into the pen every day after cleaning, not only is this a preventive to slipping, it is also healthy and the animals can take up valuable minerals from the soil (for example, iron).

The first requisite of the pen is the roof, for which various materials can

be used. The most practical way is to use the same material that the local population use for building houses. A roof of leaves is a good insulator against heat and cold, a disadvantage being that it rots quickly. Corrugated iron sheets last longer but is more expensive. Other materials can also be used for roofing provided it satisfies the following requirements: that is, the protection against rain and sun and against heat and cold. Preferably, a roof should be so constructed that it slopes down on the side where there is most wind and rain.

The construction of the walls of the pen is the most dependent on the climate. In the tropics the walls should be kept open as much as possible for good ventilation. A low wall to approximately 1 meter will suffice, the remaining distance to the roof can remain open. In windy areas, the roof should not be too high, otherwise, it will cool down too quickly in high winds. Completely open walls, made of wire netting for example, are seldom recommended. Pigs always look for shelter if there is wind and rain. In higher and colder elevations the walls should be so constructed that it is possible to close them completely. In the daytime when it is usually warm a few of the ventilators can be opened and closed again towards evening to retain the heat.

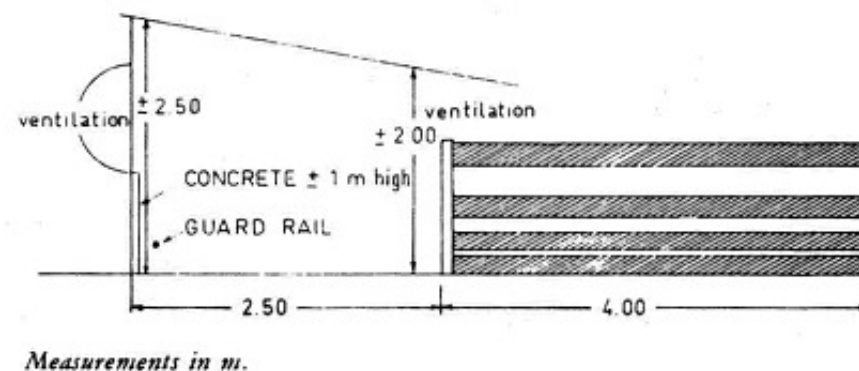
Fig II. Water-bath in pig-pen



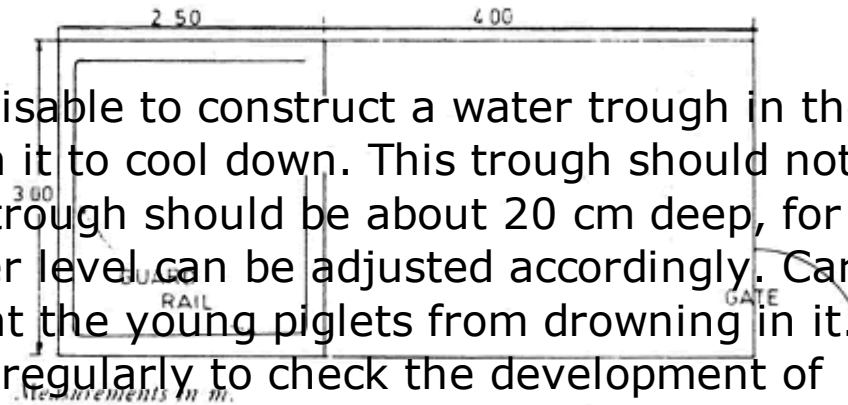
If the walls are partly open, then the roof should overlap sufficiently to prevent the rain coming in. It should be possible to close the side facing the rain completely. The walls can be made of wooden pole wicker work

and earth with a protective row of hard wooden poles on the inside. This prevents the pig from biting into the earthen wall. The walls can also be made of board or bamboo shoots. Cement walls will be the most expensive. These are stronger and last longer. If the supply of cement is limited, then the floor should be given priority. The floor of the run can also be made of the same material as the pen, a row of small tree stems will provide a simple wall, or a few poles of woodwork; here the wind can freely blow through, and the animal can go inside for shelter.

**Fig. III Pen for
all types of pig
(side view)**



**Fig. VI Pen for
all types of pig
(top view)**



In very hot areas it is advisable to construct a water trough in the run so that the animals can lie in it to cool down. This trough should not be too deep. For older sows the trough should be about 20 cm deep, for younger animals the water level can be adjusted accordingly. Care should be taken to prevent the young piglets from drowning in it. The trough should be cleaned regularly to check the development of parasites and diseases. Cement is the most suitable material for making the trough. A pit dug into the soil will quickly develop into a mud bath with all the unpleasant consequences. If there is a run, the animals will get into the habit of going outside to excrete, which can be encouraged by ensuring that the inside pen is not too big. Provided the outlet is spacious enough, the surface area of the pen need not be too large. A pen 2 x 2.5 metres is the adequate for a sow with a litter of piglets. If there is no run, then the sow and piglets will need an area of about 3 x 3 metres. The same area is sufficient for 12 weaned piglets, 1-8 light fattening pigs or 3 breeding pigs. The run, for example could be 3 x 5 metres surface area.

When making a pen with a run attached, it should be ensured too that the run is also enclosed so that the piglets do not escape. Preferably the animals should be fed outside. The trough can be made of cement, iron or hard wood. It should be long enough for all the animals from the pen to get to it at the same time. In fig. III and IV a pen is shown which is suitable for all types of pig, but because of the introduction of a guard rail, it is especially suitable for housing a sow with piglets. If a water

trough is installed in the run, then the run should be larger than is advised. It is a good idea to put the piglets in a separate corner where they can feed freely without the sow.

Housing of the sow with piglets.

As already stated, the young animals should be protected against getting too cold, directly after birth. During the first weeks, a heating lamp can be introduced into a separate corner of the pen to keep them warm. Often, artificial heating is not possible, then some good dry bedding material can be put into a part of the pen. As far as possible, the piglets should not be allowed to snuggle against the sow where they run the risk of being trampled to death by the sow. To prevent this, rails can be placed along the length of the walls around the pen at a height of 15 to 20 cms. If the sow lies down the piglets can retreat under these beams, without being trampled against the wall. Another solution to prevent the suffocation of piglets before and after birth, is to construct an additional cage for the sow. A sow cage consists of a wooden floor surface area of $\pm 70 \times 200$ cms. with a framework of iron pipes of hard wooden laths on both sides. At the front and at the back of the cage there is a door of the same material and above it a construction to prevent the animal from getting out.

Alongside the cage, a warm spot can be provided for the piglets. Fig. V. illustrates a 'piglet-box'. This is a combination of a sow cage with a space where the piglets can be kept warm. The piglets are able to crawl away from the sow on either side to a bedded area. After a few days the

shutters can be removed so that the piglets can freely run through the pen. The design has proved successful, the piglets nearly always lie under the rail-roof and not against the sow. The sow can be kept in the pen for about two weeks after farrowing. Before using the cage for the next sow, it should first be thoroughly cleaned. When the sow leaves the cage, a warm place should be found for the piglets. This could be in an enclosed corner of the pen where the animals can get used to a little feed. When the piglets reach a weight of 20 kg they can be weaned, that is to say, separated from the sow.

Housing of the other animals.

The requisites of a pen to be used for fattening pigs are less demanding. Preferably there should not be more than 10 fattening pigs in one pen. A simple pen with a run is adequate (Fig. VI). This applies to the breeding pigs and boars too. The latter may temporarily be allowed to roam freely within a fenced piece of land, but the danger here is a parasite infection. The condition of the breeding pigs will benefit from this. It strengthens the leg muscles and moreover the animal can utilize certain elements that are sometimes lacking in the feed. This is more important for the breeding pigs than for the fattening pigs; a fattening pig will never get old (slaughter) but a good breeding pig will be used as long as possible.

