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Status, Challenges and Prospects of Grasscutter Farming in the Greater Accra Region of Ghana

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ABSTRACT

Grasscutter meat remains a delicacy in Ghana and other African countries. This has led to several attempts at domestication and production of grasscutters to ensure constant availability of their meat. In recent times, grasscutter farming is increasingly gaining popularity. This work was conducted to assess the current state, challenges and prospects of the grasscutter industry in Accra, Ghana using a structured questionnaire. A total of 38 grasscutter farmers were interviewed. It was observed that 89.5% of the respondents were males whiles females represented only 10.5%. All the respondents had some level of education. Only 5.3% of the respondents are engaged in grasscutter farming as their full-time job. The remaining 94.7 % are either full time workers in the public or private sector or are into crop farming or rearing of other animals. Even though 47.4% of the grasscutter farmers have been practicing for more than 5 years, majority (57.9%) of them do not belong to any grasscutter farmer's association. Majority (71.1%) of the respondents kept at least one form of records on their farms. Major challenges of grasscutter farmers in Accra are: the unavailability of feed (pasture), difficulty in transporting grass to their various farms, lack of space to expand, lack of uniformity in pricing their animals, difficulty in handling some of the animals, waste management, lack of veterinary support and the gross unreliability of farm hands. For most of the respondents, the future of the grasscutter industry in Accra is very bright.

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INTRODUCTION

Grasscutter (*Thryonomys swinderianus*) also known as the greater cane rat is cherished by many people for its meat (Falade, 2010). There has been a steady increase in the demand for grasscutter meat, both locally and internationally, within the past two decades (ADBC, 2002). This has led to the exorbitant pricing of this delicacy (Owusu & Zschekel, 2000). The associated over exploitation of wild grasscutters (Falade, 2010) through hunting and trapping (Owusu & Zschekel, 2000) highlighted the need to domesticate this species (Falade, 2010). It was proposed that the domestication and intensification of efforts towards raising of these animals in both rural and urban areas of Ghana could make the meat readily available and affordable to the majority of Ghanaians (Djang-Fordjour, 2005). The farming of these animals in both urban and rural areas have thus become common (GLDPS, 2016).

Despite significant challenges that encumbered the domestication agenda initially, appreciable successes have been chalked in countries like Ghana, Nigeria and Benin afterwards (Adedapo & Adekunle, 2013). In Ghana, the domestication of grasscutters was pioneered by Sefa Asante and Omari in the 1960's (Mack *et al*., 2005). Later, in the early 1970's the wildlife Department of Ghana trained interested farmers in grasscutter rearing and provided the trainees with a breeding stock (male and female) and a cage, with the intention to stimulate grasscutter farming. Unfortunately, these initial attempts were largely a failure because the inputs for setting up the farms were considered inadequate. Moreover, majority of the farmers could not adopt the initiative (Adu, 2002). Subsequently, the Government of Ghana through the Ministry of Food and Agriculture (MOFA) and other development partners like the Japanese International Cooperation Agency (JICA) and the German International Cooperation Agency (GIZ) over the years initiated various projects to promote grasscutter production across the country. At present, Grasscutter Initiative for Rural Transformation (GIfT) is known to be supporting grasscutter production in the Upper West Region of Ghana (Dery *et al*., 2020).

Grasscutter farming appears to be gaining popularity amongst residents in the Greater Accra Region. Some possible reasons for the increasing popularity include but not limited to: i) relatively small space for setup; ii) market availability as it is considered a healthier alternative to regular meat sources in Ghana; iii) the portrayal of the grasscutter as a hardy animal thus carrying less risk for unexplained deaths and; iv) willingness of consumers to pay premium price for the meat. Despite the prospects of grasscutter farming for improved livelihoods the benefits of grasscutter farming in the Greater Accra Region, like the other parts of the country, has not been fully explored. This research was conducted to ascertain the current status, challenges and prospects of grasscutter farming in Accra, Ghana.

MATERIALS AND METHODS

Study Area

The study was conducted in 16 out of 29 districts in the Greater Accra Region of Ghana. The region is located in the south of Ghana on the coast of the Gulf of Guinea, Atlantic Ocean, with latitude 5º3 North and latitude 0º1 West. The Greater Accra Region is bordered on the north, east and west by the Eastern, Volta and Central Regions respectively. It is bordered on the south by the Gulf of Guinea.

Study Design

In an attempt to understand the current status of grasscutter domestication and farming, a cross sectional study design was adopted.

