RABBIT PRODUCTION IN PAPUA NEW GUINEA

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Abstract - Following introduction of 15 specific pathogen free (SPF) domestic rabbits from 2 breeds into Papua New Guinea (PNG) in 1993, the number of rabbits present in the country has now increased to around 1,200 located in over 20 sites. Preliminary results indicate that provided rabbits are managed well they have the potential to improve the diets and incomes of subsistence farmers in both the lowlands and highlands of PNG.

INTRODUCTION

Domestic rabbits were introduced into PNG for the first time in 1993 with the aim of establishing a meat rabbit industry among subsistence farmers. Based on experience with rabbits in Irian Jaya, there is potential for the domestic rabbit to improve not only the diets and incomes of villagers but also soil fertility. In PNG the growing of legume crops and trees, ostensibly to provide additional forage for rabbits and fuel wood, and the use of rabbit manure in kitchen gardens could greatly improve sustainability of gardening systems. This is of particular importance, as the population increases and garden fallow durations are reduced, leading to soil erosion and lower crop yields.

MATERIALS AND METHODS

Ten Canberra Half Lop (CHL) and five New Zealand White (NZW) rabbits were imported into PNG in March and June 1993 from laboratories in Australia. Rabbits were specific pathogen free (SPF) and were imported according to the protocol outlined by LUKEFAHR and CHEEKE (1991). Rabbits were certified free of the following diseases: all internal and external parasites including coccidiosis, pasteurellosis, Tyzzer's Disease, spirochetosis, myxomatosis, laprine rotavirus and rabbit calicivirus. Rabbits were initially placed in an air-conditioned animal house at the University of Technology in Lae. After a period of 6 months, rabbits were moved to the University farm and housed in raised wire mesh cages with thatched roofs shaded by trees.

Rabbits have been fed a mixture of locally grown and imported feeds: sweet potato vines and tubers, aibika (*Abelmoschus manihot*), banana, comfrey, stylosanthes, coconut, cowpea, pigeon pea, gliricidia, leucaena, and supplemented with either broiler finisher pellets, lucerne pellets, brewers grains, fresh coconut or copra expeller meal.

Distribution of rabbits began early in 1994 under an agreement with the Department of Agriculture and Livestock and Department of Environment and Conservation. Breeding, evaluation and training centres have been established, over a two year period, at over 20 locations. Selection of sites was based on local sponsorship, ability to provide a high level of security and willingness to eventually act as a rabbit distribution and training centre for local villagers. Sites were also chosen to reflect the range of different environments to be found in PNG. Training of key personnel at each site has involved both formal and informal classes with regular visits from the University and NGO collaborators. Assistance has also been provided with establishment of a demonstration garden with supply of planting materials and advice.
Rabbits have mostly been distributed free of charge on the understanding that an equal number of does will eventually be returned to the project to allow establishment of further sites. From the best performing does, in terms of average litter size and growth rate of kits to 28 days, female offspring are selected to be returned to the central breeding nucleus. Replacement males are in turn distributed back to each centre.

A series of studies has been undertaken to evaluate the suitability of locally available feeds for growing rabbits. Feeds studied so far are sweet potato vines and tubers, cowpea forage, fresh pigeon pea leaves and dried leucaena leaves, commercial broiler finisher pellets and copra expeller meal. For each trial rabbits were allocated to treatment at random in a hierarchical manner according to live weight and pre-trial growth rate in groups of 3-5, with each group replicated either 1 or 2 times. During the trial period (4-6 weeks; after a 1 week acclimatisation period) live-weight was recorded weekly after an ovenight fast, and the amount of food eaten was calculated from the weight and dry matter content of the feed fed and refused.

RESULTS AND DISCUSSION

Breed Evaluation

The average adult live-weight of does from CHL and NZW breeds in the lowlands was 3.2 and 3.4 kg and in the highlands was 3.3 and 3.5 kg, respectively. In the lowlands regions the CHL and NZW does reared on average 5.0 and 3.2 kits/litter and these kits grew on average 18 and 13.5 g/day, respectively, from weaning to 8 weeks of age. For the highlands the CHL and NZW does reared on average 7.5 and 5.5 kits/litter and these kits have grown on average 36 and 24 g/day. These differences in performance between rabbits kept in the cooler highland and rabbits in the lowlands are not unexpected. In studies reported from tropical countries, growth rates of between 10 and 20 g/day are usual, in contrast to 35-40 g/day commonly observed in temperate regions (LUKEFAHR and CHEEKE, 1991). The performance of the CHL breed kept semi-intensively in the lowlands compares more than favourably with that of other breeds under similar conditions (DAHLAN *et al.*, 1993). At the village level a reduced level of production is expected at least in the initial learning phase of the operation. The NZW does appeared to be poorly adapted to a tropical environment with low feed intake, compared with similar CHL does, and with low milk production and mothering ability. Additional NZW imports are needed to improve the performance of this breed. DAHLAN *et al.*, (1993) showed that NZW rabbits can adapt to tropical conditions and be productive.