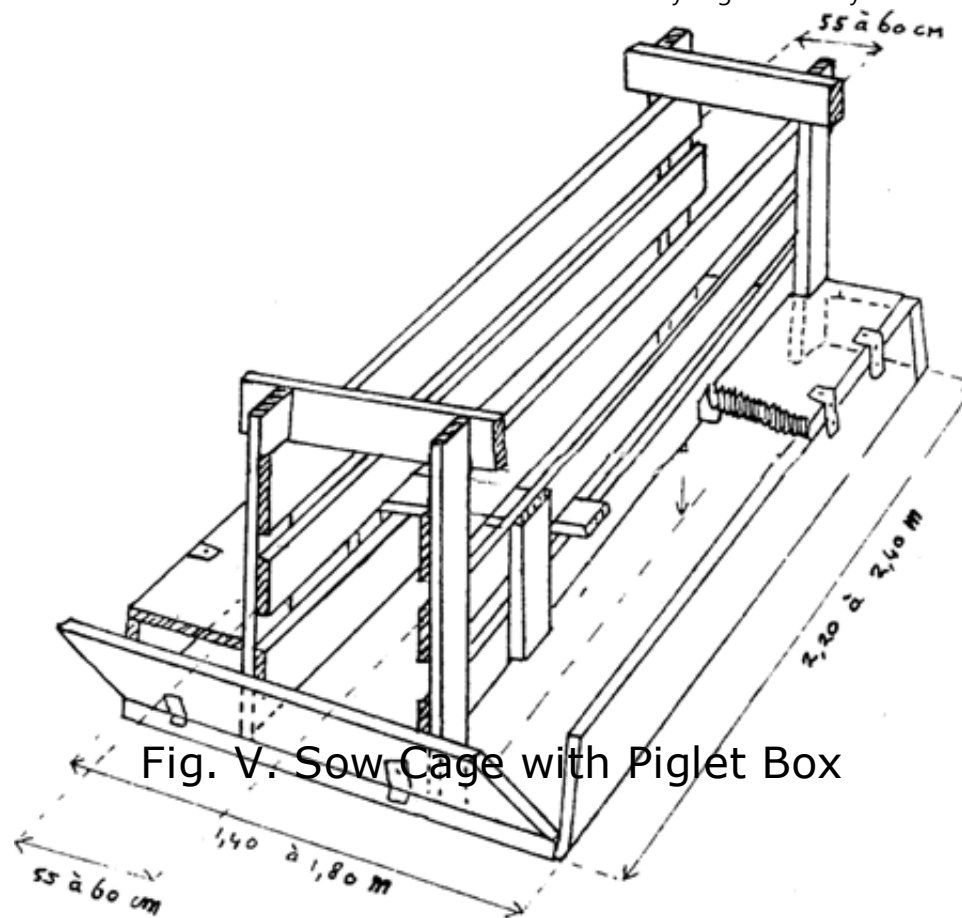


Fig. V. Sow Cage with Piglet Box

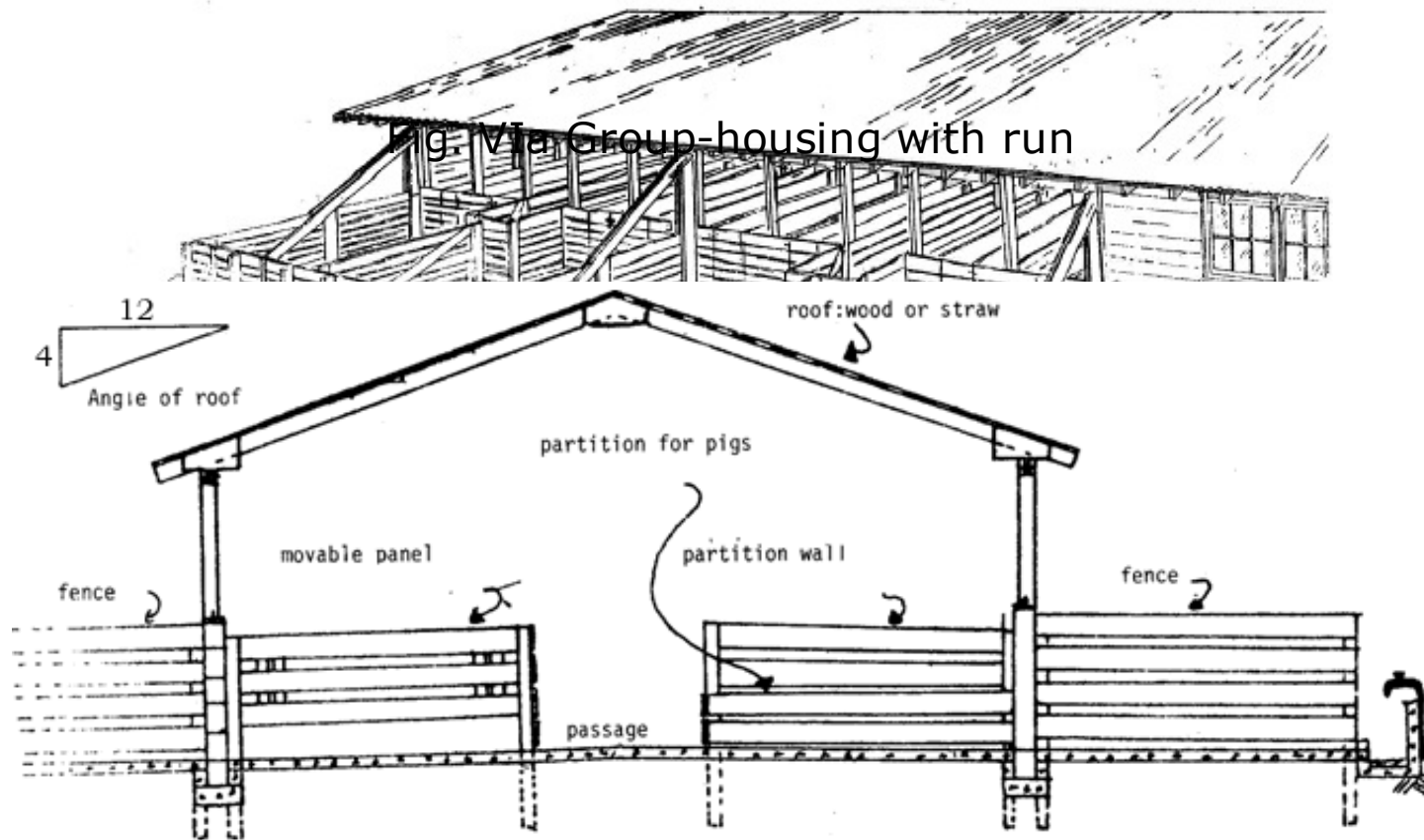


Fig. VIa Group-housing with run

Fig. VIb Group-housing with run (transverse section)

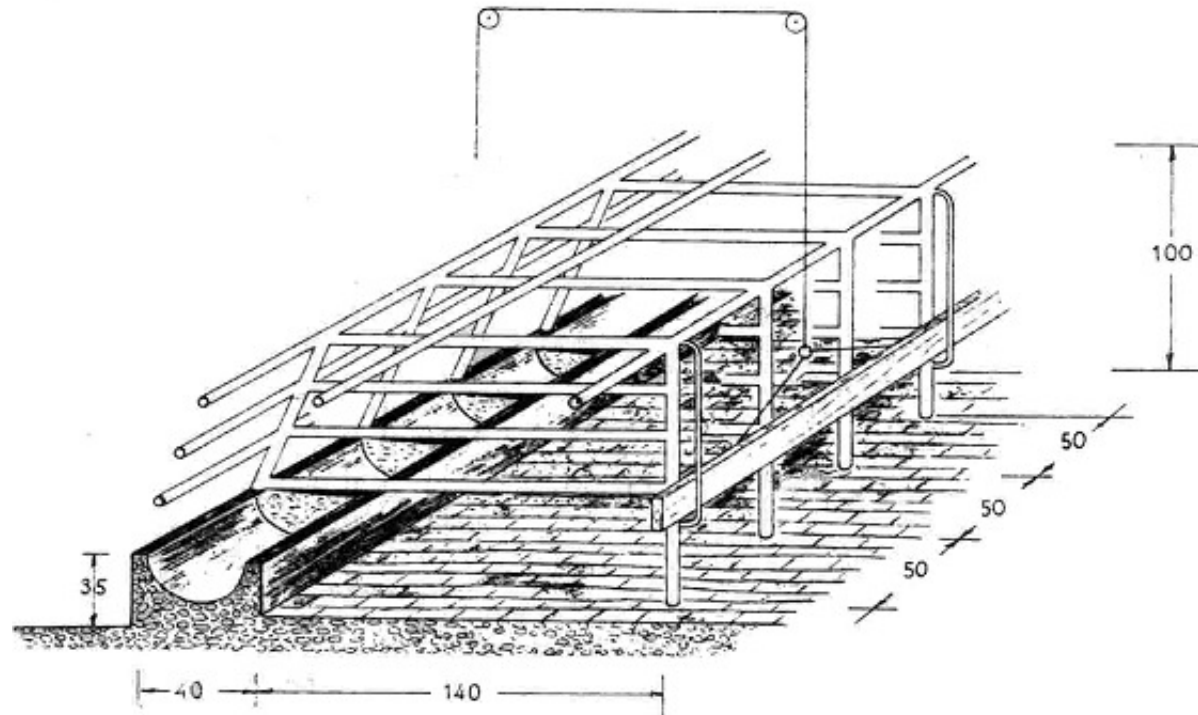


Fig. VII Separate feeding compartments for pigs (cm)

Animals of different size, for example an old and a young sow should preferably not be kept in the same pen. It sometimes happens that the weaker animal, when feeding, gets bitten and does not get enough to eat. The stronger animal will get fat at the expense of the other. However, if for one reason or another animals of different age and size have to be kept in the same pen, then precautions should be taken to ensure that they do not get in each others way while feeding. This is possible by separating the trough into compartments by means of railings (Fig. VII). These railings that have to be closed from behind,

could also be made of wood (these wear out more quickly).

