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Rabbit production practices in Kiambu County, Kenya

Abraham Kipchumba Cherwon*, Margaret Mwihaki Wanyoike and Charles Karuku Gachuiri

Animal Production Department, College of Agriculture and Veterinary Sciences, University of Nairobi, P.O Box 29053 - 00625 Nairobi, Kenya.

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To document current rabbit management practices in Kiambu County, a survey using structured questionnaire was undertaken in 45 farms identified using snow ball sampling technique. Data collected were subjected to descriptive statistics. Findings revealed that the majority of the respondents (57.8%) kept more than 10 does while the most prevalent breed was New Zealand White (82.2%). The main purpose of keeping rabbits for the majority (54%) of the farmers was income generation. Rabbit keepers depended on locally available feed resources with the majority (82.2%) feeding a mixture of forages and concentrate. The majority of respondents (71.1%) weaned the kits at 8 weeks of age while does were rebred at 9 weeks after kindling on 68.9% of the farms. Treatment of sick rabbits was done majorly by the farmers themselves (60.5%). Constraints identified included high cost of feeds (88.9%), diseases (84.4%) and lack of markets for rabbits and rabbit products (71.1%). This study concluded that rabbit farming in Kiambu County is practiced on small scale characterized by limited resource allocation and small flock sizes which may not support a sustainable off-take rate to meet the intended purpose of income generation.

Key words: Rabbits, feed resources, health, Kenya.

INTRODUCTION

Over many years, domestic ruminants and chickens were the primary food animals among many Kenyan communities (Borter and Mwanza, 2011). However, due to decreasing landholdings and ever-increasing cost of cereal-based feeds, ruminants which need large quantities of forages and chickens which compete for cereals with humans there is need for alternatives. In view of this and with the necessity to increase food production for the growing human population, the need for a livestock species that can be raised easily and cheaply has emerged.

In the recent past, there has been an increased interest in rabbit farming in the country with emergence of many new rabbit farmers and the formation of distinctive self-help organizations such as Rabbit Breeders Association of Kenya (RABAK) based in Thika (Serem, 2014). Establishment of a rabbit abattoir in Thika town is also an indication of this increased interest. High prolificacy, rapid growth, lower input requirements, better feed usage and valuable output products (meat, pelt, manure and urine) are among valuable qualities of rabbits (Kale et al., 2016; Mutsami and Karl, 2020). In addition they can be produced from the enormous forages and feed materials that freely abound in the tropics (Chah et al., 2018).

With this upsurge in the production of rabbits, management practices currently utilized by farmers as it

*Corresponding author. E-mail: cherwonabraham@gmail.com.

may impact on rabbit performance needs to be determined and farmers advised in order to make the venture profitable. This study aimed at documenting what farmers are doing with regards to rabbit breeding, feeding, and disease management in Kiambu county.

MATERIALS AND METHODS

The study was carried out in Kiambu county, which was purposefully selected on the basis of the population of rabbit keepers (MOLD, 2012), and the level of intensification and commercialization of rabbit production (Serem, 2014). The county occupies an area of 2543.42 km^2, and geographical coordinates of 1° 10' 0" South, 36° 50' 0" East. The county has a warm climate with temperatures ranging from 12 to 24°C with rainfall aggregate of 1000 mm annually. The main occupation of the majority of its inhabitants is crop and livestock production. Dairy cattle, poultry, pigs, sheep and goats are the common animal enterprises in the county. Although not traditional, rabbit keeping is gaining popularity in the county due to decreasing land size and increasing awareness of nutritional and economic benefits of rabbits as food animals.

Rabbit keepers in the county constituted the population for the study. Due to few numbers of rabbit farmers and the lack of comprehensive lists of rabbit farmers in the livestock offices a snow ball sampling technique was used to identify 45 rabbit keepers for the study. A cross-sectional survey was then carried out and data collected using a structured questionnaire which was pre-tested and then modified as necessary before being administered. On the basis of scheduled face-to-face interviews with rabbit farmers and personal observations, information regarding to feed types, sources, availability, presentation form, preservation, feeding times and constraints were collected from these farms. At the same time, data were collected on rabbit breeds as well as prevailing diseases, their treatment and prevention.

The responses were organized, categorized and coded to enhance analysis and entered into the computer. The data generated was subjected to descriptive statistics using Statistical Package for Social Science (SPSS) and results in form of percentages were presented using tables.

