PIG AND POULTRY PRODUCTION IN TANZANIA WITH SPECIAL REFERENCE TO THE SOUTHERN HIGHLANDS

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ABSTRACT

The paper reviews past research on the evaluation of the most important pig and poultry feeds in Tanzania. It provides an overview of the relative importance of the poultry and pig industries compared with ruminant livestock. Research areas which need more attention in future are highlighted and the importance of adopting a multidisciplinary approach is emphasised.

INTRODUCTION

According to FAO (1988), only 2.1% of the total value of meat production in the country is from pigs, while 12% is from poultry. The rest comes mainly from cattle (68%), with a smaller proportion from sheep and goats. Milk constitutes 60% of all animal products, while eggs constitute only 7%. In view of these facts it is not surprising that the Ministry of Agriculture and Livestock Development (MALD) has set research on ruminant meat and milk production as a priority. However, non-ruminant animals play a significant role in most smallholder farming communities. The number of chickens in Tanzania is the same as the human population (25 million), while there are over 300,000 pigs (FAO, 1988). Of the total number of pigs, about 61.1% are raised in the Southern Highlands (Table 1). Most are indigenous animals mainly kept in the rural areas under the traditional production system. They are an important source of animal protein and cash income. Our study in Mbinga District (Ruvuma Region) shows that the animals are also an important source of manure for coffee fields. All of the poultry meat and eggs consumed by rural families and 20% of the eggs and poultry meat consumed by urban dwellers come from traditional poultry production (Boki, 1988). Most of the poultry in rural communities are free ranging. Production levels are poor but the poultry are well adapted to the stressful environment (poor management, inadequate feeding, and diseases). The extent to which pig and poultry production contribute to the economic and social well-being of smallholders is uncertain.

This paper reviews past research on monogastric animals, with a special emphasis on nutrition. It identifies improved practices for introduction to small holders and suggests guidelines for future research.

RESEARCH REVIEW

Performance of traditional and improved pigs and poultry

Preliminary results obtained on the performance of local pigs at Uyole Agricultural Centre (UAC) are presented in Table 2. The findings suggest that both reproductive performance and growth rates are lower than those of exotic pigs raised on the same farm. The post-weaning growth rate is only 93 g d^{-1}, while mean birth weight is 0.9 kg and live-weight at an one month 3.3 kg. Average litter size at birth is seven piglets per sow. Similar results were reported by Holness (1969) in Zimbabwe, where indigenous pigs were inferior to exotic pigs in their reproductive and growth performances.

Table 1. Numbers of pigs in the 10 main pig producing areas of mainland Tanzania, 1984

Region	Indigenous pigs		Improved pigs		Total	
	No.	%	No.	%	No.	%
Mbeya	59 330	33.8	8 441	8.6	67 881	24.2
Iringa	39 278	22.4	11 8852	11.9	51 130	18.6
Ruvuma	36 564	21.1	4 954	5.0	41 918	15.2
Arusha	14 866	8.5	14 137	14.8	29 603	10.8
Kilimanjaro	5 314	3.0	23 919	24.0	29 233	10.6
Dar es Salaam	2 130	1.2	9 173	9.2	11 303	4.1
Morogoro	3 531	2.0	7 244	7.3	10 775	3.9
Rukwa	7 320	4.2	492	0.5	7 813	2.8
Dodoma	344	0.2	5 317	5.3	5 611	2.1
Mtwara	3 480	2.0	2 087	2.1	5 567	2.0
Total	172 557		88 326		260 883	

Source: MALD, 1986.

Table 2. Performance of local pigs at UAC

	Value	Sample size (n)
Mean litter size at birth	7	10
Mean birth Weight (kg)		
Overall	0.90	21
Females	0.92	10
Males	0.93	11
Mean liveweight at one month (kg)		
Overall	3.30	21
Females	3.28	10
Males	3.32	11
ADG (g) from weaning to 6 months		
Overall	93.0	23
Females	95.8	14
Males	90.2	10

ADG = average daily gain.
Source: Mwakilembe and Mbwile, 1992.