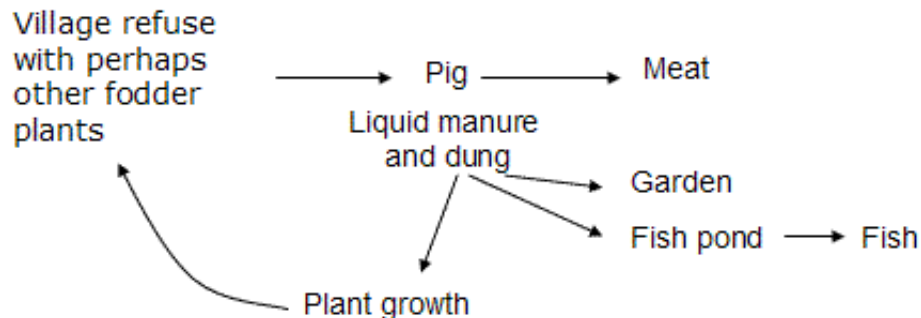
3. Some ways in which liquid manure and dung can be utilized

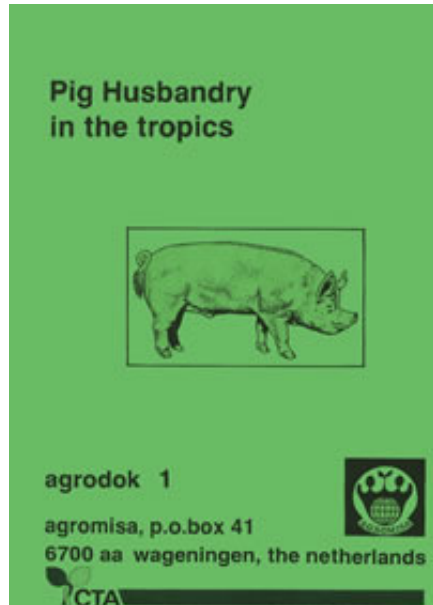
Pig manure and dung are good fertilizer for the land, so it is wise to make good use of them. Apart from manure in the field, in some areas a combination with fish ponds is possible. Also in water, the growth of organisms is stimulated by manure and dung.

If the effluent is allowed to flow into a fish pond this will stimulate the life of the micro-organisms and moreover promote the growth of plants.

The micro-organisms are the food source for *Tilapia* (*Tilapis mossambica*) a very productive fish, and others. Water plants growing on the surface of the water, such as *Ipomoea reptans* provide excellent greenfodder for pigs.










The following cycle occurs:





Pig Husbandry in the tropics

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-   IV. **REPRODUCTION AND FERTILITY DISORDERS**
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-  VI. **DISEASES AND DISEASE CONTROL**
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IV. REPRODUCTION AND FERTILITY DISORDERS

1. Introduction

The pigs that are to be kept for breeding should be separated from the litter after about 3 months. They should not be allowed to get too fat because this harms the fertility. Moving about a lot is very good for

them. When selecting the sows, the following points should be considered:

- they should have at least 12 normal teats
- they should be the biggest and heaviest of the litter
- they should have strong legs (not bandy) and can walk well
- the parents should be good breeding animals which are capable of producing a good litter at regular intervals

When the young sows are about a half year old, they are able to conceive for the first time. However, before mating it is better to wait until they are fully grown. If the animals are well fed and healthy, this is usually at about eight or nine months. Mating too soon results in small litters, problems at birth, loss of condition and poor growth of the sow. Mating will only be successful during the sow's oestrus period. Sexually mature, non-pregnant and non-lactating sows are in oestrus two or three days about every three weeks. Most sows are again in oestrus within one week after weaning. If the boar is kept away from the sows and gilts (young sows, not yet mated), which is very advantageous, it is very important to be able to recognise the oestrus period of sexually mature gilts and of non-pregnant sows.

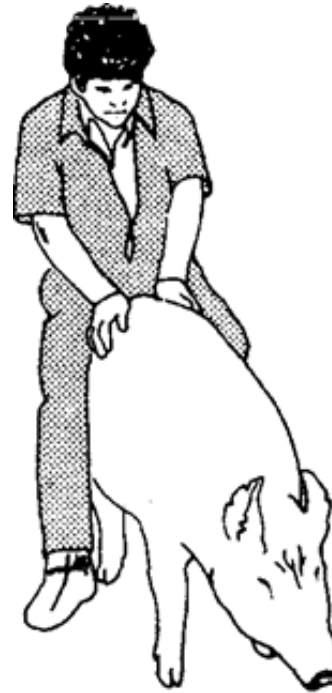
2. Recognition of oestrus

A daily check should be made of the sow's oestrus condition. This should not be done before, but some time after feeding, the best time is during the morning. Doubtful cases can be looked at again in the afternoon.

Differences in breed and climatic variations in the tropics, sometimes make it difficult to recognise oestrus. The first sign of oestrus is redness and swelling of the vulva. This is more obvious in gilts than in sows.

A clear indication is the reaction of the sow to the boar. If a boar is brought alongside the sow-pen, then an oestrus sow will go towards the boar. They exhibit a typical ear display (especially noticeable in breeds with erect ears). If the sow does not react convincingly, then the boar can be let into the pen. The boar noses in the vulva and prods the sow in the stomach. If the sow does not refuse the boar, he mounts her. A good oestrus sow will stand rigid, when mounted, with the back legs slightly apart (the so-called standing reflex). If a sow is in oestrus for the first time, it should not be mated again directly (see § 3). If there are other sows in the pen, these can mount her too. Also, without a boar the standing reflex can be initiated in a good oestrus sow. The animal should be approached quietly and prodded gently with the fist in the flank, after which the back is pressed with both hands. If the sow permits this, then you can try to sit astride the small of the sow's back (this does not work so well with gilts). If the animal does not move from her position, then oestrus is convincingly demonstrated.

Fig VIII Standing reflex in oestrus
SOW



3. The use of the boar

Normally, healthy oestrus sows and sufficiently mature gilts, should continue to be mated (the food supply and the sows' condition permitting). If oestrus passes without mating, then the animal has to be fed for three weeks until the next oestrus, without having made a contribution.

During weaning, emaciated sows should be allowed to regain their strength before they are mated again. This does not mean to say that the animals should be mated immediately at the beginning of oestrus, or for that matter at the end of oestrus, because this results in small litters.

On intensive pig holdings, the sow is usually mated within 24 hrs. after the standing reflex has been induced by man, that is without the use of the boar. This standing reflex is a characteristic of the sow at the most fertile moment of her oestrus. At this moment, the pig does not move away if she is straddled and her flanks are touched. On the contrary, she indicates that she will accept the boar (fig. VIII). However, one should be certain that this is the first standing reflex of her oestrus which is only possible by thorough regular checks.

At high temperatures especially the fertile period is shorter and less obvious. If there is some doubt about this, or it is left to the boar to detect the oestrus sow, then it is better to mate them for two consecutive days after noticing oestrus. Preferably at the end of the first and the beginning of the second day. If the oestrus is really doubtful then it is better to postpone mating until the next oestrus. Mating takes quite a long time, about 5 - 20 minutes. The animals should not be disturbed during mating, but it is advisable to keep an eye on them. Heavy boars should not be used for the lighter sows. Often a young boar is kept for the gilts and an older boar for the heavier sows. Three weeks after mating, the oestrus should be extra carefully controlled. If there is no sign of it then the sow is usually pregnant.

In choosing a breeding boar, the same factors should be taken into account as for the sows, also the presence of 12 nipples. Inbreeding should be avoided whereby fertility, growth properties and resistance usually generate quickly. Young, healthy and well developed boars should be used for the first time at 8 to 10 months. The first sow should

be preferably just as big or smaller. For the first time they should not mate more than one sow per week. This can gradually be increased to once, at the most twice a day until they are 1 year old, occasionally interrupted by rest periods, so that the boar does not mate more than 8 times a week and 25 times a month at the most. Older boars can be allowed to mate twice or at the most 3 times a day, and not more than twelve times a week and 40 times a month. Mating more often than this is injurious to the fertility and the health of the boar!

For every boar there should be about 25 to a maximum of 40 sows. The boar should be so fed that he is neither too lean or too fat. Boars should have plenty of exercise. When it is very hot and in an illness with fever, a boar can remain infertile for a long time. A boar that is very ill should be given a rest for 1 to 2 months and replaced by another during this period.

Some boars do not like to be in a pen alone and masturbate. The need often passes over when the boar is put with pregnant sows. If the boar is put with gilts and non-pregnant sows, much seed and condition may be lost with a loss of fertility as a result.

