

An Economic Analysis of a Smallholder Meat Rabbit Production System

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Abstract: The net present value (NPV) technique was employed to do an economic analysis of a 50-doe-unit meat rabbit production system in the Kumasi district of Ghana. Data from nine backyard farms, started and operated with family capital and labour, were used for the analysis. The farms had been in existence between two and six years at the time of the study. The animal population on the farms ranged from 91 to 223. Breeding does averagely kindled five times and produced an average of 21 fryers for the market in a year. It was estimated that GH¢ 6,725.37 (US\$ 6,052.83) was needed as a start-up capital for a 50-doe-unit meat rabbit farm in Kumasi. The cost of housing (hutches), equipment and breeding stock formed 62.4%, 17.2% and 8.2%, respectively, of the start-up capital while 12.2% of it was needed to cater for the operating expenses during the first six months of operation, the period during which the farm could not generate enough money to pay for its running cost. A profitability index (PI) of 1.8 and an annualised rate of return (AROR) of 36.1% were calculated for the 5-litter a year breeding programme, and the payback period was reached in the third year. However, it was found out that a more intensive breeding programme of six litters per doe a year could have improved PI to 2.2 and AROR to 43.9%, and this would have brought the payback period to the second year. It was concluded that a high return on investment and labour could be obtained if a family uses its own capital and labour to produce meat rabbits at the backyard, even more so if the doe could be managed to produce six litters in a year.

Key words: family labour, initial investment, net present value, operating cost, profitability index, rate of return.

INTRODUCTION

The domestic rabbit, *Oryctolagus cuniculus*, is noted for its high reproductive capacity and meat quality. The doe is able to produce 25-50 live kits a year^[1,2] and the meat is high in protein and low in fat, cholesterol, sodium, and calories^[2].

In many developing countries the rabbit is reared purposely to achieve protein self-sufficiency for the home. For this reason, it is of less economic importance and its production has remained in the hands of children and micro-scale producers in such countries. But the rabbit is suggested as one of the animals that could be used to solve the problem of low animal protein intake in the developing world^[1]. The situation, therefore, calls for expansion and higher efficiency in the production of rabbits in many developing countries. There will also be the need to move from self-sufficiency of meat consumption to cash income as the motive for production, if the expansion drive is to succeed. This is because a rabbit production programme aimed at self-sufficient meat consumption may not be sustained as farmers are more interested in cash income than improving their nutritional status^[3]. The canvass for a shift in production objective warrants a proper economic analysis of the meat rabbit production systems in various localities in the developing world.

It has been reported that feeding concentrate-forage combination diets are more profitable than feeding concentrate or forage diets alone to rabbits^[3,4]. Also, the rabbit requires less space, makes less noise and produces minimum odour, and so is a good candidate for backyard farming. This study was, therefore, conducted to assess the economic benefit obtainable by the family that uses its own capital, and forages with limited supplements, to produce meat rabbits at the backyard.

MATERIALS AND METHODS

Study Area: The study was carried out in Kumasi, Ghana. The area falls within a semi-deciduous forest ecological zone. It has a bimodal rainfall pattern. The long rainy season starts from March to July and the short season from September to October. The month of August is quite dry but the actual dry season starts from November to February. Annual precipitation averages 1300 mm, the wet and dry months accounting for 82.7% and 17.3%, respectively. The average daily temperature is 26°C (range: 18-35°C) and the relative humidity averages 93% in the morning and 58% in the afternoon.

Source of Data: Twenty one backyard rabbit farmers having between 26 and 223 rabbits in the Kumasi

district of Ghana were interviewed with a structured questionnaire to gather data on production and sale of meat rabbits in the metropolis.

Nine out of the 21 interviewees who had >20 breeding does, with total animal population varying from 91 to 223 and keeping some relevant records, were invited for a one day group discussion of the data gathered from their farms during the interviews. The nine farmers had been rearing rabbits between two and six years at the time of the study. The decisions at the small group meeting formed the basis of the assumptions and production choices made in this study. The prices of capital items used were averages of prices from at least three firms in the study area.

Management of Stock: The rabbits on the nine farms whose data were used in the study were kept in hutches made of galvanised iron wire and wood. The hutches were mostly arranged in tiers of two. The dimensions were either 60 cm x 60 cm x 45 cm or 90 cm x 90 cm x 45 cm, and they were roofed with felt or aluminium roofing sheet. The rabbits were fed various greens and water ad libitum. The greens included *Aspilia africana*, *Centrosema pubescens*, *Pennisetum purpureum*, *Panicum maximum*, and *Ipomoea batata* vines and leaves. Supplements were mainly wheat bran, groundnut skin, maize offal, fish refuse, soybean meal and rice bran, with or without common salt and vitamin/mineral premix.

Weaning was done 5-8 wks after kindling. Remating was usually at or around weaning. Animals were sold live, mostly when there was a willing buyer or a strong need for the farmer to raise money. The number of litters per doe in a year, which was influenced by availability of housing facility, averaged five litters. The rabbits were occasionally dewormed and given coccidiostat. They were treated as and when necessary.

