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Trends And Status of Rabbit Production and Research in Lusaka District



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ABSTRACT

Rabbit production has the potential to help alleviate poverty levels through job creation, income from the sales of rabbits and their products, and a supply of nutritional food, given its urban and peri-urban functionality. However, not much is known about rabbit production and productivity in Zambia. This study was a rapid survey which was intended to document rabbit production systems, management practices, and provide estimates of rabbit productivity in Lusaka, Zambia. Three production systems (extensive, semi-intensive, and intensive) were determined given the following criteria: breeds and number reared, housing provided, feed supplied, management practices and marketing of rabbits and by-products. Most producers practiced an extensive production system, rearing few local and crossbred rabbits which fed mostly on vegetables, and their housing was made of locally available wood materials and or on deep litter. The intensive production system, however, involved purebreds such as New Zealand White (NZW), Chinchilla (CH), California White (CA), Dutch (DU) and Flemish Giant (FG) and their crosses, with numbers ranging between 50 and 100 breeding animals raised in individual metal cages, fed hay and pelleted concentrate feed. Mortality was lower given the conducive environment and high management practices that reduced contact with faecal droppings and allowed urine to be collected for sale. The semi-intensive production system lies in the middle and is pivotal to improving productivity in the rabbit industry. Mean performances reported were litter size at birth (3.3, 5.2, 6.4), litter weight at birth (105g, 225g, 410g), litter size at weaning (1.9,

4.1, 5.7), litter weaning weight (650g, 1955g, 3256g) and average mature weight (1510g, 2120g, 2825g) for the extensive, semi-intensive and intensive production systems accordingly. The two major challenges were the limited source of breeding animals, which predisposes the sector to a high level of inbreeding and inadequate veterinary care, leading to a high mortality of over 30 per cent. The government is encouraged to develop a national rabbit development programme that will address the above-mentioned challenges.

Keywords: Rabbit, breeds, litter, kindling, parity, Zambia-

INTRODUCTION

Livestock production in Zambia, which revolves mainly around cattle, sheep, goats, pigs, and poultry, has not been able to satisfy the population's demand for high-protein animal products. There have been suggestions by Lebas *et al.* (1997) to explore other less raised animals with the potential to increase livestock production. Rabbit production seems to be the obvious choice given the comparative advantage over other micro or mini livestock species such as hares, grasscutters, bush rodents, guinea pigs, giant snails (Odubote and Akinokun, 1991; Odubote *et al.* 1995; Lebas *et al.* 1997). Factors that lend credence to the claim include its low cost of set up, short gestation length, (27-31 days), kindling interval (45-60 days), fast growth rate (12-20g/day), early sexual maturity (5-6 months), high prolificacy (at least 5 kits/litter and 6 litters per year), small body size and ability to convert forage into meat more efficiently than even ruminants (Ohiosimuan *et al.* 1994; Lebas *et al.* 1997; Lukefahr *et al.* 2022).

Rabbit production has been adjudged suitable for offsetting the protein deficiency in third world countries, given the quality of its meat and simple management practices (Lebas *et al.* 1997). Rabbit production also fits in the family farming production system due to the manageable operations. It can also serve as a climate smart livestock production strategy as the fodder requirement is very small compared to the large ruminants. Peri-urban livestock production is common in most developing countries, including Zambia (Odubote *et al.* 1995).

The rabbit industry in Zambia is still in its infancy despite the recorded introduction of a breeding nucleus of the California White breed (CA) in 1965 (Lungu, 1978). Other breeds that have found their ways into the country include, New Zealand White (NZW), Chinchilla (CH), Dutch White (DU), and Flemish Giant (FG). IAPRI (2012) reported the rabbit population in Zambia to be 53,173 in its 2012 Rural Agricultural Livelihood survey report. Zambia was also reported by Lebas *et al.* (1997) to produce between 1000 and 4900 tonnes of rabbit meat per annum). In its renewed efforts to promote rabbit production recently, the Government of the Republic of Zambia distributed hundreds of rabbits to smallholder farmers through its programme of stocking and restocking animals. Therefore, there is a window of opportunity to increase the rabbit population, production, and productivity in Zambia. The Ministry of Fisheries and Livestock and Zambia Statistics Agency (2022) in its 2022 livestock survey report estimated the rabbit population to be 287,015 Which showed some improvements nevertheless, there is a paucity of information in the literature on rabbit production and productivity research in the country. Therefore, this study aims to document rabbit production systems and management practices and determine production performances that will be useful in policy formulation directed at rabbit sub-sector development.