Moreover it is not known whether the sow has mated, and when this took place and whether she conceived. It is therefore advisable to keep the boar apart. If it is always noted down when a boar is mated with a certain sow, after a period of time details will be available about the fertility of the boar such as litter-size and the percentage of pigs that are pregnant after mating the first time. His performance can be compared

with other boars and on the basis of this he can be kept or replaced, keeping in mind that the sows too have some say in the litter size and fertility!

In general boars older than 3 years are put aside; they often become too heavy for the sows and are sometimes aggressive.

4. Poor oestrus show in sows

It sometimes happens that sows do not come to oestrus at the expected time, that is for gilts from 6 to 8 months and for sows within one or two weeks after weaning. Quite often oestrus has simply not been noticed. It also may be that the gilts do not come into oestrus because of poor health and growth etc. Hereditary factors play a role too. Well developed gilts that do not reach oestrus should therefore be replaced.

When selecting sows, as far as possible those should be kept that have a long and distinct oestrus period. If oestrus does not occur 14 days after weaning then this can be caused by:

- the suckling period has been too long, the shorter it is, the quicker the sow is in oestrus again
- poor condition
- poor nutrition or too little feed (after weaning the sow should not be given less food, but rather more)

Oestrus can be stimulated by preventing this and by:

- taking the sow away from the piglets during weaning, and not the other way round
- put the sow in a pen next to the boar, after weaning
- bringing the weaned sows regularly in contact with the boar.

It sometimes happens that sows thought to be pregnant (that is, oestrus not noticed again after mating) still do not deliver. They may have become infertile after this mating or after a termination of the pregnancy. These can better be rejected.

If all the remedies mentioned above have been tried without success, a hormone preparation RG600 can be injected if available. This should be done in consultation with the veterinary advisory service or the veterinary doctor (vet).

5. Diseases that cause fertility disorders

The diseases described below are characterised by abortion, that is a termination of the pregnancy, whereby the foetus and the placenta is rejected. Some sows eat this all up very quickly so that abortion may go unnoticed.

The occurrence of abortion is by no means always caused by the diseases described. Sometimes completely healthy animals will abort for inexplicable reasons. This is limited, however, to only a few cases of abortion to every hundred animals every year, so it is not alarming. If a few cases of abortion are noticed shortly after one another this could be caused by one of the diseases mentioned, but also from swine fever or

swine erysipelas. As soon as possible the vet should be warned or the veterinary service notified.

a) Contagious abortion (Brucellosis)

The initiator of this disease in pigs is not the same as that for similar disease in cows, sheep and goats. An outbreak coincides with sudden abortion in pregnant sows, followed by temporary or permanent infertility. The sows may abort at any stage of the pregnancy. Some animals may become crippled (inflammation of the joints) and boars may develop inflammation of the scrotum, with swelling and pain. There is no treatment for this. After a while, the disease may disappear spontaneously, but often comes back from time to time. In most cases, the animal should be slaughtered (this is compulsory by law in some countries). The complete holding should be cleaned and disinfected. For at least two months no pigs should be allowed on the holding. By means of a blood investigation, new animals should be controlled by the veterinary service.

Prevention: an infected animal brought from outside, is usually the cause (the disease is transmitted by mating etc). Also, if the sow is mated elsewhere, the disease can be brought in. One should be very cautious when buying animals. The disease is also infectious to humans!

b) Weils Disease (Leptospirosis)

The most important symptom of this disease is the aborting of many

sows, usually towards the end of the pregnancy. Typical here is that the piglets are often different in size. They have died at various stages of the pregnancy. Sometimes very weak piglets are born at the normal time. After the abortion the sows are normally fertile for their further life so that the disease dies out on its own accord within a few months. If during a leptospirosis epidemic, all the pregnant sows are injected twice, with a 1 week pause in between, with 25 mg dihydrostreptomycine per kg. body weight, in most cases an abortion can be prevented.

A similar pattern will appear by the so-called Smedi(virus)-infection. Especially newly bought gilts (that have not yet built up a resistance to the viruses present on the holding) may deliver a lot of dead piglets. These are often full term or even overdue, but have died at different stadia of the pregnancy, whereby they differ in size. Having experienced the disease the animals build up a resistance to it, and further reproduction takes place normally (such gilts should not be put aside!)

6. The birth and problems connected with it

a) Preparation

On average, delivery will take place 115 days after conception (3 months 3 weeks and 3 days) it usually takes place at night or in the evenings.

During the last 14 days of pregnancy, the udder increases in size. It feels firmer and the nipples stand out more at the end of the bearing

time. In gilts, the udder begins to develop after two months pregnancy.

About a week before the expected delivery, the sow should be put in a separate clean pen, preferably disinfected first. Before the sow is put in this pen, she should be de-wormed, treated for lice and mange, and if necessary washed with lukewarm water and soap and rinsed with 0.3% Halamid. Especially where there is a risk of disease to new-born piglets, the sow and the pen should again be washed and disinfected about 2 days before farrowing. It is advisable to give the sow plenty of straw and bedding material, so that she can make a nest. Fine litter is less suitable because the sow likes to chew it into small pieces, so if unable to do this, she will gnaw into the pen. The day before the birth, the sow should not be given food, but may be given a laxative (green fodder , for example).

b) The birth

About a day before the birth of the first piglet, the udder becomes clearly redder. From some of the teats some white or clear fluid can now be extracted. The sow becomes more alert, active, restless and starts to bite. She scrapes floor with her forefeet and using her snout she sweeps the straw bedding to a corner to make a nest. Just before delivery, the udder swells and the sow becomes quieter. Before the birth of the first piglet a slimy, bloodstained fluid comes from the birth channel. In gilts, this may be released earlier. Before and during the birth the piglets are enclosed in a membrane which usually breaks open at birth. Piglets are born in the head and tail position. On average, a piglet is born every 15 to 20 minutes. If this takes longer than 11 hours then there is usually

something wrong. Two small piglets may be born very quickly after each other. Although there are normally very few complications at birth, it is still advisable to be at hand. Especially the last piglets may be born in the membrane and many suffocate if they are not taken out. Moreover, the sows do not pay much attention to their offspring until all the piglets are born. Piglets that waste no time in the search for milk may easily be crushed if the sow lies down again in the course of the delivery. By intervening in time, this can be prevented. A few sows will not tolerate any human presence during the birth. By keeping an eye on things from a distance, the necessary intervention can be made if there are problems. Many piglets are born while they are still attached to the umbilical cord. This is left alone, it usually breaks off itself.

The sow may suck blood from the placenta to build up her strength. After a few minutes, the umbilical cord can be pulled away or cut if necessary (to \pm 5 cm length). Directly after birth the navel is soaked in a cup of iodine solution to prevent inflammation and tetanus.

Between the birth of the piglets, some afterbirth may come off, but usually this comes off all together, between 1 and 2 hours after the last piglet has been born. Each piglet is rubbed dry with a cloth and put to the udder. The groping and sucking of the piglets stimulates the womb and the milk flow while the piglets can quickly get the invaluable colostrum that will protect them in the coming weeks against diseases. Piglets that are born too soon (before 110 days) have a parchment-like skin, they often have no hair or it very short, appendages to the claws, closed-up eyes, often very red,

breathe with difficulty, and stray through the pen trying to find the nipples. Most of them will not survive.

Piglets that have difficulty in breathing (breathe only a little and irregularly) or even appear to be dead can be helped by holding up their hind legs. By pressing the thorax rhythmically, breathing can be stimulated. Pouring a little cold water over the head and chest can help, but the piglet should be dried off afterwards. Normally about one pig in 20 is still-born.

c) Slow-Delivery

If the delivery does not make headway or it takes a very long time then the first pig should be delivered by hand. Utmost hygiene is essential.

The backside of the pig as well as the hands should be thoroughly clean and even disinfected. The hand and the vagina is lubricated with vegetable oil or vaseline (avoid soap) and the hand slowly entered into the vagina with a slight rotary movement. Contractions are often stimulated and the piglet is driven off. If this does not work the sow can be injected with 5-10 units oxytocine (not more), on the market under different names. If this has no effect after an hour, then the piglet can be released, preferably by someone with a small hand which is clean and lubricated. If after waiting a while there is still nor result, then another injection can be given. If the piglet is really too big, then a Ceasarian operation is the only solution.

If there is no vet at hand then the sow will have to be slaughtered. For safety sake, this possibility should be thought about earlier.

d) Eating of the Piglets by the sow

It is normal that many sows eat the afterbirth and the still-born piglets. Some sows, especially gilts, are for mainly unknown reasons, aggressive to their litter. When farrowing, the gilts may be frightened by the new born piglets and try to avoid them and start biting. If this happens, the piglets should be put in a box with a heating lamp, and the sow usually becomes quieter, If this has no effect then the sow can be given beer (1 or 2 bottles) after farrowing or a similar quantity of alcohol, if necessary mixed with sugar (more palatable). If the sow continues to bite after this treatment, then her snout should be closed with a ring that is tied behind the ears with bands. This can have an adverse effect on some sows, for example, they stop giving milk or they wound their piglets with their head. If available 'Stresnil' (2 mg/kg) can be injected, this is a sedative. Some people maintain that the eating of the afterbirth is an encouragement to start on her piglets too.