Housing

Cages (90x70x45 cm) built from locally available timber, imported wire mesh and protected by a thatch roof were found to be suitable for the coastal environment of PNG, provided cages were set under a high tree canopy and the site was open. The best flooring material available has been found to be half inch square welded mesh (1.8 mm) which adds considerably to the cost of establishment ($US 8/m). Two cages suitable for a doe and a weaned litter costs approximately $US 25 for materials. In the cooler highlands, cages can be built more cheaply under the eaves of houses with local timber used for walls.

Disease Problems

Mouldy sweet potato poisoning, caused by infection with a fungus *Fusarium solani*, has resulted in at least 3 deaths in adult rabbits. At autopsy there was pulmonary oedema and haemorrhage into the gut. A similar problem has also been observed in pigs in PNG (LOW *et al.*, 1993). Since sweet potato tubers are likely to be a major source of carbohydrate for rabbits in PNG, care will need to be exercised when feeding tubers, especially if damaged to rabbits. Affected tubers show areas of discolouration, originating from surface injuries, and have a characteristic sweet smell.
Feeding of seed heads of black-seeded amaranthus (*Amaranthus triclor*) caused acute poisoning in 5 rabbits. One litter of 8 kits died suddenly from acute copper poisoning associated with feeding pig feed fortified with copper. Affected kits died suddenly and had haematuria at autopsy. The doe was not affected.

In at least 3 sites, salmonellosis caused deaths in rabbits. Salmonella bacteria were isolated from the intestines of affected rabbits and from the feed (commercial broiler finisher pellets). Locally produced rabbit pellets, that do not contain meat meal, are needed to minimise the chances of contamination of feed with salmonella. In addition, storage containers, which keep feed dry and away from rats and mice, have been found to be necessary if farmers feed concentrate feeds.

Three cases of maternal obstetrical paralysis have been observed and 3 does have suffered from broken back, possibly associated with rough handling by inexperienced operators. Losses from young doe syndrome (CHEEKE *et al.*, 1982) occurred at several sites with does in either their first or second lactation. Cases

occurred where managers fed chicken pellets and little forage. Feeding of copra meal at 50 % of the ration has all but eliminated this disease. The loss of young does in early lactation, and the subsequent starvation of the litter, proved to be very discouraging for new farmers.

Sodium deficiency, and to a lesser extent phosphorus deficiency, have been observed in beef cattle in many areas of PNG (HOLMES *et al.*, 1986). We have observed salt hunger in rabbits where they are being fed on forages and locally grown root crops. Supplementation with iodised salt (1 %) has been recommended in these circumstances.

Predation by dogs, snakes and rats have caused losses at several sites. Losses due to theft have also been reported. Moving cages closer to houses, fencing and improvements in cage design, which add to the cost of cages, have been necessary to limit these problems. Theft and to a lesser extent predation are likely to be a major problem for rabbit producers in PNG.

Tooth malocclusion, congenital hip dislocation and glaucoma have been observed in the CHL but not the NZW breeds. This appears to be only of minor significance with abnormalities seen in less than 1 % of kits.

Few problems have occurred with diarrhoea and there has been no evidence of respiratory tract infections in rabbits. The SPF status of these rabbits is likely to remain as they are isolated from wild rabbits and other populations of domestic rabbits. This is a significant advantage for the establishment of rabbit farming in PNG as domestic rabbits in the tropics appear especially prone to pasteurellosis, enteritis and coccidiosis (OWEN, 1976).

Nutrition Studies

Table 1 : Summary of average growth rates of rabbits fed different diets

Treatment	Growth g/day
SP Vines Fresh (*ad libitum*)	8
SP Vines Oven Dried (*ad libitum*)	4
Cowpea Forage (*ad libitum*)	5
SP Vines Fresh + SP Tubers (120 g fresh/h/d))	12
SP Vines Fresh + Pigeon Pea Leaves (100 g fresh/h/d))	6
SP Vines Fresh + BF Pellets (40 g/h/d)	22
LM (*ad libitum*)	2
LM 75 % + LLM 25 %	-7
LM 50 % + LLM 50 %	-14
LM 25 % + LLM 75 %	-18
BF Mash 100 % (*ad libitum*)	18
BF Mash 100 % + Cowpea Forage	20
BF Mash 75 % + CEM 25 % (*ad libitum*)	20
BF Mash 50 % + CEM 50 % (*ad libitum*)	18
BF Mash 25 % + CEM 75 % (*ad libitum*)	16
CEM 100 %	16
CEM 100 % + Cowpea Forage (*ad libitum*)	18

Key: SP - Sweet Potato, BF - Broiler Finisher , LM - lucerne meal, LLM Leucaena Leaf Meal, CEM - Copra Expeller Meal (+ 1 % Nacl, 3 % limestone).