Some studies involving indigenous and exotic pigs have also been carried out in Nigeria. Under an intensive management system, Fetuga *et al*,. (1976) and Adebambo (1986) found that growth rate, feed efficiency and reproduction of the indigenous pig were lower than those of exotic breeds. Adebambo (1982) and Pathiraja (1986) crossed indigenous pigs with the large white. They observed an increase in litter size, birth weight and weaning weight in the crosses by comparison with the indigenous pigs. However, the same crosses performed poorly under smallholder farmer production conditions, indicating the importance of genotype-environment interactions in livestock production. Under environmental stress, the indigenous animals have advantages over exotic breeds.

The only comprehensive study in the country involving local chickens was carried out at Sokoine University of Agriculture (SUA) (Katule, 1988). In this work, the performance of three poultry breeds and their crosses was compared. The local breed was the smallest at all periods of weighing. Regarding egg production traits, the meat breed performed rather unsatisfactorily, except for egg size. The meat type chickens attained sexual maturity at about the same age as the local chickens, but about

one week later than the egg type chickens. The cross between the local and the egg type outperformed all other groups in this respect, reaching sexual maturity at about 170 days of age, two weeks earlier than the egg breeds.

When number of eggs produced per hen over a period of 90 days was considered, the egg breed, as expected, produced significantly more eggs than the other groups. The meat breed produced the smallest number of eggs. The local breed, which is widely regarded to be a poor egg producer, appeared to compete favourably with other genetic groups and had a better performance than the meat breed.

As regards to egg size the results showed that the meat breed laid significantly larger eggs than the other groups, followed by the egg breed. The meat type x egg type cross laid the smallest eggs.

Feeds and feeding

The research on monogastric nutrition in Tanzania has mainly been based on pigs, and the main area of research has been on the evaluation of various locally available feedstuffs.

Energy feeds. A number of studies have been carried out on the nutritive value of maize by-products. Broatch (1970) investigated the effect of maize bran in an experiment in which four diets were fed to pigs weighing 17 and 58 kg. The results are presented in Table 3. The rate of gain and the feed conversion ratio (FCR) improved as the proportion of maize bran in the diets increased, although the cost per kg liveweight gain also increased.

Minja (1989) did a detailed study the use of hominy meal and rice polishing as energy sources in pig rations. Table 4 shows the composition of the test diets. The digestibility coefficients of the diets decreased with increasing levels of rice polishings (Table 5), possibly because of the high amount of fibre in rice polishings. The growth performance trial revealed no significant differences between the diets. The overall performance of animals was generally poor, with the average daily gain ranging between 0.36 and 0.46 kg and the feed conversion ratio ranging between 3.61 and 4.04.

The effect of adding rice bran to the diets of fattening pigs was evaluated by Filika (1990). The results are summarized in Table 6. The findings indicated that growth rate, feed intake and feed conversion efficiency were not significantly affected by graded increments in rice bran levels. However digestibility of dry matter (DM), ether extract (EE), and nitrogen free extract (NFE), differed significantly among treatments. High levels of fibre in the form of rice bran/hulls appeared to be responsible for the differences. It was concluded that there is the possibility of feeding rice bran to fattening pigs without adversely affecting pig performance.

Table 3. Effect of maize bran in pig fattener diets on pig daily weight gain (kg), the feed conversion ratio (FCR, feed supplied: weight gained) and the cost per kg liveweight gain (LWG)

Diet[1]	Daily gain (kg)	FCR	Cost kg^{-1} LWG (TSh)
1 (65:0:7.0)	0.43	3.11	2.80
2 (55:10:6.3)	0.46	3.18	2.29
3 (45:20:8.6)	0.47	3.06	2.36
4 (35:30:4.9)	0.47	3.03	2.49

[1]Numbers in parentheses represent the percentage of maize meal, maize bran and crude fibre in the four diets, which all contained 15% copra cake, 15% meat meal, 5% minerals and 20% crude protein.