Investment Appraisal: The net present value (NPV) technique was used to appraise the investment. The interest rate for the 2-yr fixed rate note of the Government of Ghana Securities for the week of the analysis was used as the discount rate. The net discounted returns was calculated as the product of the net returns and the discount factor, while the discount factor was calculated as $(1+i)^{-t}$, where i = discount rate expressed as a fraction of one, and t = the time (period) of the cash flow^[5]. The profitability index (PI) was determined as the present value of the inflows divided by the initial capital investment. The rate of return (ROR) and the annualised rate of return (AROR) were also calculated following Wikipedia^[5] as follows: $ROR = (100 \times \text{total discounted returns}) \div \text{total capital investment}$; $AROR = (100 \times \text{total discounted returns}) \div (\text{total capital investment} \times \text{years (period) of operation})$.

RESULTS AND DISCUSSION

The important assumptions made for the analysis are presented in Table 1. Litter size at birth was calculated to be 5.2. Mortality from birth to market age was 20.2%. The total number of fryers sold per doe in a year was put at 21 and 25 for the 5- and 6-litter per year breeding cycles, respectively. Details of the GH¢ 5,907 (US\$ 5,316.30) estimated as the initial capital for the 50-doe-unit farm are given in Table 2. The costs of breeding animals, housing and equipment formed 9.3%, 71.1% and 19.6%, respectively, of the initial investment. Table 3 presents the estimated annual operating cost for the farm. Estimated cost of feed supplements constituted 48.8% and 49.1% for the 5- and 6- litter per year breeding cycles, respectively.

The annual incomes to be generated by the farm during its 5-year lifespan are detailed in Table 4. The sale of live rabbits was deemed as the only source of income for the farm. It was assumed that the GH¢ 818.37 (US\$ 736.53) needed to run the farm for the first six months of operation would be provided by the family since the farm would need that much time to raise enough money to cater for its operating costs. This amount together with the initial capital of GH¢ 5,907 (US\$ 5,316.30) would, therefore, constitute the start-up capital (GH¢ 6,725.37; US\$ 6,052.83) needed for the 50-doe-unit meat rabbit farm. Housing cost forms 62.4% of it while the costs of breeding animals and equipment, and operating cost for the first six months constitute 8.2%, 17.2% and 12.2%, respectively. Table 5 gives the discounted cash flow for the five-year duration of the farm. The profitability index (PI) and annualised rate of return (AROR) were 1.8 and 36.1%, and 2.2 and 43.9% for the 5- and 6-litter per year breeding cycles, respectively.

Discussion: The present performance data recorded for the backyard rabbit farms are not very different from data reported by Lukefahr and Cheeke^[1]. They reported an annual mean of 4 litters/doe, a litter size of 5.0 and a mean of 20.0 fryers/doe for rabbits in Ghana. The corresponding mean values reported for rabbits in some 20 developing countries were 4.6, 6.0 and 25.2. The present litter size is also comparable to the 4.5 reported earlier in Nigeria^[6]. In Vietnam a similar litter size of 4.9 was reported for rabbits reared in cages, but a higher value of 6.7 was obtained when the rabbits were reared underground^[7].

The mortality rate of 20.2% recorded in the present study is higher than the 16.7%, but similar to the 20.8% reported in Benin for rabbits fed on molasses and non-molasses pelleted diets, respectively^[8]. The present result, however, is better than the 27.9% pre-weaning mortality reported for rabbits in Nigeria^[6]. An examination of the earlier reports shows that the productivity of rabbit farms in Ghana has remained low for a very long time. The data also indicate that assumptions and operational choices made for the present study were realistic.

Table 1: Assumptions made in the economic analysis of a 50-doe-unit meat rabbit production farm

Item	Assumption
Feed cost per kilo (°GH¢)	0.20
Daily feed supplement per breeding animal (g)	62
Daily feed supplement per fryer (g)	50
Feed spilled or consumed by animals before death (as percent of fryer feed)	7
Repairs (as percent of housing and equipment costs)	4
Age at weaning (wk)	5
Weight at weaning (g)	420
Fryer market age (wk)	12
Fryer market weight (g)	1300
Fryer selling price (GH¢)	5
Breeders replacement rate (%)	33
Pre-weaning mortality (%)	15.0
Post-weaning (5-12 wk) mortality (%)	6.3
Mortality in breeding stock (%)	3.3
Litter size at birth	5.2
Fryers sold per doe per year (5 litters/doe/yr)	21
Fryers sold per doe per year (6 litters/doe/yr)	25

°GH¢ = US\$ 0.90

Table 2: Initial investment for a 50-doe-unit meat rabbit production farm

Item	Quantity	Unit cost (°GH¢)	Total cost (GH¢)
Breeding stock (50 does; 5 bucks)	55	10	550
Housing (55 hutches for breeders, 50 for kits)	105	40	4200
Equipment:			
Drinkers (55 for breeders, 50 for kits)	105	3	315
Feeders (55 for breeders, 100 for kits)	155	3	465
Kindling boxes	40	2	80
Weighing scale	1	30	30
Spade	1	15	15
Wheel barrow	1	60	60
Buckets	2	2	4
Scoop	1	5	5
Feed receptacle	1	18	18
Water storage tank	1	150	150
Machete	1	15	15
Sub-Total			1157
Total			5,907