MATERIALS AND METHODS

Study Site

The study was conducted in the Lusaka district of Zambia encompassing both urban and peri-urban settlements. The district falls within a humid subtropical climate and is located in Agro-Ecological Zone (AEZ) II, which receives medium rainfall from 800 mm to 1000 mm annually. It has an average monthly temperature of about 26.2°C, with a maximum of 32°C in October and a minimum of 11°C in June. It is hot and dry between mid-August and mid-November, wet and rainy between mid-November and April, and cool and dry between May and mid-August. There is no rain in June, July and August.

SAMPLING

Twenty-five rabbit producers were surveyed in a multistage sampling involving two rabbit producer associations and the district livestock office. The remaining twenty-five rabbit producers were identified and traced through purposeful selection, using the information obtained from the initial rabbit producers. In total, 25, 22 and 3 respondents belonged to the extensive, semi-intensive and intensive categories. The information on the breeds and breeding stock number, sales, type of housing and feed provided, and whether a beneficiary of government rabbit stock distribution helped to have a diversified producer base for the rapid survey.

DATA COLLECTION

A structured questionnaire was designed for use among rabbit producers to obtain information on the rabbit production system and management practices on their farms. The survey instrument was pre-tested on five rabbit producers within the target district before being rolled out in the field. Prior informed consent was obtained from the individual producer. The data collection took place between April and June 2022. 50 producers were interviewed, and the information gathered covered the following: the purpose of raising rabbits, breeds of choice, supply of breeding stocks, housing, labour requirement, water, feeds and feeding, health care, disease control, mating practices, manure management, marketing of products, and record keeping. The methodology combined questionnaire surveys with on-farm direct observations on litter size and body weights at birth and at weaning, mortalities, and average mature body weight.

Data Analysis

The statistical analyses comprised quantitative and qualitative methods. The qualitative data for each production system characteristic and management practices were summarised and presented in table form. The rabbit production systems were characterised into distinct categories based on the critical criteria. The quantitative data was analysed using simple descriptive statistics (mean and range) following Industrial Business Machines (IBM) Statistical Package for Social Sciences (SPSS) statistics procedures (IBM Corp. Released, 2013) and the results were presented in a table.

Results

Production systems

Table 1 summarises the features of the different production systems observed.