Study population and sample size

The study population comprised of grasscutter farmers from 16 districts in the Greater Accra Region of Ghana. Thirty-eight (38) farmers were interviewed on their grasscutter farms. The interviews span 8 months (from October 2020 through to May 2021). The various districts (Figure 1) and the associated number of farmers interviewed are: Ablekuma Central (1), Ablekuma North/ALN (1), Adenta/ADT (2), Ashiaman/ASH (3), Ayawaso East/AWE (1), Ayawaso West/AYW (2), Ga Central (1), Ga East (7), Ga South (1), Ga West (2), Kpone Katamannso (2), Krowor/KRO (1), La Dade-Kotopon (1), La Nkwantanang/LNM (7), Shai Osudoku (1), and Tema West (5) Municipal Districts

Sampling Procedure

Snowball sampling technique was used to recruit participants for the study. Both verbal and written consent of the participants were sought before data collection. A structured questionnaire, originally written in English language was used for the collection of data. In situations where the respondent did not understand English, it was interpreted into one of three common local languages; Ga, Akan and Ewe based on the preference of the respondent.

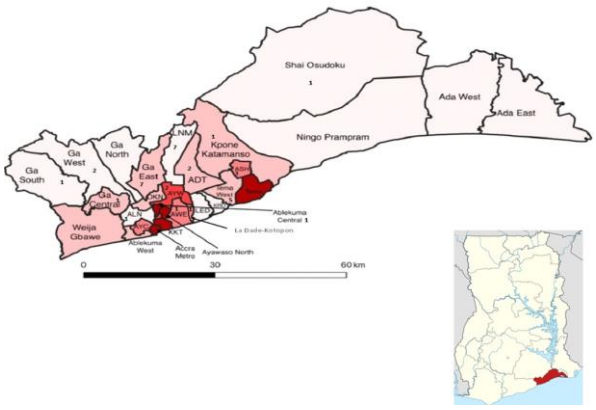

Figure 1. Distribution of respondents across the various districts of Greater Accra Region

The questionnaire was administered by the principal investigator or his trained assistant. All responses were entered in English while some of the names of local feed resources, and herbal medications were captured in their local languages and later identified by their corresponding botanical names

Statistical Analysis

Statistical Package for Social Sciences (SPSS) version 25 for Windows was used for data entry and analysis. Descriptive analysis, specifically frequencies and percentages were used to analyse qualitative variables whilst mean and standard deviation were used to analyse continuous variables.

RESULTS AND DISCUSSION

Demographics

The demographic features of grasscutter famers in the study area are detailed in Table 1. It was observed that grasscutter farmers in the Greater Accra Region are predominantly males (89.5%). The palpable absence of females in the industry was mostly attributed to the tedious nature of grasscutter farming. Some of the respondents explained that the daily cutting of grass from forested areas and handling of the animals (especially the ones caught from the wild) are not classically considered traditional feminine roles. Djang-Fordjour *et al*. (2005) observed that dry season feeding, handling of diseases including lameness and coccidiosis and difficulty in learning how to manage the grasscutters discouraged women. However, as observed, the relatively docile nature of most 'domesticated' grasscutters and possibility of using commercial feed makes the venture gender unbiased.

Although grasscutter rearing span all classified age groups, majority (55.3 %) of the respondents were between 30 - 44 years. This observation is in consonance with findings of Dery *et al*. (2020) who reported that grasscutter rearing in the Northern part of Ghana is more likely among the relatively active age groups. The involvement of the active age groups might be due to the increase advocacy for children below 20 to be in school. Adults older than 60 years may not be able to handle the physical exertions associated with grasscutter farming. That is, dependants below 20 years and above 60 years may constitute an unreliable source of labour for grasscutter farming. However, adults over 60 years may venture into grasscutter farming as farm managers or on a much smaller scale making grasscutter farming a viable alternative post pension.

Table 1. Demographic characteristics of respondents (n=38)

Variable	Respondent	Percentage (%)
Sex	Males	89.5
	Females	10.5
Age group (years)	18-29	7.9
	30-44	55.3
	45-59	26.3
	60 and above	10.5
Marital status	Never married	21.1
	Married	76.3
	Divorced	2.6
Dependents	<6	52.6
	6 – 10	47.4
Sources of labour	1	15.8
	2	7.9
	3	7.9
	> 3	2.6
	0	31.6
	Family	34.2
Educational qualification of Farm owners/ respondents	No formal education	0
	Basic education	21.1
	Secondary education	31.6
	Tertiary education	42.1
	Vocational or technical	5.3
Highest level of formal education of farm hand	No formal education	2.6
	Formal education	65.9
	Not applicable	31.5
Occupation (In addition to the grasscutter farming)	Grasscutter farming only	5.3
	Crop and/or other animal farming	26.3
	Non-farming profession	68.4