Source: Broatch, 1970.

Table 4. Composition (%) of experimental diets used to evaluate hominy meal and rice polishings

	Diet				
	I (control)	II	III	IV	V
Maize meal	84.5	-	-	-	-
Hominy meal	-	57.0	44.0	41.0	-
Rice polishings	-	29.0	44.0	60.5	9.5
Cotton seed cake	7.0	7.0	5.5	2.0	-
Fish meal	6.0	4.5	4.0	4.0	2.5
Nutrafos	2.5	2.5	2.5	2.5	2.5

Source: Minja, 1989.

Table 5. Effect of experimental diets on the digestibility of various nutrients

	Diet				
	I	II	III	IV	V
Dry matter (%)	86.13^{a}	80.75^{ab}	73.97^{abc}	68.40^{bc}	64.42^{c}
Organic matter	81.19^{a}	76.58^{b}	70.38^{c}	64.18^{d}	60.27^{d}
Crude protein	81.58^{a}	80.09^{a}	72.23^{b}	70.60^{b}	66.83^{b}
Ether extract	83.03^{a}	86.30^{a}	81.00^{a}	61.82^{b}	68.68^{ab}
Crude fibre	50.82^{a}	40.99^{ab}	32.49^{b}	28.30^{b}	31.66^{b}
Nitrogen free extract	94.09^{a}	90.81^{ab}	85.71^{bc}	85.08^{c}	81.85^{c}
Digestible energy (MJ kg^{-1})	16.33^{ab}	17.02^{a}	15.76^{b}	12.94^{c}	13.11^{c}

Means with different superscript letters in the same row differ significantly ($P<0.05$).
Source: Minja, 1989.

Table 6. Effect of rice bran on the performance of pigs and the digestibility of the feed

	Rice content (%)			
	0	10	20	30
ADG (g)	522	515	500	493
ADG kg Pig^{-1} day^{-1}	2.0	2.09	2.33	2.46
Feed conversion ratio	3.83	4.06	4.46	4.99
Feed cost: gain	92.10	91.97	94.33	95.90
Metabolizable energy intake MJ d^{-1}	22.17	22.29	23.12	23.02
Digestibility (%)				
Crude protein	80.15	80.84	81.18	78.02
Dry matter	73.70	70.45	67.40	62.91
Ether extract	77.01	80.73	86.40	87.18
Crude fibre	9.96	25.92	26.36	30.39

Source: Filika, 1990.

Lekule *et al.*, (1986) used rice polishings as the only energy source for pigs (79.5%). The average growth rate of pigs fed the diet was 660 g d^{-1}, which was slightly higher than that for pigs fed a commercial sow and weaner diet (625g d^{-1}). The rice polishings also gave the most profit. When Minja (1989) fed rice polishings as the main source of energy (95% of the diets, the growth performance of pigs was poor (360g d^{-1}), possibly because protein supplements were included at sub-optimal levels. Lekule *et al.*, (1988) concluded that rice polishings were an excellent energy source for pigs. For broilers, Mwanjali (1990) found that a combination of maize bran (29%) and sorghum (35%) can totally replace maize in the diet.

Goodchild and Kabatange (1983) evaluated the use of wheat feed a mixture of wheat pollard and wheat bran for pigs at Mpwapwa. Table 7 indicates the composition of the test diets and the results obtained. Wheat feed, with 16.1% crude protein and CF 9.0% crude fibre, was shown to be on excellent source of energy and could meet both the energy and protein requirements of finishing pigs.

Triticale is a new hybrid grain, not only in Tanzania but in the world in general. Investigations on its nutritive value for pigs were carried out at UAC (Mwakilembe, 1992). The composition of the experimental diets is presented in Table 8 and the parameters measured are shown in Table 9. Both digestibility and growth trials demonstrated that triticale can completely replace maize meal without detrimental effects. It was concluded that the use of triticale in pig rations is feasible where other energy sources are scarce or relatively expensive.