Table 1: Summary of rabbit production systems characteristics in Zambia

Criteria	Rabbit production systems		
	Extensive	Semi Intensive	Intensive
Production objectives	<ul style="list-style-type: none"> ●Home consumption ●Informal market sale of live rabbits ●Manure 	<ul style="list-style-type: none"> ●Live rabbit sale ●Sale of dressed carcass ●Manure 	<ul style="list-style-type: none"> ●Live rabbit sale ●Sale of dressed carcass ●Manure ●Manure and urine
Breeds	<ul style="list-style-type: none"> ●Local breeds ●Crosses of local breeds and exotic crosses 	<ul style="list-style-type: none"> ●Crosses of Local breeds and exotic breeds ●Crossbred of exotic breeds 	<ul style="list-style-type: none"> ●Exotic purebreds (NZW, CH, CA, DU, FG) ●Exotic crossbreds
Breeding stock size	<10	10 – 50	>50
Feeds and feeding practices	<ul style="list-style-type: none"> ●Fresh greens ●Postharvest agricultural by-products 	<ul style="list-style-type: none"> ●Fresh and dry greens ●Postharvest agricultural by-products ●Supplementary concentrate feeds 	<ul style="list-style-type: none"> ●Fresh greens ●Hay ●Supplementary pelleted concentrate feed
Housing	<ul style="list-style-type: none"> ●Cages made of local plant materials. ●Deep litter on fenced bare ground ●Provision of feed and water bowls 	<ul style="list-style-type: none"> ●Deep litter with cemented floor ●Cages made of wire mesh. ●Feed and water troughs provided 	<ul style="list-style-type: none"> ●Cages with wire mesh ●Feed and water troughs fitted to the cage. ●Fitted with pipes for urine collection
Access to market	<ul style="list-style-type: none"> ●Home consumption ●Informal marketing – gifts, exchange of live animals 	<ul style="list-style-type: none"> ●Informal marketing – gifts, exchange ●Walk-in buyers of live animals 	<ul style="list-style-type: none"> ●Supply of dressed carcasses to supermarkets ●Walk-in buyers of live animals for breeding
Manure utilization	<ul style="list-style-type: none"> ●Spread in garden 	<ul style="list-style-type: none"> ●Spread in garden 	<ul style="list-style-type: none"> ●Spread in garden
Record keeping	<ul style="list-style-type: none"> ●Nonexistent 	<ul style="list-style-type: none"> ●Basic – number born, number dead 	<ul style="list-style-type: none"> ●Moderate level – records of mating, kindling, body weights at birth, weaning and maturity
Labour employed	<ul style="list-style-type: none"> ●Family members 	<ul style="list-style-type: none"> ●Family and occasional hired labour 	<ul style="list-style-type: none"> ●Hired labour

Breeds and Breeding animals

In addition to the common breeds of rabbits listed in Table 1, there are the Angora (AN), English Spot (ES), Checkered Giant (CG), and Silver Fox (SF) and their respective cross breeds. In the extensive and semi-intensive production systems, the rabbits were mainly crossbreeds of the breeds mentioned in varying proportions. The breeding stocks under the intensive production system were mostly imported from Zimbabwe and South Africa.

Management practices

Management is typically a low input and output system for the extensive and semi-intensive production systems and makes use of family labour. However, for an intensive system, two or three attendants are employed, and the management practices include cleaning of the cages and house which is done early in the morning; dead animals are removed at the same time; fresh greens and concentrate pelleted feeds are supplied, and water is changed. Mating is carried out

by taking the doe to the buck and pregnancy test is by palpation. A nest or kindling box is introduced into the cage about 4 to 5 days before kindling. After kindling, the nest box was checked daily for any dead newborn which should be removed. The young ones are weaned at 4 to 8 weeks (it is earlier at four weeks in the intensive system and up to 8 weeks for the extensive), and the doe is ready for mating. Meanwhile, the weaners are raised in groups until they attain market weight before being sold.

Housing

For the extensive and sometimes the semi-intensive systems, housing for rabbits is mostly simple, consisting of locally available bush poles and burnt or unburnt bricks for the construction of open sided shelter which houses the cages or hutches. Cages are located under a tree or covered by a corrugated iron sheet. Roofing materials can be grass thatched or iron roofing sheets. The feed and water are provided in earthen pots for the extensive system. In the intensive system, however, breeding does, and bucks are mainly reared in cages made of poultry wire mesh, which could be 2 or 3 tier in the intensive system. It is most suitable for keeping control of the mating and keeping the females from the time of mating to birth and until weaning. Each adult is allocated a cage fitted with a water bottle and feed trough. The size of the cages for the intensive system is generally 60cm x 60cm and 50cm, although it varies. The young weaners are raised together in a wider cage, which allows for the weaner's movement and exercise. Other producers raise the rabbits on concrete floors (deep litter system) with feed and water in troughs and grasses placed on the floor.