In terms of marital status, 76.3% were married, 21.1% were never married (single) and 2.6% were divorced. Also, 52.6% of the respondents had less than 6 dependants while 47.4 % of respondents had between 6 and 10 dependants. Dery *et al*. (2020) also reported a similar trend in Northern Ghana where nearly 90% of the respondents were married with more than six dependants. Unlike the study by Dery *et al*. (2020) where nearly all respondents resorted to the family as a cheap source of labour, only 34.2 % of the respondents in this study used family as a source of additional labour. While about a third of the respondents ran their farm by themselves, 31.6 % and 2.6 % of the respondents employed at most two and at least three non-family workers respectively. The respondents attributed the low patronage of external sources of labour to; I) the exorbitant cost of labour (26.3 %), II) the sensitive nature of grasscutter requiring a level of care and attention they did not trust workers, who are usually interested much more in money only, to be able to handle (0.8 %), and III) the fewer number of animals and the farm. The excessive use of family labour also suggests grasscutter farming contributes to family income

All the respondents in this survey have exposure to different stages of formal education. Majority (42.1%) of the respondents had tertiary education, with 31.6%, 21.1% and 5.3% having secondary, basic and either vocational or technical education respectively. Among the farm hands, 2.6 % and 65.9 % had no formal and formal education respectively. These findings are contrary to Dery *et al*. (2020). They observed that a third of their respondents had no formal education, with a majority of the formally educated respondents having a tertiary background. The differences in the educational levels between the two studies are expected. The illiteracy rate in Northern Ghana is relatively higher than that of Southern Ghana. Furthermore, Greater Accra Region has the least illiteracy rate (10.7 %) and highest literacy rate (89.3 %) of population 11 years and older (GSS, 2010). This can be attributed to the increased number of rural areas characterised by poor access to formal education in Northern Ghana compared to Southern Ghana. Again, most of the districts sampled were within or close to Accra (the capital city) where the drive and presence of better education abounds. However, the distribution of education amongst respondents suggests the near absence of education as a barrier to grasscutter farming. Furthermore, that both studies show the massive involvement of respondents with tertiary education in grasscutter suggest the absence of education as a barrier.

In terms of other sources of occupation in addition to the grasscutter farming, 26.3 % and 68.4 % of all respondents were into crop and/or (other) animal farming and non-farming jobs respectively. However, 5.3% of the respondents farmed grasscutter as a fulltime job. Unlike the results reported by Dery *et al*. (2020), most of the respondents in this study were engaged in non-farming professions. These included teaching/lecturing, preaching, sales and marketing, driving, hunting, radio presenting and students. This is indicative of the viability and propensity of grasscutter farming as an alternate source of income and food.

The respondents were from sixteen (16) out of the 29 districts in Greater Accra Region of Ghana. The 16 districts have a relatively higher population with a concomitant increased commercial activity. The grasscutter farms were located either as part of their houses (on the roof or sharing a wall), on the compound of the houses or few meters (less than 20 meters) away from the main compound. That nearly all of the respondents were from the hub of the region and kept the grasscutters in close proximity in their abode is suggestive that grasscutters can be kept in both rural and urban areas. This is possibly due to the less nuisance associated with grasscutter rearing. That is, grasscutters are not associated with malodorous smells and intolerable noise levels (Opara, 2010)

General information on grasscutter keeping in Accra

Majority of the respondents (52.6 %) rear grasscutters primarily for the purpose of recreation and love for the animals (Table 2). The rest of the respondents (47.4 %) kept the grasscutters for business purposes. There is a sharp contrast in the data reported

by Adu *et al*. (1999) where nearly all the farmers kept the grasscutters only for long term commercial intentions. Regardless, all respondents sold some of the grasscutters when the number of animals exceeded the number they could handle, reached maturity and/or when the respondents needed immediate finances. One of the respondents (who kept the grasscutters for recreation) recounted how he sold four adult grasscutters for one thousand six hundred Ghana Cedis (GHC1600) in 2018; an amount he used to offset the cost of keeping his new born child in incubator.

Table 2. General information on grasscutter keeping in Accra

Variable	Category	Percentage (%)
Motivation	Love for animals	31.6
	Business	39.5
	Family Business	2.6
	For recreation	21
	Love for animals and business	5.3
Belong to Grasscutter farmer association	Yes	42.1
	No	57.9
Source of Grasscutter for farm	Gift	5.3
	Bought from other farmers	84.2
	Hunted	10.5
Knowledge of the types of grasscutters kept on the farm	By colour	26.3
	By size	39.5
	Both colour and size	7.9
	No knowledge	26.3
Duration of rearing grasscutters	<1 year	23.7
	1 – 5 years	28.9
	>5 years	47.4
Farm size	1-10 grasscutters	15.8
	11-50 grasscutters	39.5
	51-100 grasscutters	34.2
	100 grasscutters and above	10.5

Most of the respondents (57.9 %) did not belong to any grasscutter farmers' associations. For the purpose of this study, only the Ghana Grasscutter Farmers' Association, Accra and its subsidiary WhatsApp groups were considered as associations. Common reasons provided by some of the respondents for not joining the association included lack of knowledge of their existence, high association dues and/or previous bad experiences with other farmer associations.