Table 7. Composition of test diets and performance of pigs fed graded amounts of wheat feed

	Diet			
	1	2	3	4
Maize bran (%)	73.7	36.9	0.0	0.0
Wheat feed (%)	0.0	36.8	73.7	97.2
Protein Supplement (%)[1]	23.5	23.5	23.5	0.0
Vitamins & Minerals (%)	2.8	2.8	2.8	2.8
Liveweight gain (kg d^{-1})				
0-21 days	0.42	0.44	0.48	0.37
21 days-slaughter	0.69	0.71	0.67	0.67
Feed conversion ration				
0-21 days	3.88	3.70	3.51	3.51
21 days-slaughter	3.52	3.48	3.67	3.65

[1]The protein supplement contained 12% cotton seed cake, 10% sunflower cake and 1.5% fishmeal; up to 45 kg LW, more protein supplement was fed.
Source: Goodchild and Kbatange, 1983.

Table 8. Composition of experimental diets used to evaluate Triticale meal

	Diet				
	1	2	3	4	5
Maize meal (%)	80.0	58.9	37.8	19.7	0.0
Triticale meal (%)	0.0	23.0	46.0	69.0	92.0
Fish meal (%)	2.0	2.0	2.0	2.0	2.0
Cotton seed cake (%)	8.0	7.0	7.0	3.5	1.6
Sunflower cake (%)	7.8	6.9	5.0	3.6	2.2
Mineral vitamin (%)	2.0	2.0	2.0	2.0	2.0
Lysine (g)	130.0	115.0	99.0	137.0	147.0
Methionine (g)	94.0	65.0	43.0	38.0	2.0

Source: Mwakilembe, 1992.

Table 9. Effect of triticale on feed intake, average daily gain and feed conversion ratio of pigs (n=8)

	Triticale content (%)					
	0	23	46	69	92	SE
Mean initial LW (kg)	19.5	19.5	19.5	20.4	20.0	0.55
Mean final LW (kg)						
Castrates	89.5	89.6	89.9	89.9	89.9	?
Females	89.7	89.9	89.9	89.9	89.0	0.09
Mean	89.6	89.8	89.9	89.8	89.3	0.11
Mean daily feed intake (kg)	1.2	1.4	1.3	1.3	1.1	
Mean ADG (g)						
Castrates	437	397	423	474	438	13
Females	415	410	420	472	434	13
Mean	426	403	422	473	436	8
Feed conversion ratio						
(kg feed kg^{-1} LW gain)	3.4	3.6	3.2	3.2	3.2	
DE intake (MJ day^{-1})	17.0	19.0	17.4	18.2	16.1	
DCP intake (g day^{-1})	137.7	172.5	168.9	190.3	178.2	

Source: Mwakilembe, 1992.

Protein feeds. Cotton seed cake (CSC) is the most abundant protein source in the country. Its use in monogastric animals is, however, limited by the presence of gossypol, especially in undecorticated CSC. Madata (1975) demonstrated that a relatively large amounts of CSC (up to 24%) could be used to feed pigs for a short period of time (Table 10). Pigs with average LW of 15 were fed *ad libitum* for 49 days.

Lekule *et al.* (1986) conducted a series of experiments to determine the nutritive value and optimum level of inclusion of cotton seed cake derived from the variety Ukiriguru. The composition of the experimental diets and the performance of the pigs are shown in Table 11. As the level of cotton seed cake was increased in the diet, the digestibility of both the diet and of cake alone decreased. This was ascribed to the high content of tannins, crude fibre gossypol in the cake. The estimated free gossypol content of the diets was 0.001, 0.006 and 0.009% for treatments containing 6, 12 and 24% cotton seed cake respectively. These values are below the levels considered to be toxic to pigs (0.01% and above). Ukiriguru cotton seed cake was shown to be reasonably digestible in small amounts. It was concluded that levels of up to 18% can be included in pig rations without impairing performance.