Table 1 summarises the results of various feeding trials. Growth of rabbits fed totally on forage diets was poor. It is concluded that some form of concentrate feed is needed to achieve satisfactory levels of performance. In many areas of PNG without access to road transport, and hence to concentrate supplements, sweet potato tubers could provide a concentrate for rabbit production. Where farmers have access to chicken feed, and markets are available for sweet potato, it would be more profitable to supplement the diet with a small amount of a commercial poultry feed than to feed first grade sweet potato tubers to rabbits.

Inclusion of leucaena leaf meal in the diet resulted in weight loss in growing rabbits. This was attributed to the binding of protein by condensed tannin. A similar result was obtained by TANGENDJAJA *et al.*, (1990). Low tannin varieties of leucaena are currently being evaluated and leaves will be fed fresh to maximise protein availability. No evidence of mimosine toxicity was observed during this trial. Rabbits probably have the ability to degrade mimosine in the digestive tract to DHP and appear to be relatively resistant to the toxic effects of DHP (TANGENDJAJA *et al.*, 1991).

Copra expeller meal proved to be a satisfactory alternative to feeding chicken feed to weaner rabbits, especially if forages were also fed. Substitution of most, if not all, chicken feed with copra expeller would save around 70 % of feed costs. Based on the efficiency of feed conversion, the estimated cost of 1 kg live-weight gain for weaner rabbits fed chicken feed and copra expeller meal is $US 1.4 and 0.4, respectively. Trials involving

feeding of copra expeller to breeding does will commence shortly. This ration will be pelleted to reduce wastage and improve intake.

Palm kernel cake also needs to be evaluated as a concentrate supplement for rabbits. It is readily available, costs $US 50/ton and appears to have a suitable nutrient composition for rabbits (BABJEE, 1988). Copra expeller meal and palm kernel cake, however, contain high levels of copper (20 and 24-36 mg/kg DM, respectively) and feeding large amounts of this to rabbits may result in Cu poisoning. Addition of molybdenum may be necessary to limit absorption of Cu in such diets.

Potential Impact of Rabbits In Papua New Guinea

Agriculture - Traditional systems of agriculture in both PNG and Irian Jaya involve a shifting garden system with little intensive animal production. Villagers have problems arising from a lack of sustainability in their gardens (short fallows, soil erosion and declining crop yields), protein deficiency (particularly for women and children), and low incomes. In addition, traditional sources of bush meat are now scarce. While living in Irian Jaya one of the authors (ASKIN), worked with villagers to show that rabbits could be integrated in sustainable gardens and agroforestry. Legumes were grown ostensibly to feed rabbits but they also improved soil fertility. Manure was used for high value vegetable production and in kitchen gardens. With this approach rabbits are more likely to become part of the life of the people rather than seen as just another agricultural project.

Role of Women and Children - It is also important that rabbits are seen as something that involves and benefits the women and children. In PNG men traditionally run projects such as rearing broiler chickens but profits often do not benefit the women and children. Women appear to take more responsibility for the nurture and good management of rabbits than the men in PNG culture. They are also more likely to provide meat to the family regularly, rather than selling all fryers, and to spend the profits in ways that benefit the family, such as school fees and medical care.

Diet - A village farmer with 4 does kindling 3-4 times per year, and feeding mostly forages and a small amount of purchased concentrate, could easily produce 50-60 rabbits per year. If half are consumed this represents around 20 kg of meat per year, which is a significant contribution to the meat requirements of families in PNG. This is particularly important for women and children who traditionally eat meat very rarely. The ultimate goal of rabbit raising is to provide more meat at the family level.

Income - Rabbit sales ($US 3.50 to 5.00 for a 2 kg carcass) and sale of skins ($US 3.00 to 5.00 depending on quality) would provide an income of around $US 350 per year from the rabbitry. If chicken pellets are fed, feed costs for the rabbitry are estimated to be $US 180/year and if copra expeller plus salt and limestone is fed $US 68/year. The estimated start up cost using imported mesh and local timber is approximately $US 110 for 4 doe cages, 5 weaner cages and 1 buck cage. Rabbits thus can make a significant contribution to incomes of families in PNG. By way of comparison, the average wage of an unskilled labourer in PNG is around $US 3.50 per day.