RESULTS AND DISCUSSION

Characteristics of rabbit keepers

The characteristics of rabbit keepers in the study area are shown in Table 1. Of the total keepers, 76% were males and 24% females. This gender disparity with a high predominance of males can be attributed to high prevalence of men as family heads (Osei et al., 2012) and cultural beliefs that rabbit farming is meant for men and boys (Borter and Mwanza, 2011). Over 93.3% of the rabbit owners were 30 years and above, an observation that negates the historical perception that rabbit farming is a pastime activity for young boys (Hungu, 2011; MOLD, 2012). Among the respondents, 24.4% were university graduates, 37.8% middle level college graduates while the remaining 20%, 13.3% and 4.4% had secondary, primary and no formal education respectively. This finding indicates that rabbit farming was not only being increasingly undertaken by the older persons but also by the educated. A positive relationship between farmer's level of education and productivity has been reported (Gasperini, 2000; Reimers and Klasen, 2013; Oduro-Ofor et al., 2014), this being attributed to the fact that farmers with higher education levels can think critically, make better decisions and choices (Oduro-Ofor et al., 2014) and more easily adopt new farming technologies (Mendoza et al., 2008), all of which have positive effects on productivity.

Most of the farmers (44.4%) owned 1 to 3 acres, 42.2% owned less than 1 acre while 13.3% more than 3 acres of land (Table 1). According to Serem (2014), land size was a significant factor in determining whether a household kept rabbits or not. Rabbit farming is gaining popularity among small landholders particularly those in urban and peri-urban areas mainly because they require less space than other types of livestock (Hungu, 2011; Mutsami and Karl, 2020). Majority of respondents (40%) had kept rabbits for <3 years while 36 and 24% had spent 3 to 7 and more than 7 years respectively. These results confirm that rabbit farming continues to attract new entrants in Kenya as reported by Kale et al (2016). According to Borter and Mwanza (2011), for rabbit production to gain hold in a new production systems, it takes on average 7 years given the right attitude and parent stock availability. More experienced rabbit producers would be expected to be better informed and able to improve farm productivity (Tembachako and Mrema, 2016). These researchers also reported that experience significantly affected commercialization of the enterprise and this was reflected in this study since the total average number of rabbits kept per respondent increased from 33.9±28.7 to 46±16.5 as years of rabbit farming increased from <7 to >7 years respectively. This increase in the number of rabbits kept with years of experience could also be due to a realization of the economic benefits of the enterprise as was observed by Sylvester et al. (2014) in Zimbabwe.

The main reasons given by rabbit keepers for the establishment of rabbit enterprises were income generation (54%), source of family food (33%) and both (13%) as shown in Table 1. These findings are in agreement with those of Serem (2014) in four rabbit producing counties in Kenya, that majority (51%) of the respondents kept rabbits for income generation. Other useful, but not primary reason for keeping rabbits were manure (91.1%), urine (51.1%) and pelts (8.9%). The main constraint to achieving the intended purposes of keeping rabbits for 71.1% of the respondents was a poorly developed market for rabbits and their products.

The main outlet for sale of rabbits was farmgate (75%) followed by local markets (21.9%) and hotels (9.4%). The mean age for an estimated 2 kg live weight rabbit was 4 months while the average cost per kg live weight was KES 350 (3.5US$). Lack of well-developed rabbit markets has been identified as a major constraint facing rabbit production in developing countries with farmers

Table 1. Characteristics of rabbit keepers in study area.

Variable	Category	Frequency (%)
Gender	Male	75.6
	Female	24.4
Age (years)	<30	6.7
	30-60	71.1
	>60	22.2
Education status	Graduate	24.4
	Certificate/diploma	37.8
	Secondary level	20
	Primary Level	13.3
	No formal education	4.4
Size of the land owned	<1 acre	42.2
	1-3 acres	44.4
	>3 acres	13.3
Years farmed rabbits	<3 years	40
	3-7 years	36
	>7 years	24
Reasons for keeping rabbits	Income generation	54
	Source of family food	33
	Source of income and food	13

Table 2. Breeds of rabbits kept by farmers in the study area.

Breed	Frequency	Percentage (%)
New Zealand white	37	82.2
California White	34	75.6
Crossbreed	32	71.6
Chinchilla	27	60
Dutch	25	55.6
Flemish Giant	18	40
Checkered Giant	13	28.9
Angora	4	8.9
French lopped	3	6.7
Palomino	3	6.7

who had previously kept rabbits citing lack of markets as the main reason for discontinuing the enterprise (Serem, 2014).