Feeds and Feeding

Extensive and semi-intensive producers feed rabbits on fresh greens such as Lucerne and Callindra, which are high in protein. Others also fed a variety of greens which include Rape (*Brassica napus*), Cabbage (*Brassica oleracea*), Sweet potatoes (*Ipomea batata*), Blackjack (*Bidens pilosa*) and Moringa (*Moringa oleifera*). In the extensive systems, kitchen wastes were also reported to have been provided as feed. However, for those on intensive system, hay and commercially available pelleted concentrates (from commercial feed millers) are fed to rabbits. There is also an increase in the amount of hay and concentrate feed during pregnancy, lactation, and post-weaning before mating.

Reproductive and Body weight performances

Table 2 below shows the mean performances for litter body weight, litter size, mortality and mature body weight for the different production systems. The intensive system recorded the highest mean performances for all the traits except for mortality which was the lowest.

Table 2: Mean performances for litter body weights, litter sizes, mortality and mature body weight.

	Extensive	Semi Intensive	Intensive
Average litter size at birth	3.3 (2-6)	5.2 (3-7)	6.4 (4-8)
Average litter weight at birth (g)	105 (95-150)	225 (150-270)	410 (240-460)
Average birth weight (g)	32	45	62.4
Average litter size at weaning -4 weeks	1.9 (0-4)	4.1 (2-7)	5.7 (3-7)
Average litter weight at weaning (g) 4 weeks	650 (300-1350)	1955 (1620-2575)	3256 (2340 – 3754)
Average weaning weight (g) – 4 weeks	335 (225-420)	448 (250-620)	603 (300-675)
Average mortality (%)	45	32	18% (15-25)
Average mature body weight (g) 12 weeks	1510 (1350 – 1905)	2120 (1850-2550)	2825 (2220 – 3500)

Note: Figures in brackets are the range values.

Mortality

The extensive system recorded the highest mortality while the intensive system had the lowest mortality. Causes of mortality include; cannibalism, stomping and abandonment.

Diseases and Control

Disease incidence reported include coccidiosis, pneumonia and snuffles. There are no disease control measures practiced as there are unrestricted movements into and around the rabbitry. Coccidiosis treatment is mainly with Amprolium. Ear canker and skin mange were also reported in the extensive system.

Manure Handling

In all the production systems, the manure is collected and later spread for use in the garden as an organic fertiliser. It was also found that urine is collected in the intensive system by fitting a drainpipe that allows flow into a bucket or container.

Marketing

The producers using extensive systems mostly sell live animals to their customers at the farm gate or displayed by the roadside, ostensibly for consumption. The semi-intensive and intensive producers sell live animals for breeding to other producers and for home consumption. Manure is not sold in any of the production systems. However, urine collected in the intensive system is sold for cash.

Record Keeping

The rabbits under the extensive system are not tagged for identification purposes and little or no records are kept except for the rabbit number. However, under the intensive production system, adequate records are kept on each individual breeding animal, including their pedigree, mating records, expected and actual kindling date, body weight performances, and mortality.

DISCUSSION

The rabbit industry is still in its developmental phase, because no producer has up to 100 breeding rabbits. This has limited the industry's expansion at the semi-intensive and extensive production systems down the ladder. Every effort must be made to expand on the intensive production category to cater for uptake by the semi-intensive producers. At the same time, the extensive producers must be assisted in upscaling to the semi-intensive level due to the inefficiencies associated with the lowest rung (Oseni, 2012). This will also allow for well-defined value chain nodes in the rabbit industry. Currently, the intensive production system producers are involved in multiple nodes viz, input supply (breeding stock, housing cages, feeds), production, processing, packaging and transportation, and marketing (Lukefahr *et al.* 2022).