If the sow gives too little milk, the piglets sometimes get so excited that they damage the udder and make the mother aggressive. As far as possible, these sows should be well fed. One or two injections of 10 units Oxytocine encourages the milk flow so that the piglets get enough milk and quieten down. In extreme cases, it may be necessary to trim the piglets teeth to prevent them wounding the udder. If the sow gives too little milk, the piglets should be given additional food (see under e and

g).

e) The sow becomes ill after farrowing

The most common disorder of sows directly after birth is a combined uterus and udder inflammation (metritis and mastitis). The sow is dazed, remains lying does not eat and has a fever. Sometimes a whitish-yellow, sometimes offensive substance flows from the vagina (It is normal after the birth that for a small amount of red coloured slime comes away for a few days; often there is hardly a flow). If a bloodstained, offensive liquid is exuded from the vagina, then this should be checked to see if there are still piglets inside. If so, then they should be released, in the manner as explained in § c. One or more of the udders may be hard swollen and red to reddish-blue in colour. Usually this starts at the back. The milk production diminishes rapidly, whereby the piglets become hungry and start to squeak and screech. As soon as possible the sow should be given an injection of oxytocine (15-20 units) and with an antibiotic (penicilline/streptomycine. (oxy)tetracycline or chloramfenicol). If this treatment does not have any effect after a day, then the antibiotic should be changed. The sow may become constipated. This can be eased by a laxative (lettuce, fruits etc.). Oil or lard can also be mixed with the food. If constipation is persistent castor oil (wonder oil) or Epsom salt can be given. The salt should then be dissolved in a small quantity of water. To avoid constipation at the time of the birth, daily one or two tablespoons of Epsom salts should be mixed with the feed, anyway extra green leafy feed should be added. The hungry pigs should be kept warm(lamp) and given additional feed with goat or cow milk for

example, or a sweetened porridge of bean meal. In extreme cases, the piglets should be put with another sow or artificially reared (see below).

Prevention

- hygienic measures (clean pen, washing the sow etc.)
- at the time of the birth, do not disturb the sow, do not suddenly change the feed etc.
- a few days before the birth, reduce the quantity of food a little, on the day itself reduce considerably and after that increase gradually.

f) Anaemia in young pigs

Young pigs that are kept in a pen with a concrete floor may quickly develop serious anaemia, because the sow milk on its own does not have enough iron to cover the piglets need. After two or three weeks they become pale and grow slowly. They may develop a fat neck. This can be prevented from the birth by daily putting a shovel of 'clean' iron-rich soil or compost, perhaps with wood and ash added, into a corner of the pen. The piglets can rummage around in it and take up some of the iron in the soil. Much of the red, brown and yellow soils in the tropics contain adequate iron. Healthy 2-4 day old piglets may be injected with an iron preparation, but these are expensive and can result in the death of the weak piglets.

g) Artificial rearing of motherless piglets

If a sow dies shortly after farrowing, then the piglets will have to be reared by hand, or better still, let another sow take over the mother role. Also, if the sow gives too little milk, a number of piglets can be brought over to another sow, or the remaining pigs reared by hand. Artificial rearing of pigs is laborious and usually presents problems, so it should always be attempted to give the piglets to another sow, that has farrowed less than 3 days ago. This is usually successful if the piglets are all given the same scent (refined oil). If this does not work, or what more often is the case, there is no sow available, then the piglets must be reared by hand.

They are put into a clean pen, preferably with straw and kept warm. The ideal temperature the first week is 30°C (day and night) decreasing to 25°C after a fortnight. If necessary, a heating lamp should be hung in the pen at night and a thermometer. Some soil is put in the corner of the pen to protect the animals from becoming anaemic. The first two days the piglets are fed, with regular intervals, 5 times a day, about 10 minutes each time. On the third and fourth day they are fed four times and after that 3 times a day until they can manage with normal food, usually at about 3 weeks. If no nutritious feed is available then they should continue to get milk for a longer time. After the last feed of the day, boiled lukewarm water should be put in the pen, about twice the quantity of a milk feed. The weaker brothers /sisters can be fed four times a day for a longer time. As milk, fresh cow or goat milk can be used, even sweetened with sugar or syrup. This should not be diluted - milk from the sow is very concentrated. The milk is warmed up slightly above body temperature (37°-40°C) by placing it in a pan that is again

put in a larger pan of boiling water. This is given to the piglets in a shallow trough, so that they can easily get at it. At first the piglets have to be taught how to drink by holding the snout in the milk. After every feed the bowl must be thoroughly cleaned and dried and occasionally disinfected. To avoid indigestion, the piglets should not be given too much.

The following table serves as a guide.

Day	Number of times	Quantity each time in ml.
1	5	30
2	5	40-45
3	4	60
4	4	70
5-7	3	80-100
8-9	3	100-110
10-11	3	110-120
12-14	3	120-130
14 and after	increase quantity each time, gradually decrease the number of times per day, change over to regular feed	

These figures give the maximum quantities. It is better to give too little than too much feed. Every day, water should be available. It is better to boil this to avoid contamination. As soon

as possible pigs should get regular food. This should be good quality with much protein and easily digestible. In spite of all the attention given, it should be remembered that pigs reared in this way will always grow less quickly than their sow-reared colleagues.

7. Teeth Trimming and Castration

If the piglets tend to fight, then the tusk teeth should be trimmed. This will stop the piglets from fighting for a teat and biting into it, for which the sow is very sensitive. If the piglets are less than 2 days old then the whole tooth can be cut away. If the pigs are older, then not more than half of the tooth (or 1/3) should be removed, because the teeth are harder and the remainder can be damaged (fig. IX)

Castration of the male pigs, necessary for good quality meat and to calm the pigs when they become sexually mature, is best done in the 4th or 5th week. The animals should be healthy; if not, it is better to wait until they are fit. Castration of a pig, requires two people: one holds the pig securely on its back with head directed towards the person concerned, who secures the pig's head between the knees. The other person operates with the sharp knife disinfected with lysol solution.

The scrotum should first be washed and smeared with a disinfectant solution. One of the testicles is pressed against the

skin and an incision is made, large enough to allow the ball to be pressed out. The cord by which it is attached is torn off alongside the knife. This should not be cut off in one operation, this causes more loss of blood (fig.X). Afterwards the wound should be washed out with a disinfectant, lysol for example. The other ball is treated in the same way. A dry and clean pen is indispensable.

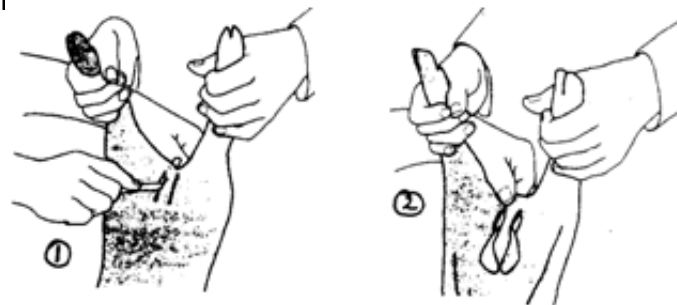


Fig. IX Teeth trimming of the piglets

Fig. X Castration of the boars

8. Administration

For those farmers who keep more pigs with the intention to breed, and who are unable to rely on their memory, a good administration is necessary so that he can compare his records with others and is able to review the whole set-up.

The purpose of this is to put down on paper simply and clearly all important data and happenings, also the activities that have to be carried out. An example of this is given on the next page. On a chart or a piece of paper, vertical columns are drawn, one for each month, over a period of 1 or 2 months for example. The sows are listed underneath each other in a horizontal column, giving the name, number or description and their date of birth. In the partition all the relevant details are noted in code form, for example B for birth, followed by the day and the month when things took place.

The following matters, for example, can be noted down as shown.

0 17-19	Oestrus from 17th to 19th of the month

M 18 (Hannibal)	Mating on the 18th by boar Hannibal
K 9(-)	Control for oestrus on the 9th, that is 3 weeks after mating. The sow showed no signs of oestrus (-), she is therefore pregnant. Birthdate can be established, that is 115 days after mating. It can also be charted when the sow comes into the delivery pen (that is, 2 weeks before farrowing). If the sow, on control, appears to be in oestrus, then mate again and fill in when the next control took place (that is 3 weeks after mating).
S4	Separate the sow, on the 4th of the month, this is about 15 weeks after mating. De-worm etc.
B (21/4m,3f)	Birth on the 21st, a litter of 4 boars and 3 sows. (the number of still-born piglets, the weight etc. can be mentioned also).
W 7(3m,3f)	Weaning of the litter on the 7th , 3 boars and 3 sows (one of the boars has died).
Ab.	Abortion
D	Disease (in a separate column, details, treatment etc. can be mentioned).