Breeds and breeding practices

The breeds of rabbits kept in the study area are shown in Table 2. Up to ten (10) rabbit breeds were kept with the three most commonly kept breeds being New Zealand White (82.2%), California white (75.6%) and crossbreeds (71.6%). Similar dominance of New Zealand and California White breeds has been reported by others in Kenya (Hungu, 2011; Serem, 2014) and their popularity associated with their good growth characteristics and high carcass weight. These two breeds are also widely accepted as meat breeds (Mailafia et al., 2010) and together with their crosses, were reported to attain a liveweight of 2 kg in 12 to 15 weeks under tropical conditions (Wanjala, 2015). The mean colony size was 37±19.1. Though the majority kept rabbits for sale and home consumption, the average number of 37 may be too small to sustain a family economically.

The main source of foundational stock was from other

rabbit farmers (76.5%), a practice that denies farmers a guaranteed access to and continuous supply of quality and diverse breeds of rabbits including improved and/or imported ones (Oseni and Ajayi, 2008; Hungu, 2011) hence constrain productivity and quality (Mailu et al., 2013; Kale et al., 2016). Additionally, this practice can contribute to spread of diseases between farms (Ogolla et al., 2017). Replacement stock was mainly from own stock (89%) and exchange with other farmers (46.7%) with the later being done in order to prevent inbreeding. Serem (2014) dismissed the possibility that such methods would prevent inbreeding since most of the rabbits kept in the country originated from the government owned Ngong rabbit breeding centre. This could be further exacerbated by poor keeping of breeding records observed in the study area (28.9% of the respondents). Inbreeding leads to a general drop in performance of the animals due to reduced growth rates and increase in both mortality and frequency of hereditary defects (Kristensen and Sørensen, 2005; Nagy et al., 2012).

Breed (55.6%) and reproductive performance particularly litter size (37.8%) were the key determinants to breeding stock selection in the study area, in agreement with Hungu (2011). Breed choice is an important determinant of the productivity of a rabbit enterprise (Kumaresan et al., 2011; Fadare and Fatoba, 2018) since it has significant effect on mothering ability, body weight, growth rate among other traits (Sivakumar et al., 2013). Huish (2005) stated that consideration of rabbit performance while doing selection ensures passage of excellent traits on to the offspring which ultimately will improve performance. Reproductive performance, particularly litter size was the key determinant to breeding stock selection in the study area, in agreement with Hungu (2011).

The mean age at first service varied from 5 months (64.4%), 6 months (20%) to > 7 months (15.6%). Lebas et al. (1997) suggested that rabbits should be bred when they reach more than 80% of the their mature weight which is reportedly attained at 6 to 7 months of age depending on level of feeding (Serem 2014). The majority of kits (71.1%) were weaned at 8 weeks of age while does were rebred at 9 weeks after kindling in 68.9% of the farms. The average litter size at birth and weaning was 6 and 4 respectively and an estimated 90-day kindling interval. The weaning litter size of 4 was lower than 5 reported in other parts of the country by Serem (2014) but was within the range of 4 to 6 reported in Nigeria by Abu et al. (2008). However, the 90-day kindling interval was twice that recommended by the American rabbit breeders association of 45 days (ARBA, 2012). The combination of longer kindling interval with a small average weaning litter size would impact on the profitability of the rabbit enterprise as this translates to fewer animals for sale and/or slaughter for home consumption.

Feeds and feeding practices

At the time of the study, 65.8% of the keepers raised rabbits on a mixture of forages and concentrates, 25.4% on forages with or without concentrate depending on the availability, 13.3% forages alone and 4.5% concentrate alone. These findings are similar to those of Hungu (2011) and Serem (2014) who reported that majority of the farmers fed their rabbits on both forage and concentrates with the latter being fed only as and when one is able to afford them. According to FAO (2014), it is essential to ensure that animals receive adequate quantities of a balanced feed which is free from toxins and contaminants if productivity is to be maximized. A study by Wanjala (2015) showed that rabbits under forage-based feeding took five weeks longer to the target weight of 2 kg compared to concentrate-based feeding. Further, in the same study, the grower rabbits on the concentrate based diet had a better lifetime feed conversion efficiency mainly due to the reduced time to target weight.