It was not surprising that the main breeds used for production in this study were the same breeds noted for meat production (Fielding 1991; Lebas *et al.* 1997; Moreki *et al.* 2019; Lukefahr *et al.* 2022). These breeds have been used extensively with success in several countries in sub-Saharan Africa (Oseni *et al.* 1997; Moreki *et al.* 2019). The challenge, however, has been the need for continuous importation of breeding animals in the absence of developing a national rabbit breeding programme in the country. Only producers

at the intensive production level could mobilise funds to import purebred stocks from Zimbabwe and South Africa. Therefore, the rest of the producers depend on what is offloaded as surplus breeding stock or commercial end product. This is in agreement with the report of Moreki *et al.* 2019. There are no conscious efforts at pure breeding because the source of breeding stocks over the years have equally not maintained the purity of each breed (Odubote and Somade, 1992; Oseni, 2012). Therefore, the rabbit breeds are diverse, consisting of mixed breeds and therefore heterogeneous. This explains the use of the wide range of crosses in this study by the lower producer levels. It was established that rabbit producers on the extensive production system buy or borrow rabbits for breeding purposes from fellow producers, not minding the pedigree of the animals, thus predisposing to inbreeding.

Most of the extensive and semi-intensive producers had little knowledge of the best practices for rabbit production before venturing into the business (Walubita, 2003). This is similar to reports by Bailey and Kasolo, 2014 and Moreki *et al.* 2019. Most of the mortalities recorded were preweaning through inappropriate touching of the kits, poor feeding regimes, dirty environment, lack of care for the does, uncontrolled mating, and poor handling of the adult rabbits (Odubote and Somade, 2012).

The rabbit housing is very important as it predisposes the rabbit to stress if improperly constructed and positioned (Lukefahr *et al.* 2022). The materials used for construction should allow for deep cleaning and prevent disease organisms from harbouring in the cage. The cages should also not be placed to face direct sunlight. Metal cages are recommended but expensive to procure. However, it allows for deep cleaning, rabbit mating, and collecting manure and urine if necessary. The type of housing is directly related to the scale of production and level of investments. Therefore, it is not surprising that very few producers operate at the intensive production level. It must also be mentioned that simple hutches are suitable and preferred in rural areas due to cost and affordability (Lebas *et al.* 1997). Rabbits are bulk feeders and are adaptable to various food and feedstuffs. Rabbits have been raised successfully on scrap foods such as waste products from the kitchen and garden when kept for hobby or home consumption (Lebas *et al.* 1997). This includes scraps of bread, fruit peelings, carrots, groundnuts, green lettuce, soft banana leaves, etc. Most producers reported that rabbits could be sustained on vegetables and grasses alone.

According to Lukefahr *et al.* (2022), feeding with pre-mixed rabbit pellets is expensive and unviable in a rural small business setting. Ohiosimuan *et al.* (1996) had fed rabbits forages supplemented with concentrates and recorded improved growth rate and reproductive performance. Moreki *et al.* (2019) also reported that 8 per cent of producers sampled in Gaborone city in Botswana fed vegetables and pelleted feed while only 15 per cent fed pelleted feed alone. More importantly, as with all animals, is the constant provision of clean and fresh water and occasional extra vitamins in the water that was recommended as beneficial.

There is only one rabbit pelleted feed miller in Zambia, which limits availability and access for purchase. This could lead to poor nutrition, especially during Zambia's long dry season from June to November. Limited studies have been carried out on the nutritional requirements of rabbits at various stages of development in Zambia. Chimbaka and Walubita (2020) had included garlic in the rabbit pelleted feed and found significant growth performance with increasing levels of inclusion. Reports from Zimbabwe and South Africa (Mangka *et al.* 2022) suggested that moringa could also help improve growth performances. Matondi *et al.* 2015 reported significant weight gain with cowpea-based rations. Research and Development institutions should be encouraged to conduct nutritional studies on rabbits to determine their nutritional requirements, given that what is available is for temperate regions.

The average litter size obtained in this study is comparable to similar reports for some sub-Saharan countries for the intensive production system (Oseni *et al.* 1999; Mankga *et al.* 2022). The average birth weight for the intensive production system was almost double the weight of kits under the extensive production system. The intensive production system continued to enjoy superior average litter body weights and average mature body weights compared to the other two production systems. This could be attributed to better genetics, nutrition, and health care that the rabbits received. The average mature body weight obtained in the study was higher than the data reported for Nigeria (Oseni and Odubote, 1998; Oseni *et al.* 1999). This could be attributed to poor genetics (purity of the breed) of the rabbits and the humid conditions. The lower body weights recorded on the extensive production system could be as a result of poor nutrition, exposure to diseases and possibly high levels of inbreeding in the herd. However, It is difficult to quantify the different effects because they were confounded.