Limitations to Successful Expansion - Before importation, the possibility of the domestic meat rabbit becoming a pest in the wild was carefully evaluated. Establishment of domestic rabbit populations in the wild only appear to be successful on islands where preying mammals are absent. This is because domestic rabbits do not go underground during the day nor seek surface shelter. They tend to be diurnal rather than nocturnal and do not protect nestling young (STODART and MYERS, 1964). The presence of snakes, dogs, rats, pigs and birds of prey in PNG means that domestic rabbits can only survive and breed when confined in cages. In addition, domestic rabbits have been present in Irian Jaya, the other half of the island, for at least the last 50 years without any reports of wild populations becoming established. Fears that domestic rabbits may eventually pose an environmental threat in PNG has limited the acceptance of rabbit farming at both the policy making level and village level. Education programmes are continuing to inform people about the differences between domestic and wild rabbits.

Correct care and management are necessary if rabbit raising is to be successful. Traditionally, animals in PNG have not been kept under intensive conditions in stables. Careful screening and training of farmers, largely through demonstrations, will be needed to overcome this problem. Government extension services to village farmers are generally poorly developed. Mission organisations and other NGO groups have, however, shown

interest in establishing demonstration farms and assisting with breeding and distribution of rabbits. Training of local rabbit "experts" to support these centres will require considerable effort and funds.
We expect that women and children will take most of the rabbit feeding and management responsibilities. Since women also do most of the gardening work they may not be able to also provide the high level of labour required to raise rabbits.

Preservation of rabbit skins using a mixture of kerosene and baking soda has given reasonable results. Locally these skins have a high value. Technologies to tan skins are needed if a rabbit skin industry producing drumskins, hats, rugs, toys and skins for decoration is to develop. If the skins have a high value farmers will be more likely to eat the animal and sell the skin.

In conclusion, self-help small-scale rabbit production using locally produced feeds has the potential to benefit the people of PNG through improvements to diet, incomes and soil fertility. It will however, take a number of years to overcome the many problems facing establishment of rabbit production at the village level.

REFERENCES

BABJEE A.M., 1988. The use of palm kernel cake as animal feed, Part II. *Asian Livestock, FAD*, **14**, 28-33.

CHEEKE P.R., PATTON N.M., TEMPLETON G.S., 1982. Rabbit Production, 5th ed. *The Interstate Printers & Publishers, Inc.*

DAHLAN I., MAZILA M., SALAM A. ABD., 1993. Evaluation of rabbit breeds in the tropic: Preweaning mortality and mothering ability. *World Conference on Animal Production, Edmonton, Canada*, **Abs 323**, 193-4.

HOLMES J.H.G., EDYE L.A., POTTER J, WALTON E., 1986. Mineral status of beef cattle in Papua New Guinea. *Trop. Anim. Hlth. Prod.*, **18**, 31-9.

LUKEFAHR S.D., CHEEKE P.R., 1991. Rabbit project development strategies in subsistence farming systems, 2. Research applications, *World Anim. Rev.*, **69(4)**, 26-34.

LOW S.G., GRANT I.McL., RODONI B., BRYDEN W.L., 1993. Sweet potato (Ipomoea batatas) poisoning of pigs in Papua New Guinea. *Proc. Symposium on "Mycotoxicoses of Grassland Farming" New Zealand Vet. Jou.*, **41**, 220.

OWEN J.E., 1976. Rabbit production in tropical developing countries: a review. *Trop. Sci.*, **18(4)**, 203-10.

RAFAI P., 1984. Temperature requirement of does for optimal performance. *Archiv-fur-experimentelle-veterinarimedizin.*, **38(3)**, 450-7.

STODART E., MYERS K., 1964. A comparison of behavior, reproduction and mortality of wild and domestic rabbits in confined populations, *CSIRO Wildl.Res.*, **9**, 144-59.

TANGENDJAJA B., RAHARDJO. Y.C., LOWRY J.B., 1990. Leucaena leaf meal in the diet of growing rabbits: evaluation and effect of low-mimosine treatment. *Animal Feed Science and Technology*, **29**, 63-72.

Production de lapin en Papouasie Nouvelle Guinée - Suite à l'introduction en Papouasie Nouvelle Guinée en 1993 de quinze lapins domestiques spécifiques qui étaient exempts de pathogénes, le nombre de lapins dans le pays a augmenté jusqu'à 1200 - répandus sur plus de vingt emplacements. Des résultats préalables indiquent que, du moment que les lapins soient bien maniés, ils seraient capables d'améliorer l'alimentation et les revenus de fermiers de subsistance et dans les terres basses et dans les terres hautes de la Papouasie Nouvelle Guinée.