Nearly all the respondents (84.2%) purchased grasscutters from other farmers with the rest acquiring part or all of their stock as gifts (5.3%) or from hunters (10.5%). There is a sharp contrast with a previous study by Adu *et al*. (1999) reported nearly 90% of

farmers relied on captured wild grasscutters. The number of years a respondent kept grasscutters was also interrogated. It was observed that 23.7% of the respondents kept grasscutters for less than a year whiles 28.9% and 47.4% of the respondents reared grasscutters between 1 and 5 years and more than 5 years respectively. In terms of number of grasscutters per farm, 15.8% of respondents kept between one to ten grasscutters. Whiles 39.5% and 34.2% of the respondents kept between 11-50 and 51-100 grasscutters respectively. Respondents who kept more than 100 grasscutters represented 10.5% of the farmers interviewed. There was a significant relationship ($p= 0.002$) between the farm size (number of animals) and number of years a respondent had been farming. However, other factors, which were not explored, such as the start-up stock/colonies, can affect this when comparing two farms.

Grasscutters are classified by sizes: the greater cane rat/long *(Thryonomys swinderianus)* is known to have an average weight of 6kg while the smaller cane rat/short *(Thryonomys gregorianus)* weights averagely 3.5 (Jori *et al*., 1995; Vink, 2014; Adu *et al*., 2017). However, the use of colours to identify grasscutters have been used locally by farmers. Some of the colours used to identify grasscutters include white, grey, ash and coffee brown. The respondents were asked about their knowledge of breeds. Less than a third of the respondents did not know how to identify the breeds. 7.6 %, 26.3 % and 39.5 % of respondents could identify the grasscutters by both size and colour, colour and size respectively. Some of the respondents emphasised the differences in demand and associated prices of the different colours of grasscutters. They divulged that, the white grasscutter was more expensive as many people preferred that breed for socio-religious and cultural purposes. Surprisingly, the white grasscutter required no additional special care and management. A hunter doubling as a grasscutter farmer introduced a novel classification of grasscutters based on geographic location of origin. According to him, grasscutters can be of mountainous (long), grassland (medium sized) or riverine (black and short) origins.

Grasscutters are housed in either opened or closed pens. Open pens are enclosed areas or structures ($3m^2$ by 1.5m) without any roof or covering on top, while closed pens are enclosed areas or structures with appropriate materials used to cover the top (Vink, 2014). These cages can then be considered individual or group cages (Vink, 2014). Closed cages can also be arranged on top of each other to form tiers. While most of the respondents had no idea the type of pens they had, an observation of their structures showed that only one of the respondents had both open and closed cages on the farm. None of the respondents had open cages alone. All the respondents used the tier system with an average of three tiers per stand. The cages were constructed from materials such as cement, wood, iron bars and clay. Some of the respondents made smaller holes in the sides of the cages with the aim of improving ventilation. Others refused to do that with the reasoning that grasscutters are used to living underground. Hence, the netted door they used was good enough to provide all the air the animals needed. They also argued that too much air may result in death of the rodents from

cold (pneumonia). However, it is imperative for beginner grasscutter farmers to realise the importance of good ventilation to the health of the animal.

Husbandry

Nearly two-thirds (71.1 %) of the respondents kept one form of record or another. Some of the records kept were reproduction only, financial only, routine only, a combination of any of the three records and an all-encompassing record representing 31.6 %, 2.6 %, 2.6 %, 28.9 % and 5.3 % of all respondents (Table 3). Records are essential as they aid in decision making, help solve problems, enhance monitoring, and finally serves as a basis securing of loans and other financial assistance. It is therefore, essential for farmers to keep records. Records are to be made simple to allow the farmer to keep them. A respondent chose to keep the reproduction records on the pen while writing, in a sentence or two, what happened on the farm on a daily basis (Figure 2). This method, although not detailed enough, is recommendable. On the other hand, a respondent had stopped keeping records because he did not see the need to keep the records anymore. According to him, he was denied opportunities on tribal background although he met the requirement of providing a detailed record of farm activities. While this claim was not confirmed by the researchers, identical arguments have been raised by Bukari & Schareika (2015) who investigated the stereotypes, prejudices and exclusion of Fulani pastoralists in Ghana. They concluded negative perceptions of Fulani herdsmen have ossified in the minds of most Ghanaians and has resulted in the denial of Fulani herdsmen of settlements and access to resources, and in some cases local and national expulsion exercise. There is, therefore, some credibility to the claims of the respondent and such actions should be discouraged.