Example of Administration

Sow	date of birth	jan.	feb.	march	april	may	june	july	august
1.	3-4-82	015-16	05-7 M6	C27(-)		S22 B31(4m,3f)		W21 (3m,3f)	01-2 M2 C22(+)

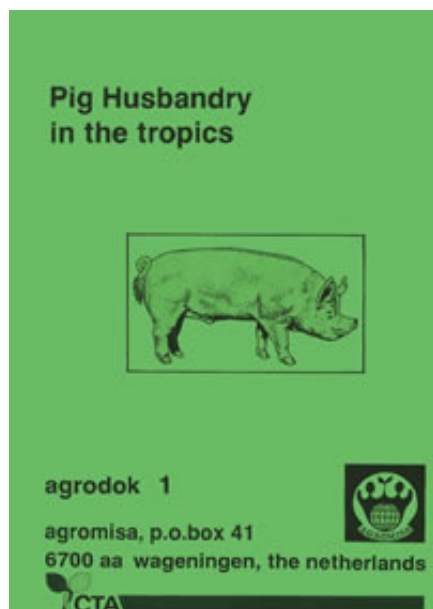
In the following table it can be quickly seen when the delivery is expected, knowing the successful time of mating (date of mating + 116 days)

Table giving date of mating to the expected date of delivery

Date of mating		Expected delivery date		Date of mating		Expected delivery date	
January	1	April	26	July	5	October	28
	6	May	1		10	November	2
	11		6		15		7
	16		11		20		12
	21		16		25		17
	26		21		30		22
	31		26		4		27
Febr.	5		31	Aug.	9	Dec.	2
	10	June	5		14		7










	15		10		19		12
	20		15		24		17
	25		20		29		22
March	2		25	Sept.	3		27
	7		30		8	Jan.	1
	12	July	5		13		6
	17		10		18		11
	22		15		23		16
	27		20		28		21
April	6		25		3		26
	11		30	Oct.	8		31
	16	Aug.	4		13	Feb.	5
	21		9		18		10
	26		14		23		15
May	1		19		28		20
	6		24	Nov.	2		25
	11		29		7	March	2
	16	Sept.	3		12		7
	21		8		17		12
	26		13		22		17
	31		18		27		22

June	5		23	Dec.	2		27
	10		28		7	April	1
	15	Oct.	3		12		6
	20		8		17		11
	25		13		22		16
	30		18		27		21
			23		31		26



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V. PIG FOODS

1. Introduction

Pigs are omnivorous animals, that is to say, their food can be of both vegetable and animal origin. Moreover, in general a pig is not particular about its food. So pigs can be given almost everything.

From various findings it has been shown that the pig is one of the oldest domesticated (agricultural) pets. (with the dog). In the vicinity of humans, pigs have found sufficient to their liking to be able to survive and multiply. This should not imply that it does not matter what feeds are given to the pig. Stalky fibrous plants are not digested by the pig and therefore poorly utilized. Hay, straw is most unsuitable for pigs although they will eat it in time of need

Hay and straw are ate best, however, only suitable to keep older animals alive, growth and reproduction are out of the question. In similar, extremely difficult circumstances the pig takes up its own excrement again (coprofagy) partly after passing through the second time and partly because vitamins etc. are formed on the intestine that can be utilized during the second passage. If it is expected that pigs grow very quickly and have many healthy offspring, then partly foodstuffs are necessary which also could be used by man: grains, rootcrops, milk products. It depends on the local situation in how far this competition can be permitted. The conversion of grain into pigmeat and subsequently for maintenance and growth of man entails more losses than when grain is consumed by man directly.

2. The Digestive System

The digestive system of the pig, compared with other agricultural domestic animals, is most like that of man. After the food has entered the mouth, (devoured) it passes via the gullet into the stomach. There digestion begins properly, the gradual breaking down and making soluble of the food material. Although pigs have good teeth, the food is not well chewed. With the result that, for many centuries, man has introduced ways to break up foodstuffs into small pieces (by grinding, flattening and rolling and by crushing). Around and inside pyramids, pictures can still be seen of reduction equipment, for example, the grinding stone. After the food in the stomach has been mixed with the digestive juices, it passes to the small intestine where further digestion takes place by enzymes from the intestinal wall and from the pancreas and bile from the liver. In so far as the food is digestible, it will be broken down in the small intestine into soluble substances and can pass through the intestinal wall into the blood and transported to those organs or cells where the components are needed.

Insoluble substances pass into the large intestine where the many bacteria act upon them, multiply in great numbers and finally are excreted with the dung. Only water and salts (minerals) can pass through the large intestinal wall. The bacteria in the dung, however, are digestible to the pig and are rich in vitamins. If this dung is taken up (coprafagy) the nutrient intake will be adequate. However, the pig only resorts to this in an emergency.

3. Feed Composition

Although feeds vary considerably in composition, there are some similarities and comparisons that can be made:

Feedstuffs contain:

Liquid:

Sometimes a lot, for example milk, tubers, grass; sometimes only a little: mature cereals and seeds

Minerals:

In vegetable feedstuffs the differences are fairly slight; in animal products the differences may be much greater

Protein:

The quantity of protein may vary considerably from plant to plant and even from one part of the plant to the other. This applies to the animal products too: milk contains little protein, fish meal has a lot. Concerning proteins, not only the quantity is relevant, but also the quality. The quality is determined by the source from which the protein is built up. Animal protein with few exceptions are of high quality, vegetable proteins are less valuable, but within the large group of vegetable protein, there is a lot of difference: soya protein is valuable, grain proteins is of

moderate quality, pulses are better. These protein values are very important to the pig feed, because the pig has to make do with the feed that it is given. In cows, buffalo, sheep and goats the protein quality is less important, because in the stomach various protein conversions and building processes take place.

Fat:

The fat level in feedstuffs varies considerably. Only in exceptional cases there is a risk of fat shortage. If the feed contains a lot of fat, this may cause diarrhoea. The fat in the feed influences the pork quality that is obtained. Products with an oily fat such as maize and rice etc. will result in a tender pork quality. Products with still a lot of firm fat even at high temperatures will produce a compact bacon quality (copra for example). For preservation, this aspect is important: the firmer the pork the longer it can be kept. In general, the fat level of the usual feeds is low.

fibrous tissues: in man and animals it is the skeleton which gives the shape and posture, in plants this is determined by the fibrous tissue. Fibrous tissue is also called crude fibre. The amount of crude fibre varies considerably. Animal products contain more than 40%. In a growing plant the amount of crude fibre increases as it gets older. Young green fodder can still be digested by pigs, older plants are more difficult. Crude fibre deficient plants are: young green feeds, tubers and roots. Also many cereals and seeds are fairly low in crude fibre. Pigs prefer

fodder that is low in fibrous tissue. Cows and other ruminating animals have in contrast a composite stomach in which fibrous tissue can be broken down easily.

Starch and starchy materials:

Apart from moisture, minerals, protein, fat, and fibrous tissue , one component remains, the carbohydrates. Of these starch is the most important, followed by the sugars. The animal body is capable of converting this starch into body fat and if there is adequate protein of good quality, into meat etc. The starch level varies considerably. In animal products there is very little (animal meal, fish meal) or some(milk, milk products);in cereals, seeds and some tubers there may be a considerable amount (cassava).

The digestibility of the protein, fat, starch etc. and the crude fibre too is strongly dependant on the percentage of fibrous tissue. Every plant cell has a cell-wall of fibrous tissue, within the cell-wall the protein, fat and starch are enclosed. The quicker the cell-wall breaks down, the quicker the contents are released. The digestible organic components (protein, fat, starch, fibrous tissue etc.) provide the energy supply for the pig.

This energy is necessary for:

maintenance	to maintain body temperature and the replacement of dead cells.
labour	movements requires energy

growth	increase in weight depends as well as water and minerals, protein fat and a little starchy material, these provide energy. Fats provide a lot of energy, protein a moderate amount and starchy materials the least of all.
reproduction	the foetus contain proteins, fats, starchy materials, therefore involves energy.
milk production	milk consists of water and minerals as well as proteins, fats, milk sugar and some vitamins, all carries of energy.

4. Feed requirements

Usually 3 criteria are given for the requirements of the pigs:

a) dry matter: the pig, as all animals, has a certain stomach and intestine requirement, but the amount is limited. The dry matter quantity seems to be the best standard. Pigs that take up more than 5 kg per day(that often concerns the lactating sows) are an exception.

b) energy: it has previously been stated why energy is necessary.