°GH¢ = US\$ 0.90

Table 3: One year operating cost of a 50-doe-unit meat rabbit production farm

Item	Cost (*GH¢)	
	5 litters/yr	6 litters/yr
Feed supplement:		
Breeders (55 x 365 d x 0.062 kg feed/d @ GH¢ 0.20/kg)	248.93	248.93
Fryers (1050 [†] x 49 d x 0.05 kg feed/d @ GH¢ 0.20/kg)	514.50	612.50
Spillage and stock which died (7% fryer feed)	36.02	42.88
Sub-Total	799.45	904.31
Transportation	120	120
Water	240	300
Veterinary care	160	200
Stationery	55	55
Telephone	48	48
Repairs (4% housing and equipment costs)	214.28	214.28
Total	1636.73	1841.59

*GH¢ = US\$ 0.90; [†]1250 fryers used for 6 litters/yr

Table 4: Yearly income generated by a 50-doe-unit meat rabbit production farm

Year	Income (*GH¢)				Income (*GH¢)			
	5 litters per year breeding cycle				6 litters per year breeding cycle			
	Fryers	Culls	Herd inventory	Total	Fryers	Culls	Herd inventory	Total
1	5145**	95 [†]	0	5240	6145***	95	0	6240
2	5145	95	0	5240	6145	95	0	6240
3	5145	95	0	5240	6145	95	0	6240
4	5145	95	0	5240	6145	95	0	6240
5	5145	95	275**	5515	6145	95	275	6515

*GH¢ = US\$ 0.90; **5145=1050 fryers-21 replacement stock @ GH¢ 5; [†]95=19 culls @ GH¢ 5; [‡]275=55 breeding stock @ GH¢ 5; ^{***}6145=1250 fryers-21 replacement stock @ GH¢ 5

Table 5: Discounted cash flow for a 50-doe-unit meat rabbit production farm

Year	Costs (GH¢)	Returns (GH¢)	Net returns (GH¢)	Discounted factor at 21.0%	Net discounted returns (GH¢)	Net Present Value (NPV)
5 litters per year breeding cycle:						
0	5907	0	-5907	1	-5907	-5907
1	1636.73	5240	3603.27	0.8264	2977.74	-2929.26
2	1636.73	5240	3603.27	0.6830	2461.03	-468.23
3	1636.73	5240	3603.27	0.5645	2034.05	1565.82
4	1636.73	5240	3603.27	0.4665	1680.93	3246.75
5	1636.73	5515	3878.27	0.3855	1495.07	4741.82
6 litters per year breeding cycle:						
0	5907	0	-5907	1	-5907	-5907
1	1841.59	6240	4398.41	0.8264	3634.85	-2272.15
2	1841.59	6240	4398.41	0.6830	3004.11	731.96
3	1841.59	6240	4398.41	0.5645	2482.90	3214.86
4	1841.59	6240	4398.41	0.4665	2051.86	5266.72
5	1841.59	6515	4673.41	0.3855	1801.60	7068.32

*GH¢ = US\$ 0.90; 5 litters/yr: Profitability index (PI) = 1.8, Rate of return (ROR) = 180.3%, Annualised rate of return (AROR) = 36.1%; 6 litter/yr: PI = 2.2, ROR = 219.7%, AROR = 43.9%

The present PI compares favourably with PI values of 1.1-1.7 reported by Raharjo^[3] in Indonesia. The present result is, however, superior to the 152% ROR reported in Nigeria by Okojie *et al*^[9]. It, therefore, appears that the profitability of a smallholder meat rabbit farm in the present location compares favourably with values from similar farms in the developing world.

The rate of inflation in Ghana at the time of the study was 17.4%. This means that the AROR of 36.1% showed a real growth of the capital invested. The rate of return is indeed high compared to interest rates of 13.8% and 23.3% paid on fixed deposits and government 1-yr treasury-bill, respectively at the time of the study. The present results indicate that the meat rabbit farm could be made more profitable by adopting the 6-litter a year breeding programme. The sale of by-products arising from rabbit production could also improve the profitability of the farm. Composted rabbit manure, for instance, could be sold to backyard gardeners and landscape designers for additional income^[1,2]. Also, rabbit farming could be integrated with home-gardening to reduce cost of production and improve the family's income. For example, recycling of garden refuse as rabbit feed would reduce the production cost of the rabbit, and the conversion of rabbit manure into compost to enrich garden soil will increase productivity of and income from the garden.

Conclusion and Recommendation: It is concluded that the family could derive high returns on investment and labour from smallholder meat rabbit production. It is suggested that the 6-litter per year breeding programme should be adopted, and rabbit manure should be composted and sold to further improve the profitability of the smallholder meat rabbit production.

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