Most of the respondents (78.9 %) relied on pasture as the only source of feed for the grasscutters. The rest (21.1 %) combined both commercial/pelleted feed

and pasture in feeding the grasscutters.

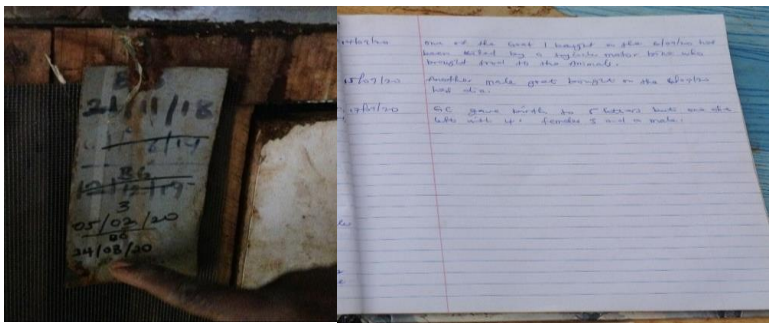

Figure 2. Recording keeping in a grasscutter farms in Accra, Ghana

A respondent listed over 100 plants used in feeding grasscutters including grasses (e.g., elephant grass, Thompson grass, guinea grass, bamboo), grains (e.g., maize, soya bean, wheat), fruits (e.g., coconut, watermelon, sugarcane, pineapple) and other plants including moringa, plantain, river tamrind. Most of the respondents abhorred the use

of commercial/pelleted feed because; I) it is believed to change the taste of the meat, II) commercial feed are relatively expensive, III) forces them to give water which is tedious and expensive and, III) not considered organic enough. While the effect of the commercial feed on the taste of the grasscutter has not been explored, the effect of commercial feed on the coefficient of digestibility of nutrients was assessed by Gboshe *et al*., (2018) and Gboshe and Osarenakhue (2020). According to them, there is a significant positive relationship with addition of supplementary commercial feed and digestibility of feed in grasscutter. An increment of performance was also observed by Attoh-Kotoku *et al*. (2015) when blood, soya bean and fish meal were added to supplement the feed of grasscutters. By virtue of the farms being in urban areas, getting constant and reliable sources pasture becomes a challenge. Furthermore, the late application of weedicides and pesticides to crops before harvesting, reduces the availability of pasture to grasscutter farmers. The situation is made dire during the dry season. Therefore, the unwillingness of farmers to explore commercial/pelleted feed exacerbates the problem of feed provision in grasscutter farming.

Table 3. Knowledge of housing, records and feeding

Variable	**Category**	**Percentage (%)**
Types of pens	Closed	97.4
	Open	0.0
	Both	2.6
Keeping records	Yes	71.1
	No	28.9
Types of records kept	Reproduction only	31.6
	Financial only	2.6
	Routine only	2.6
	All of the above	5.3
	Some of the above	28.9
	None	28.9
Sources of feed	Pasture only	78.9
	Commercial only	0.0
	Both	21.1
Do you believe grasscutters drink water	Yes	84.2
	No	15.8
Do you give the grasscutters water	Yes (always available)	28.9
	No (never)	42.1
	Only in the dry season	7.9
	Occasionally	21.1

When the respondents were asked if they provided drinking/free water to the grasscutters, 28.9 % claimed they always provided drinking water for the animals. Majority of the respondents (42.1 %) never provided water, whiles 7.9 % and 21.1 % only provided water in the dry season and occasionally respectively. The observed distribution was rather interesting since only about a sixth (15.8 %) of all respondents did not believe grasscutters drank water. Most respondents (65.8 %) suggested the grasscutters got enough water from succulent pastures. One of the respondents belonging to this category showed a male grasscutter that has not drunk water in nearly three years (figure 3). Other reasons ascribed by the respondents for their inability to give water regularly were: I) that the practice of giving water was tedious and expensive (considering the cost of waterers and labour) (13.2 %), II) wastage of water as the grasscutters had more than enough from the pasture given them (2.6 %) and, III) they kept grasscutters from mountainous areas which did not require frequent water. Those who provided water did so because: I) it served as a medium for administering oral medication to the grasscutters (10.5 %), II) all animals need water to survive (10.5%), III) to increase the odds of the success of pregnancy (21.1 %) and IV) the pastures are usually not succulent or juicy enough during the dry season (10.5 %). That water improves the quality and outcome of pregnancy has been established by Ngo-Samnick (2012). The proof of this concept practically by farmers is worthy and can be recommended to other farmers. Farmers can adopt automated nipple drinkers, including improvised versions as used by one of the respondents, or troughs made of stronger materials e.g., cement and ceramics.