Both fresh and dry forages were fed with Kales (66.7%), Rhodes grass (53.3%), Cabbage leaves (48.9%) and sweet potato vines (33.3%) being the most common. Other forages that were fed to the rabbits are presented in Table 3. The choice of forage offered to rabbits was based majorly on availability (57.8%) and this explains increased usage of Kales which is a common vegetable in most households. Other determinants were cost (35.6%), palatability (28.9%) and perceived nutritional value (13.3%) of the forage. Many studies on farm rabbit studies have shown that for most producers, the important determinant of feeds offered to rabbits is local availability (Aduku and Olukosi, 1990; Lukefahr, 1998; Chah et al., 2017). This may be indicative of the low level of commercialization of the rabbit enterprise as suggested by Serem (2014) in many areas of the tropics. Knowledge on quality of feed is important in determining how to best meet the quantities of nutrients required for maintenance and production.

All the keepers who fed forages to rabbits (95.5%) reported periodic forage scarcity mainly during the dry season. Despite the seasonality, only 29% conserved forages mainly as hay. Forages were also cultivated purposely for rabbits by 35.6% of the keepers; lucerne (25%), kales (56.3%), sweet potatoes (62.5%) and Napier grass (43.8%). According to Chah et al. (2017) very few farmers conserve forages for rabbits. This is an indication of lack of preparation for the dry season which may reflect a lack of information on feed conservation and/or a generally low availability of forages and therefore no surpluses to conserve (Serem, 2014). The low quantities required may also be the reason for lack of forage conservation by rabbit farmers.

High cost of rabbit concentrate feeds continues to make the use of forages in feeding rabbits a common practice especially in tropics as was noted by

Table 3. Forages used for feeding rabbits in study area.

Forage type	Percentage
Kales (*Brassica oleraceae var acephala*)	66.7
Rhodes grass hay (*Chloris gayana*)	53.3
Cabbages (*Brassica oleraceae var capitata*)	48.9
Sweet potato vines (*Ipomoea batatas*)	33.3
Kikuyu grass hay (*Pennisetum clandestinum*)	28.9
Gallant soldier (*Galinsoga parviflora*)	24.4
Household vegetable wastes	24.4
Napier grass (*Pennisetum purpureum*)	20
Black jack (*Bidens pilosa*)	15.6
Amaranthus (*Amaranthus spp.)*	13.3
Banana leaves and peels (*Musa spp*.)	11.1
Alfalfa (*Medicago sativa*)	8.9
Wandering Jew (*Commelina ensifolia*)	6.7
Maize leaves (*Zea mays*)	t4.4
Pumpkin leaves (*Cucurbitaceae*)	4.4

Iyegheerakpotobor and Muhammad (2008). However, the use of forages alone cannot sustain optimum productivity of rabbits thus the need for supplementation (Mailafia et al., 2010). This is especially so when such consist of tropical grasses, which are said to be relatively less digestible, low in protein and high in lignin compared to temperate ones (Mailafia et al., 2010). Rabbits raised on forage only have been reported to grow at a lower rate thus taking longer to attain slaughter weight (Wanjala, 2015). According to this author, rabbits on concentrate based diet grew at 202.5 g/week while those on forage diets 148.1g/week.

The majority of the farms (97.4%) purchased commercial concentrates while 2.6% use the home formulated. Chick mash was used in 10.3% of the farms. The amount of concentrate fed to rabbits ranged from 25 and 150 g/day per rabbit with an average of 91.5 g. Serem (2014) reported a considerably lower mean daily concentrate allowance at 70 g/day per rabbit. Majority of the farms (80%) did not keep proper records on rabbit feeding, thus, the amounts of concentrates offered to rabbits were estimated. Where forage constitutes the bulk of the rabbit diet, a minimum concentrate supplementation level of 25 g per day is recommended (MOLD, 2012). Supplementation is important to compensate for low nutritional value of available forage (Bösing et al., 2014).

Feed troughs for concentrate feeding were present in 88.9% of the farms while 28% had forage racks. The use of feeders has been reported to lead to better performance by rabbits (Brzozowski et al., 1998). This can be attributed to improved health and reduced mortality that may arise due to consuming feed contaminated with faeces and urine when rabbit feed is placed on the floor. Hanging of forages inside the rabbit cage at a comfortable height, as was the case in 35.6% of the farms, also helps prevent rabbits from trampling on and soiling the feed (Borter and Mwanza, 2011).

Eighty nine percent (89%) of the rabbit keepers provided rabbits with drinking water while 11% thought water was not essential to rabbits hence never provided it to the rabbits. Rabbits require water and will cease to eat if not provided with water (Tschudin et al., 2011). Bawa et al. (2006) reported a lower growth rate and an increasing mortality rate among water deprived rabbits and concluded that water should be availed to rabbits for at least 12 h per day for optimum performance. This, however, depends on environmental conditions primarily temperatures and relative humidity under which rabbits are kept as well as the moisture content of the feed.