Energy can be provided by starchy materials (the cheapest source), fats (more expensive) and if necessary proteins (very expensive). Rich sources of energy are: the cereals, the legumes (contain quite a lot of protein), tuber and

root crops. The by-products of human foodstuff production can be very well used in the pig feed (waste of flour milling, fat extraction etc).

c) protein: protein is necessary for up-keep, growth, reproduction and milk production. As well as the quantity, the quality of protein is of great importance. If available, some animal protein is desirable.

Besides these, minerals and vitamins play an important role. The minerals calcium and phosphorous are very important, but also the trace elements such as copper, zinc, iron etc. are required in small quantities. For optimal production (growth, reproduction, lactation) a good vitamin supply is essential.

5. Practical aspects of feeding

It has previously been pointed out that pigs as well as being a valuable source of food (meat, fat), are at the same time in competition with man for such beneficial products as cereals legumes, roots and tubers, milk and milk products. In areas where human food, and protein content considered from its energy point of view is scarce, then the use of cereals etc. (quantitative), for feeding the animals should be considered very carefully and judiciously. Often feeds will have to suffice which are not directly suitable for man or waste products of the human foods. This does not mean only the by products of the food and

confection industry (bran, molasses etc.), but also kitchen waste and garden refuse.

Energy sources: cereals, cereal waste
tuber and root crops
pulses
molasses
young green fodders, kitchen waste

Protein source: pulses
young green fodder
animal waste products
kitchen waste

In a varied diet, the vitamin supply will be adequate, but if animal protein is lacking, then the vitamin B₁₂ may be affected. For good measure, a shovelful of cow, buffalo, sheep and goat dung (ruminating animals) should be put into the pig-pen every day. This type of dung contains all the B-vitamins. Where vitamin compound (with calcium and phosphorous) are available, a dose of 50-100 gm. per animal every day is advisable (pigs above 15kg). By boiling tubers and kitchen waste in sea water, the mineral requirements (with the exception of phosphorous) will be satisfied in an economical way.

Pigs above weaning age (usually above 12 kg body weight) can

suffice with a ration containing $\pm 13\%$ protein. Cereals and cereal waste will not provide more than 10% protein. Peas and beans provide 20% . That means that a mixture of 2 parts cereal or cereal waste + 1 part peas and beans will satisfy the 13% protein requirement mentioned above. Still better is to add 3% minerals to every 100 kg mixture. Tuber and root crops are usually very poor in protein. 1 kg peas and/or beans with tuber- and/or root crops can be given according to the animals' need. If young greenfodders, leaf waste of vegetables etc. are available, then it will be sufficient to give daily $3/4$ kg peas/beans with plenty of other feed. If the animals are able to grub in soil, then the need will be smaller. Soya beans, if used, should first be cooked. Because these beans contain more than 30% protein, smaller quantities will suffice. Shelled groundnuts (24% protein) if free from mould, can also be used in the pig feed. If 250 to 300 gms. of protein is given daily in the form of protein rich products, then the feed can be supplemented with products poor in protein, whatever these might be. With cereals and cereal by-products, 200 gms of protein from the protein richer products will suffice. If milk or milk products, animal or fish meal are present, then the piglets and lactating sows should be given priority. Only if there is a surplus can the pigs that have been weaned be given this. Fibrous products are not very important in the pig feed. Unknown products which may be unreliable, they may be poisonous for example, should first be cooked or boiled. Many poisonous products cannot withstand high temperatures if you can make a

mixture of 20% protein and every day 1 kg is given, then all other less protein rich products can be fed with it. If a 30% protein mixture is possible then 600 gms. is enough and with 40% protein, 500 gms.

This has to be supplemented continually with other feeds, according to the animals' need. (peas, beans, lentils, china beans, vetches contain $\pm 20\%$ protein, orobus and chick pea $\pm 16\%$ protein; lupins (boil!) and soybean $\pm 30\%$ protein). Cotton seeds, safflower seed and cabbage seeds are dangerous for pigs and are not eaten.

A sow with piglets requires extra attention, of course

If sows are fed adequately (not forgetting water!), the piglet can certainly be suckled for 6-8 weeks; this is not advisable for a longer time because the sows get too thin. During lactation the sow should be given extra feed: ± 1 kg meal for each suckling pig per day in addition to a ration of 1 kg meal (20% protein) for example with other feed. If the sows are pregnant again, they can be given less feed. Piglets pass through a difficult stage, from 2-4 weeks. Their milk requirement exceeds what the sow can give and the supply of iron with which they are born, is then used up. As far as possible, easily digestible food (cereals) should be given and a shovel of soil should continually be put into the pen every day to supplement the iron deficiency. The feed for the piglets should be kept away from the sow. If animal protein can be incorporated into the pig feed then this is ideal. Also some

young green (which should contain 18% protein), fodder is very healthy for these piglets.

6. A few final remarks

Molasses should be used with care; it moulds and ferments very quickly and if given in large quantities diarrhoea will set in. However, molasses may be used if the feed is less appetizing. Molasses consists of 50% sugar!

Liquid deficiency results in a reduced feed intake; water or another liquid (milk etc) should be given as required.

The practical tips above apply for difficult circumstances; in areas where manufactured complete feeds or nucleus feeds can be bought, these are preferable. Complete mixtures are given with water. Nucleus feeds (with 20, 30 or 40% protein) are a supplement to the products available on the holding. Regular disinfecting of the feeding trough is advised because mouldy or rotten food leads to diarrhoea, often fatal for young pigs.



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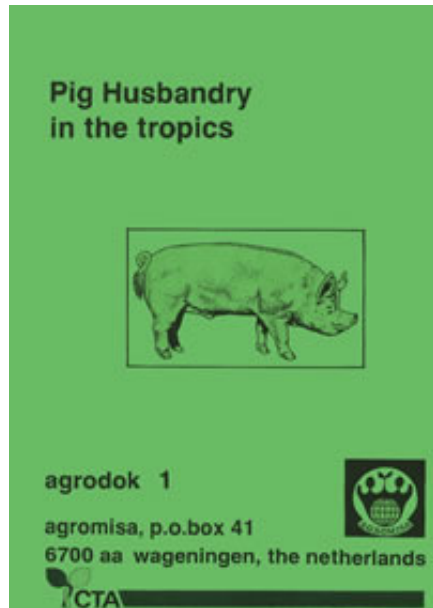
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VI DISEASES AND CONTROL

In pig husbandry, hygiene is of great importance. Prevention is better than cure. Not only because a sick animal is unproductive, but also because control remedies are either unavailable in the tropics or difficult to obtain. Moreover they are often very expensive. The causing agent of the disease becomes quickly resistant to some medicines. Other substances such as DDT are very dangerous to man and animal.

Therefore great care should be taken to ensure that disease germs are not transmitted to healthy animals via footwear, clothes etc. Even insects, wild animals and rainworms can bring over infection. Therefore, take precautionary measures. In the event of disease, antibiotic and sulphur preparations are commonly applied. Antibiotics are substances

that check the growth of harmful micro-organisms. These substances, on the market available in quantities of 10-20 mg and mixed with the food and given to the animal every 24 hours. A few exceptions to this are:

Tetramycine: 3-4 mg per kg. body weight(BW) injected, usually for 5 consecutive days.

Chloramphenicol: **4-10 mg per kg BW. Usually 5 days following. Inject twice daily or double (2x) dose mixed through the food every 24 hours.**

Depomycine: is penicilline + streptomycine

Streptomycine: **10 mg per kg BW in the drinking water every 24 hours. Keep on for 6 days.**

Furoxone: is Furazolidone, 10-15 mg per BW in the drinking water.

Sulphur preparations are chemicals against intestinal inflammation. For every kg BW 100 mg should be injected.

If disease prevails the pen should be continually cleaned and disinfected with halamid or 5% sodium hydroxide (NaOH). When the slaughter pigs are sold, the pen should also be disinfected before the new pigs are housed again. All animals that die of a disease should be burnt to prevent further contamination. Also, the meat of healthy pigs may become contaminated with parasitic germs. It is therefore important always to cook meat well, or fry it before eating.

Up to a point, death of piglets is acceptable. In Dutch circumstances a piglet mortality of 15-20% is usual.

In broad outline, diseases can be subdivided into 5 groups as follows:

- 1. viral diseases**
- 2. bacterial diseases**
- 3. parasitic diseases**
- 4. feed related diseases**
- 5. other diseases**

In short , a few diseases will be described.

1. Viral diseases

A.-Swine-fever

The cause is a virus that is very contagious. The symptoms that may vary from hardly perceptible to very serious, in the pregnant sow are:

- a) the animal may be very ill for a few days with high temperature and constipation, after which it recovers again.**
- b) the animal is seriously ill, high temperature (between 41-42°C), diarrhoea, unsteady walk, sometimes bleeding**

in the skin (visible as brown blemishes)

c) as well as these symptoms, the sow may abort.