Figure 2. A Farmer displaying a 3-year-old male grasscutter that has never drunk water before

Reproduction

To assess the knowledge of reproduction practices in grasscutters farming, the respondents were asked about sexing, minimum age of first mating, crossing, and determination of success of mating, gestation and weaning in grasscutters.

Sexing of grasscutters can be achieved through observation of genito-anal distance and head size (Adu *et al*., 2002). The respondents were allowed to describe how they are able to categorise their animals into males (bucks) and females (does) at any stage in the life of the grasscutter. Their answers were then distributed under the above listed categories including 'do not know'. Of all the respondents, 26.3 %, 5.3 %, 2.6 %, 18.4 %, 13.2 % and 28.9 % correctly identified the various sexes via genito-anal distance only (Figure 4A and B), head size only, reddish-brown discoloration of the groin only (Figure 4C), both genito-anal distance and reddish-brown discoloration of the groin, both genito-anal distance and head size and all methods of sexing grasscutters. The remaining 5.3 % of all respondents had no knowledge on how to sex grasscutters. That nearly all the respondents (89.4 %) could correctly sex grasscutters using the genito-anal distance was encouraging given that this method is considered the best way to sex grasscutters (Adu *et al*.,2002). Furthermore, this shows a massive improvement in the knowledge of farmers compared to reports by Adu *et al*. (1999). They reported over 32% of all respondents or 47% of remaining respondents (majority) could not or were conversant with using head size only in sexing grasscutters respectively.

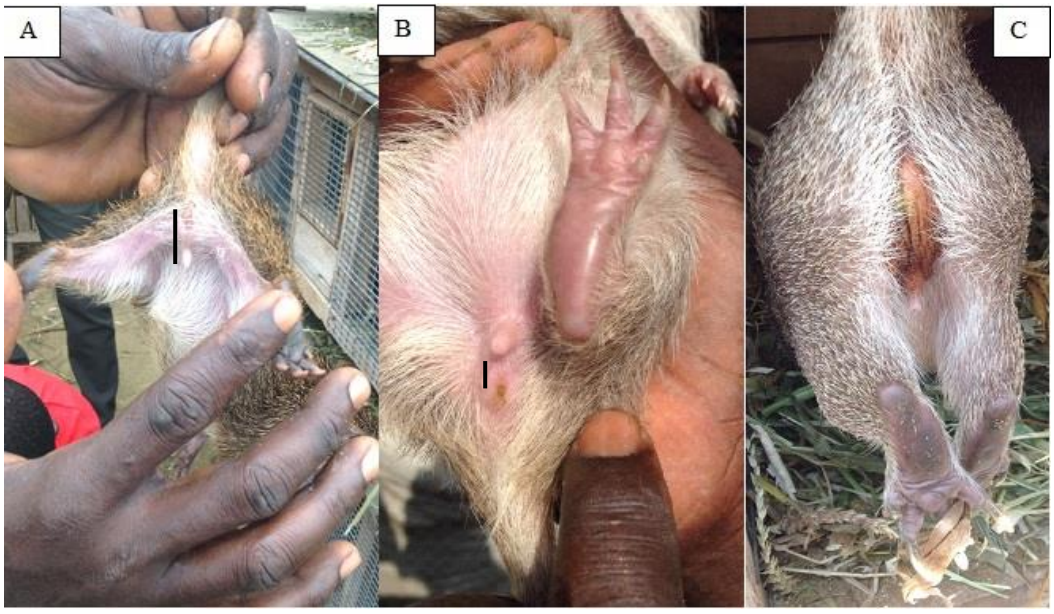

Figure 3. sexing of grasscutter using the genito-anal distance and discoloration of groin. A. longer genito-anal distance signifying a male. B. shorter genito-anal distance showing a female. C. discoloured groin of a mature male

The minimum age of first mating is the equivalent of puberty/sexual maturity (Vink, 2014). It is accepted that while bucks attain this age at 8 months, does do so at 6.5

months (Ngo-Samnick, 2012). Sexually matured does manifest a periodic vaginal membrane perforation phenomenon and are reflex ovulators (Addo, *et al*., 2007). The gestation of grasscutter ranges from 148 – 158 days (Addo, 2002; Akinola *et al*., 2015). Grasscutters are generally weaned at 6 weeks (Vink, 2014, Addo *et al*., 2007). The average litter size is 4 with a range of 2 to 7 (Akinola *et al*., 2015).