Studies of the use of cotton seed cake meal as a protein supplement in layer rations were undertaken by Kinabo (1980). The treatments used are shown in Table 12. None of the treatments had any significant negative effect on egg production or egg quality, at least when used for up to 16 weeks. It was concluded that Ukiriguru cotton seed cake can safely be incorporated at levels of up to 18% in layer diets, but a level of 12% was considered safer for long term use.

In an effort to evaluate other sources of protein, Kabatange (1981) explored the possibility of using locally available oilseed meal as the only protein source in layer rations, with or without additional lysine and methionine. Fishmeal was replaced with sunflower or soybean meal. Egg production was poor in all treatments, even in the fishmeal control and the soybean meal treatments. It was concluded that high fibre content of the sunflower meal resulted in poor digestibility and poor nitrogen retention. Energy content was also considered to be limiting factor in the sunflower-based diets. The addition of amino acids did not have any significant effect. It was concluded that Tanzanian sunflower meal should not be used as the major protein source in layer diets.

Table 10. Effect of replacing meat meal by cotton seed (CSC, %) cake on the performance of growing pigs

	CSC (for 35-55 kg LW/over 55 kg LW)[1]				
	1	2	3	4	5
	0/0	6.0/3.5	12.1/7.1	18.1/10.6	24.1/14.2
ADG (g)	660	800	800	680	550
Feed conversion ratio	3.30	2.95	3.04	3.12	3.35

[1]Crude protein content 16% for the lighter pigs and 13% for the heavier pigs.
Source: Madata, 1975.

Table 11. The composition (%) of experimental diets used to evaluate cotton seed cake, and of daily weight gain (g) and feed conversion ratio of pigs fed the diets

Ingredients	Treatment			
	1	2	3	4
	Composition of diet			
Cotton seed cake	0	6	12	18
Soyabean meal	15	10	5	0
Fishmeal	3	3	3	3
Sorghum (serena)	64.5	61.3	59.7	58
Maize bran	14.7	17.0	17.6	18.5
Dicalcium phosphate	2.0	1.9	1.4	1.1
Limestone	-	-	0.5	0.0
Salt	0.5	0.5	0.5	0.5
Vitamins and minerals	0.3	0.3	0.3	0.3
	Pig performance			
Average daily gain				
Males	517	563	599	532
Females	532	552	521	559
Mean	525	558	535	546
Feed Conversion ratio				
Males	3.75	3.82	3.48	3.27
Females	3.85	3.97	3.80	3.46
Mean	3.82	3.38	3.46	3.37

Source: Lekule *et al.*, 1986.

Table 12. The composition (%) of experimental diets used to evaluate the effect of cotton seed cake on the performance of laying hens

	Treatment			
Ingredient	1	2	3	4
Maize	39.6	40.45	40.45	40.45
Sorghum (serena)	22.0	22.0	22.0	22.0
Wheat pollards	2.05	0.8	0.4	0.0
Cotton Seed exp. extr. 33.3% CP	0.0	6.0	12.0	18.0
Simsim, esp. extr. 38.8% CP	18.0	12.4	6.8	1.20
Fishmeal	8.0	8.0	8.0	8.0
Guatemala grass	2.0	2.0	2.0	2.0
Ground limestone	5.55	5.55	5.55	5.55
Mineral - Vitamin premix	2.5	2.5	2.50	2.50
Salt	0.3	0.3	0.30	0.30

Source: Kinabo, 1980.

Animal health and diseases

Diseases are one of the major problems facing the pig and poultry industries. In Mbinga District worm infestation in pigs is a serious animal health hazard, while in Rungwe District (Mbeya Region) African Swine Fever (ASF) poses a threat to improved pig production. In the period 1986-1987, ASF wiped out most of the pig units in Rungwe District, as well as those in Kilimanjaro and Arusha Regions (Loretu *et al*, 1988). To date there is no vaccine being produced commercially against ASF. The vaccine that is available is still in the experimental stage.