Diseases and health management

Occurrence of different types of rabbit diseases/ conditions was reported in majority (84.4%) of the farms. The three most occurring conditions were bloat (68.9%), mange (62.2) and ear canker (42.2%) as presented in Table 4. It was noted that disease occurrence was common in farms keeping many rabbits (average 37.8 rabbits) compared to those keeping fewer (32.9). This high occurrence may be attributed to a higher level of intensification resulting in inadequate ventilation and sanitation of rabbit houses (Owen, 1976; The Mercks Veterinary Manual, 2010). In addition, increased intensification could lead to decreased management quality and increased confinement of animals (The Mercks Veterinary Manual, 2010) both of which have impact on disease occurrence. Rabbit health combined with feeding has a large effect on their production

Table 4. Common rabbit diseases and frequency in study area.

Disease/condition	% of farmers reporting disease	Most affected age group (%)		
		Young	Adults	All ages
Bloat	68.9	40	11.1	17.8
Mange	62.2	4.4	44.4	13.3
Ear canker	42.2	6.7	26.7	8.9
Pneumonia	37.8	20	6.7	11.1
Coccidiosis	26.7	-	6.7	20
Diarrhea	24.4	17.8	2.2	5.6
Snuffles	22.2	13.3	4.4	4.4
Eye infection	11.1	2.2	8.9	-
Worm infestation	4.4	-	-	4.4

performance (Martino and Luzi, 2008; Sanchez et al., 2012; Okumu et al., 2015).

Other studies have reported prevalent of such diseases in rabbit farms. Serem (2014) reported diarrhea, mange and bloat to be the most common while Hungu (2011) reported diarrhea and bloat. Aleri et al. (2012) investigating the occurrence of rabbits conditions in Nairobi, Kenya reported high incidences of ear canker, gastrointestinal conditions (such as bloat) and pneumonia. According to 46.7% of the respondents, feeding rabbits un-wilted forages was the main cause of bloat followed by abrupt change of diets (28.9%). In addition to the current noted causes of bloat, Ogolla et al. (2017) also reported use of excess pellets and poor quality feed.

These diseases can reduce production of rabbits to unprofitable levels. For instant, coccidiosis is a major cause of losses in rabbit production (Okumu et al., 2015) which impair their growth and utilization of feed (Soulsby, 2005). According to Elshahawy et al. (2016), mange which is caused by mites has become a common and major constraint in rabbit production. It causes rabbits to lose appetite, body condition and stunts the growth rate (Chah et al., 2018) leading to economic losses and animal welfare problems in rabbit farms (Sharun et al. 2019). It is highly contagious and can spread easily between sick and healthy rabbits (Chebet et al., 2018). In Kenya, coccidiosis and mange are ranked the most important diseases affecting rabbits (Okumu et al., 2015).

On occurrence of disease, majority (60%) self-treat the rabbits, called animal health providers (28.8%), slaughtered the sick ones (6.7%) or do nothing (4.4%). Self-treating of sick rabbits by the keepers is widely practiced among Kenyan farmers (Ogolla et al., 2017; Chebet et al., 2018). In the study area, this was attributed to poor accessibility of veterinary services/rabbit health experts (46.7%) and where accessible due to high cost (26.7%). Schiere (2004) reported that lack of both veterinary drugs and animal health experts impedes rabbit farming in the tropics. Of those treating their rabbits 46.7% used contemporary medicine, 20% traditional medicine while 33.3% combined both types of medicine. The knowledge on the management of rabbit diseases and drug use had been obtained either from non-professional sources (62.7%) including fellow farmers or professional sources (37.5%) including veterinarians. According Ashfaq et al. (2014), relying on traditional methods by farmers rather than seeking proper veterinary advice for livestock diseases treatment is detrimental to their incomes and development of the industry. Some of the keepers practiced some disease preventive measures including deworming (20%), coccidiostats in feeds (48.7%), isolation of sick and/or newly acquired animals (31.1%) and spraying of rabbit houses (8.9%).

Conclusions

This study concluded that rabbit keeping is still practiced on a small scale basis where the number of rabbits kept may not be able to generate enough income to sustain families. The major constraints to rabbit production are high cost and poor quality feeds, disease occurrence coupled with absence of rabbit specific drugs and health experts, and lack of markets for rabbits and rabbit products.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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