Table 4. Knowledge of reproductive features of grasscutters

Variable	**Characteristic**	**Percentage (%)**
Sexing of grasscutter	Genito-anal distance only	26.3
	Head size only	5.3
	Discolouration of groin only	2.6
	Genito-anal distance and discoloration of groin only	18.4
	Genito-anal distance and head size only	13.2
	All the above	28.9
	Do not know	5.3
Minimum age of bucks/males at first mating	Do not know	7.9
	< 8 months	29.0
	8 months	36.8
	≥ 9 months	26.3
Minimum age of does/females at first mating	Do not know	7.9
	< 6 months	5.3
	6 months	31.6
	≥ 7 months	55.2
Average litter size	Do not know	13.2
	1 – 3	10.5
	4 – 6	71.0
	≥ 7	5.3
Duration of weaning	Do not know	10.5
	4 weeks	10.5
	6 weeks	34.2
	8 weeks	36.8
	≥ 8 weeks	7.9

All of the respondents described an oestrus cycle inconsistent with the available literature (Addo *et al*., 2007, Addo 2002). About a tenth (Table 4) of the respondents did not know when their grasscutters attained puberty. Twenty-nine percent (29.0 %) of the respondents used their males for mating at 8 months of age whereas 36.8 % and 26.3 % of the respondents used the males for mating earlier than 8 months and above 9 months respectively. The females were mated before 6 months (5.3 %), at 6 months (31.6 %) and above 7 months (55.2 %) by the respondents. According to some of the respondents, the signs of successful mating were opening of the vagina, whitish

discharge from the vagina, drips of blood from the vagina normally around one month after mating. Similar signs were observed by other researchers (Addo, 2002; Fadimu *et al*., 2020). With regards to litter size, 13.2 % did not know as they are new to grasscutter farming and yet to cross their animals. Some respondents (10.5 %) had between 1-3 pups on average whiles, 71.0 % and 5.3 % 4 – 6 pups and ≥ 7 pups respectively. While most respondents (44.5 %) weaned the pups before 8 weeks, 36.8 % and 7.9 % weaned the pups at 8 weeks and above 8 weeks respectively. The remaining 10.5 % of the respondents did not know when to wean pups. While their reason that they were yet to have their first litter, it questions the research done by some farmers do prior to starting a farm business.

The respondents that used their bucks and does above 8 and 6 months respectively argued while the grasscutters had attained puberty, mating them at the suggested months resulted in either complication at birth or low litter sizes among the does and decrease in libido in bucks as a result of bullying by much older does. They therefore, allowed the grasscutters to mature even after attaining puberty. Some of the respondents also observed an increase in litter size with delayed mating date (does at ≥ 7 months and bucks at ≥ 9 months). Most of the respondents resorted to late weaning (8 weeks and above). They argued weaning is dependent on litter size with respect to growth rate of pups and availability of feed and space for the litter. There was no statistical relationship between the average litter size and the minimum age of mating for neither bucks ($p=0.195$) nor does ($p=0.332$). Therefore, mating a primi-parous doe at more than 6 months for the first time has no effect on the size of litter assuming all other factors are held constant. However, the argument made by the interviewees has been demonstrated in other animals including rodents. Some of the respondents also agreed that the pups can be weaned as early as 2 weeks. They had attempted and succeeded early weaning following the demise of does post-partum. They however, avoided this system due to the labour and time requirement as well as the unavailability of favourable feed for pups. Identical views were shared by Adu (2003) who observed that weaning can be done as early as 4 weeks' subject to proper post weaning management. Some of the feed used by such farmers included cattle and/or sheep milk and corn sprout.

No statistical relationship exists between education level and membership of an association to any of the reproductive parameters identified. When the age of the farm was considered, there was a significant association with the age at which the animals are weaned ($p=0.005$). This implies that, while respondents were grounded in the information they acquired prior to the commencement of the farm, they only fine-tuned their ability to wean the pups as time progressed. The minimum age at which the grasscutters were mated also had no relationship the age at which the pups were weaned.

Health

To analyse the believes of the respondents about the ability of grasscutters to become clinically ill, the respondents were asked to list common clinical signs they have observed in their *flock* and how they treated or managed such issues. About three fourth of the respondents reported at least 3 clinical signs they observed in their grasscutters. The remaining had not observed any signs in their flock. The major signs reported were hyporexia, dullness, diarrhoea, hairs standing on edge, trauma, coughing and difficulty in breathing, and, dystocia, stillbirths and abortions (Figure 5).

Figure 5. Abortion (day 45) with areas of mutilation (arrow heads) by the doe

Most farmers use traditional remedies while a few patronised orthodox medicines. Traditional medicines, as used by this study, implied the used of plant extracts (ethnobotanicals) and other natural products that have not undergone any formal laboratory tests or quality control processes. Such products are also not produced in commercial quantities and cannot be purchased from a pharmacy, being it human or veterinary. Orthodox mediations implied medications that are produced in commercial quantities, can be purchased at a pharmacy and have undergone all the necessary quality control processes.