A survey of the role, management and economic importance of animals in the farming systems of the Southern Highlands showed that the most important poultry diseases in the area are Typhoid, Coccidiosis and Newcastle Disease (Mbwile *et al.*, 1992). Extension workers have concentrated on cattle, and in particular on dairy production, neglecting poultry and pigs. In future, extension workers need to play a leading role in improving these industries. Farmers need to be educated on simple disease control programmes in order to improve their pig and poultry production.

CURRENT PRACTICES AND CONSTRAINTS

As in other developing countries, most pigs and poultry in Tanzania are raised by the traditional sector. In the Southern Highlands, farmers in rural areas raise pigs with minimum inputs. Pigs are fed on vegetables, weeds and swill, all of which are characterized by a very low dry matter content. Consequently, pigs are underfed in terms of both energy and protein. Mineral vitamin supplementation is unavailable and concentrate feeds are in short supply.

Traditional pigs are allowed to range freely, tethered or confined, or in some places a combination of two of these systems is used. In Kyela District, for example, the tethering system is the predominant one while in Mbinga District a combination of free range and tethering is mainly used. The confinement system is mainly practised in Rungwe District, where some farmers have raised wooden or concrete floors. Most pig houses have earthen floors. Some pig pens have thatched roofs, while others have no roofs at all. Only a few are roofed with corrugated iron sheets.

Traditional poultry are raised under free range conditions, where the birds look for their food within the homestead. No concentrates are used. There is a serious lack of veterinary services.

It is apparent that both pig and poultry farmers face a number of constraints, both technical and non-technical.

- *Feeds and nutrition.* Concentrate feeds for pig and poultry are unavailable, or if available the cost is prohibitive. There is a lack of knowledge among farmers about the nutrient requirements of pigs and poultry.

- *Management.* There is a lack of knowledge on pig and poultry husbandry, and poor or non-existent housing.

- *Genetic source.* There is a lack of unrelated breeding boars. Inbreeding in some rural communities appears to be an important limitation to pig production.

- *Diseases.* Various pig and poultry diseases and parasites are prevalent. Veterinary extension services are in short supply or non-existent. Prices of Veterinary drugs and vaccines are prohibitively expensive.

- *Lack of Government Support.* The government has placed emphasis on ruminant meat and milk production only.

- *Misconceptions about the pig.* The pig is viewed as a greedy and un-clean animal.

INNOVATIONS FOR IMPROVING PRODUCTION

The following is a list showing a suggested order of priority for the introduction of innovations in pig and poultry production to smallholder farmers.

1. *Improved feeding regime.* Provision of balanced diets rich in energy, protein, minerals and vitamins, improve the plan of nutrition for pigs and poultry and enhance productivity.

2. *Disease and parasite control.* The economic losses which result from diseases and parasites are usually high. It is important to ensure adequate control measures are undertaken.

3. *Improved management practices.* The provision of better shelter to protect the animals from heat and cold may be necessary. In addition, hygiene and sanitation are important to reduce the incidence of disease.

4. *Improved breeds.* Once farmers have acquired experience in pig and poultry husbandry practices, the next step may be to use improved breeds to achieve further increase in productivity.

FUTURE RESEARCH PRIORITIES

In the past, research has addressed itself Mainly to the commercial producer and hence has not benefited smallholder farmers. There has been a lack of coordination between different research centres. Animals, were considered purely as economic entities. Most of the research was carried out on-station. The Government contribution to the poultry and pig industries compared with that to the livestock sector has been small.

In future, if the pig and poultry industries are to be developed, the role played by smallholders must be recognised. This will require research on the following:

- Pigs and poultry as components of the whole farming system
- Ways of improving the sustainability of the whole system
- Ways of increasing the efficiency of the whole system at the least possible cost
- Low cost feeding systems appropriate to the smallholder in rural areas
- Mixed farming systems, with an emphasis on recycling resources, enhancing the environment and improving the economic well-being of the farmer, by the directly or indirect use of pigs or poultry
- On-farm trials that place greater emphasis on using the genetic material most common in each locality

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