In fattening pigs see a) and b)

In the piglets:

- the chronic symptoms: retarded growth of piglets; diarrhoea - they are rather pale and slowly die**
- the acute picture - diseased piglets huddle together, pale, diarrhoea, high temperature (41-42°C), unsteady gait, sometimes brown blemishes on the belly skin.**

Sometimes a piglet in the litter suddenly dies (pale body with skin bleeding). The rest of the pigs are often normal.

There is no treatment for this disease; only a preventative vaccination can control the disease. This vaccination (with the so-called chrystal violet vaccine) is given to pigs at the age of 8 to 10 weeks, sows and boars yearly.

B. African-Swine-Fever

This is another disease than ordinary swine fever. The illness starts with a rapidly developing fever. A characteristic of the disease is that the animal remains lively in the beginning and eats normally. About 48 to 36 hours before dying the pig becomes

restless and stops eating, lies down a lot, is weak in the back legs. Sometimes the pig has runny eyes and nose discharge (sometimes with blood) and vomits. Often, the skin is reddish-blue (especially the legs). There is no treatment for this disease.

C. Swine-Erysipelas

This disease is often confused with swine fever. To illustrate the difference, the two diseases are compared as follows:

Swine erysipelas

constipation or rather soft dung

pink skin, with often indented blemishes (you can put your thumb in)

no appetite

stiff, limping gait

screeches hoarsely when roused

disease manifests itself in hot weather

only one or a few pigs ill in the

Swine fever

obvious diarrhoea

pale skin, brown blemishes, not indented

poor appetite, often abnormal appetite

weak, meandering gait

grunts

disease can occur throughout the whole year

herd**more pigs ill at the same time**

The treatment is with injections of penicilline and spot disease serum. The treatment is not always effective.

D. Pneumonia

This condition may be caused by bacteria, virus (usually by both at the same time and parasites (lungworms and intestinal worms that have found their way to the lung). The condition is worsened by: too many pigs in a small space, low temperature, draught, air humidity too low, dusty surroundings. The illness is more prevalent in the rainy season. At this time the pigs should have dry and draught-free conditions. The animals cough especially after exertion and when roused and breathe with convulsions. More-over they are retarded in growth. If the condition is caused by viruses and bacteria, then antibiotica is given (streptomycine-penicilline, chloramphenicol, tetrecyclines). Against lungworm, Ripercol R is given.

2. Bacterial Diseases

A. Intestinal inflammation or enteritis

There are many forms and causes of this disease (wrong feed and many microorganisms). It is not possible here to describe them all at length. A few of the following symptoms may be noticed:

apathy, (high) temperature, no appetite, diarrhoea (sometimes with blood), loss of weight. If food is the cause, then for one or two days only clean water is given, after that gradually feed up again; this is also the treatment if the cause of the illness is the too sudden change over to other feed.

In short, a number of very common forms of intestinal conditions are mentioned.

a) intestinal parasites (worms): there are many forms of these which especially cause many losses to piglets. Contamination occurs when worm eggs are taken up, they are microscopically small and are found in the dung of infected pigs, in the straw, in ditches, and other places frequented by pigs. Hygiene plays an important role. Medicines that can be given with the feed are: chenopodium oil, sodium fluoride piperazine, A-gard, thiabendazole. It is advisable to de-worm the sow before farrowing takes place.

b) Clostridium enterotoxaemia, usually in pigs 1-5 days old. There is no good therapy. The sows can be inoculated, whereby the piglets build up anti-bodies via the sows milk

c) Transmissible gastro-enteritis(TGE) - in pigs of all ages, they have a watery soft diarrhoea. No therapy is possible.

d) Dysentery (Doyle) - variable success with one of the following medicines: tylosine, spiramycine, preparations with organic arsenic compounds, preparations with dimetridazok.

e) Salmonellosis; therapy: injection of chloramphenicol (50 mg/kg light weight) or neomycine (20 mg/kg light weight) for 3 days.

f) Intestinal problems caused by E.coli bacteria, Therapy:antibiotics.

B. Tetanus

If a deep closed wound is caused, for example by standing on a rusty nail, then tetanus bacteria can develop. The animals finally die as a result of a severe cramp condition. There is no therapy.

C. Mastitis

This disease affects the udder tissue and can result in permanent damage with the result that breeding pigs can no longer be used. To a degree infection can be avoided by hygienic measures on the holding. If an udder inflammation is noticed, the milk should first be drawn off before an antibiotic is injected into the udder.

D. Anthrax

This is dangerous to man and other animals. Acute condition with a bloodstained fluid coming from all the body openings. The body should be burned, not buried. The disease germs can survive in the soil for years. In a field where anthrax has been, as far as possible, cattle should be kept away. The affected animals are usually found dead in the field.

E. Brucellosis

Causes infected delivery in female animals and infection of the reproductive organs in the male animal. Sterility may occur. In the female, a cure is possible; antibiotics can be tried, but it is better to dispose of infected animals. The boars should be carefully controlled because the germs from the boar can be transmitted without the boar itself being ill.

F. Trypanosoma simiae

This is transmitted by the Tse-Tse fly. The infected animals have a fever, no appetite, fast breathing. Prevention is only possible by destroying the Tse-Tse fly. In areas where this fly lives, pig breeding is almost impossible.

3. Parasitic diseases

A. Intestinal parasites (worms)

Worms are one of the most serious threats to pig-breeding, because more there are than 30 types, that can affect the intestinal wall. The most important are: the intestinal roundworm, the lung worm, the kidney worm, the stomach worm and the tape worm. Contamination takes place when the worm eggs are taken up; these are microscopically small and are found in the dung of infected pigs, in the straw, in ditches and other places where pigs are to be found. Piglets can be treated against them, but the best remedy is a good hygienic care.

Medicines for de-worming that can be mixed with the feed are: chenopodium oil, sodium fluoride, piperazine preparations, A-gard and thiabendazole 0,1%

B. Lungworms

The affected animals cough when disturbed and grow poorly. General hygienic measures are necessary to control the disease. Injection of ivermectin is a cure, but this is very difficult to obtain.

C. Mange

This is an irritating external parasitic disease. It is caused by small mites such as the small grass louse. They cause severe itching and irritation. Especially the skin between the legs, around the eyes, ears and neck is affected. Treatment: removal of scales and dirt with a hard brush and water with soap.

Afterwards, wash with calcium sulphide, Lindane or powder with DDT. Repeat this treatment several times. Against mange, Lindane is a good remedy as well as against other ecto-parasites. A light contamination can be cured by smearing with coconut oil.

D. Lice

These are also irritating blood suckers. A good remedy is to place a pole sturdily in the ground at an angle of 45° and to wind an old sack around it, which has been immersed in crude oil or used motor-oil.

Insecticides, such as Lindane and benzene hexachloride is an excellent remedy. (0,1 - 0,25% solution) against lice. Although very dangerous, DDT is also very effective.

E. Sandflea

The sand flea lives on plants and dry grass, from where it is transmitted especially to piglets. The female flea delves into the skin of the host (usually between the claws and around the jaw) to lay the eggs. These fleas should be removed from the skin without breaking open the blisters that are full of eggs. The best remedy is to spray the breeding places with DDT and after that smear the wounds with a disinfectant.

4. Feed related diseases

A. Aneamia-or-blood-deficiency

Especially in young pigs; these are very pale a few weeks after birth and the growth slows down. The cause is an iron deficiency in the mothermilk. This can be prevented by daily putting iron rich soil , such as ditch mud, forestry soil or wood ash in the pen, in which the pigs can root. This should be started in the first week. Very young pigs can be given an injection of iron-dextron.

B. Constipation

For constipation the sow should have a daily dose of 2 oz. linseed oil in the feed. If this does not help, then 2 oz. Epsom salts should be given, and the pig activated.

5. Other Diseases

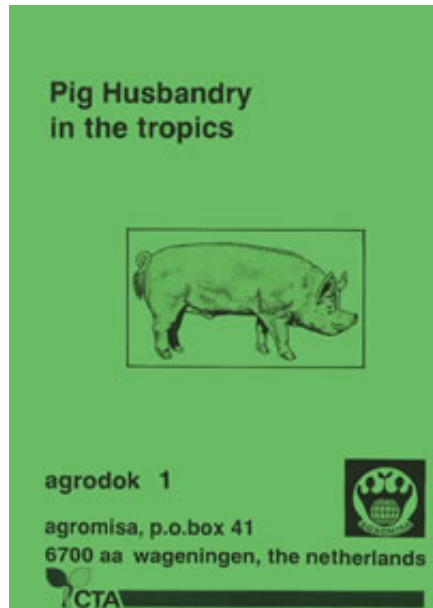
Sunstroke

If the animal gets sunstroke then only the head should be bathed in cold water. If possible give the pig some brandy or whisky with a teaspoon. Give the animal shade.



Pig Husbandry in the tropics

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