In the extensive production system, rabbits are sometimes raised close to other animals, such as chickens and goats. There is a possibility of transfer of diseases among the species. According to Lukefahr *et al.* 2022, coccidiosis was the number one disease of rabbits and could lead to fatality if not promptly treated. Other diseases include pneumonia and snuffles. However, it is noted that there are very few veterinarians who specialise in rabbit disease diagnosis and treatment in the country. The norm has been to provide standard medication regimes for poultry as recommendations for treating rabbits (Oseni, 2012). However, disease control in the rabbitry is directly related to cleanliness and avoidance of stress factors, because the rabbits are very sensitive to stress (Lukefahr *et al.* 2022). Skin diseases such as mange and ear canker have also been reported. Maintaining a high level of hygiene is important; hence, the cages and rabbitry should be cleaned daily.

Mortality was highest in the extensive production system, which could be attributed to the low technical skills and poor management practices as elucidated earlier. Pre-weaning mortality accounts for most of the mortalities under the different production systems as a result of kits delivery on the cage floor, cannibalism, abandonment and stamping (Oseni 2012). The level of management required is higher shortly before birth and after delivery than after weaning.

All the producers found value in using rabbit manure as organic fertiliser in the gardens. There were unconfirmed reports that the rabbit manure was superior as it has four times more nutrients than cow or horse manure and is twice as rich as chicken manure. However, the only challenge is the volume of manure produced, given the rabbit's small size. It was observed that only the intensive producers could venture into urine collection because of the extra investment for the drainpipe. According to Kemunto *et al.* (2022), rabbit urine can be applied as foliar fertiliser (applied directly to plant leaves) and as a pesticide (applied directly to the soil). Rabbit urine was found to be safe, healthy and not harmful to the environment. The ease of manure collection is relative to the production system, especially the housing system.

There was no clear marketing pathway for live rabbits and rabbit products as was also reported by Moreki *et al.* 2019; Tembchako and Mrema (2016) in Botswana and Zimbabwe respectively. The bulk of the sales seems to be for further breeding at the lower echelon of the production system. This could have hindered the development of a robust rabbit value chain with defined nodes. Rabbit meat is not yet widely known and accepted as meat by the majority of the populace.

Tembachacko and Mrema (2016) had reported that low rabbit prices are a major factor affecting rabbit marketing in Zimbabwe. Acceptance of rabbit meat is still an issue with certain religious faith in Zambia that consider it “unclean”. Awareness and sensitisation campaigns would be required to promote rabbit production, meat and products in schools, agricultural shows and trade fairs (Lukefahr *et al.* 2022). The government should also include rabbit production in the livestock census or survey to determine the current estimate of population, productivity and tonnage of meat produced, and the spread in the country. This can provide valuable information to aid the awareness campaign.

The rabbit producers should be encouraged to keep basic records that would aid in delivering on good management practices and enhance productivity. Lukefahr *et al.* (2022), has recommended that records on the doe should include the mating date, expected kindling date and weaning date records, which are essential for good planning. As discussed earlier, the above will help cut production costs and avoid pitfalls such as does kindling on the cage floor instead of the nest box.

CONCLUSION

The rabbit industry is still in its developmental phase and will require concerted support from the Government, R and D Institutions, Non Governmental Organisations (NGOs) and producer associations to create awareness of the potential of rabbit production and its products. Rabbit production should be included in the livestock census and survey and school curriculum.

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Data availability

The datasets analysed are not publicly available but can be accessed from the author upon reasonable request.

Code availability.

Not applicable

Conflict of interest

The author declares no competing interests.

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