Twenty-one percent (21%) of the respondents claimed they occasionally used orthodox medications whereas the remaining 79% never used such medications. Oral orthodox medicines were used. They administer the drugs per os directly using a syringe, through water and/or impregnate certain feed mostly sugarcane with the drug. In our opinion, high mortalities in the grasscutter pups on farms visited could be due to heavy worm infestations as earlier reports suggested same (Jori *et al*., 2001; Awuah-Ndukum, 2001; Futagbi *et al*., 2010). These researchers were of the view that administration of water facilitated the ability to give medications to grasscutters. However, there was no statistical relationship between the administration of water

and orthodox medications to grasscutters (p=0.178). The fraction of respondents (21%) that deworm their grasscutters at least once a year corresponded to those who used orthodox medications occasionally. We therefore speculate that the most used orthodox medication in grasscutter farming could be dewormers e.g., albendazole. This is seconded by virucides either given orally to the grasscutters or used as disinfectants. Only Doxin 200® (doxycycline and tylosin) and metronidazole were the antibiotics rarely used. One respondent claimed he used metronidazole as a desperate attempt to stop a diarrhoea bout he observed in his flock. These antibiotics were used as last resort to stopping bouts of diarrhoea. These antibiotics have been suggested to be good for grasscutters (Vink, 2014).

Reasons given by respondents who did not patronise orthodox medications are; I) their grasscutters do not fall sick (46.7 %), II) practicing organic farming (16.7%); and, II) 36.7 % have no idea how such orthodox medications can be used safely in grasscutters. It is rather strange to admit seeing certain signs of ill health in grasscutter and conclude grasscutters did not get sick. It rather points to the fact that most of the respondents' lurch unto common misconceptions surrounding most wildlife, including the inability of certain wildlife species to become clinically ill (Kamins *et al*., 2014). The lack of knowledge on how to correctly select and administer orthodox medication can be a great challenge. This is particularly pronounced in grasscutter farming. Preliminary research and anecdotal evidence by this research team suggests the complete lack of grasscutter education in veterinary schools in Ghana and the inadequate availability of trusted sources of information on grasscutter orthodox medications with respect to dose rates, mode of action, side effects and contraindications. The desire to practice organic farming, is perhaps, the most laudable reason for the neglect of orthodox medicines in grasscutter farming. Regardless, the research team did not find any premium associated with the production of organic meat from grasscutters. While the minimal use of orthodox medication implies the little to no contribution of grasscutter farming to antimicrobial resistance, it also questions the ability of the industry to rightfully prevent and treat diseases and grow. It also questions, the investment of the African scientists in disease prevention and control in grasscutters and other wildlife species peculiar to the continent.

Majority of the interviewees (89%) knew at least one traditional remedy to certain presentations of ill health in grasscutters. These involved the use of plants (including paragis, mint, moringa for inappetence, pneumonia and worm infestation respectively), charcoal (suspected poisoning) and salt (dullness and loss of appetite). Knowledge about the type of traditional remedy for any condition is spread from farmer to farmer and usually serendipitously stumbled upon. Most of the respondents were convinced these remedies were useful. Regardless, it will be essential for these ethnobotanicals to be properly investigated as they serve as cheaper alternatives to orthodox medications.

Table 5. Knowledge of health conditions and use of medications

Variable	Characteristics	Percentage (%)
Use of orthodox medicine	Sometimes/Only when they are sick	21.0
	Used to	7.9
	Never	71.1
Why don't you use	Grasscutters do not fall sick	46.7
	Do not know how to administer drugs	36.7
	Organic farming	16.6
Frequency of deworming	Never	78.9
	Once a year	5.3
	Biannual	10.5
	Quarterly	5.3

Medication, access to veterinary services and knowledge on zoonosis

The role of veterinary services in animal health cannot be relegated in the growth of both industries. An attempt to preliminarily measure the impact of veterinary in the grasscutter farming was analysed. Questions about accessibility of farmers to veterinary services, the ability of veterinary professionals to diagnose diseases and the perception of such services were asked. Less than half (44.7%) of the respondents had come in contact with a veterinarian, veterinary para-professional or both at least once since the grasscutter farm was started. Of this fraction, only 7.9 % of the respondents had a diagnosis (dystocia) made and managed by a veterinarian successfully. The remaining percentage (39.6 %) claimed the veterinary officials either advised them on management practices or admitted they had limited knowledge on the treatment of grasscutters. The general perception of the quality of veterinary services with respect to grasscutter based on first hand experiences and hear-say was also assessed. A majority of respondents (23.7 %) who agreed to answer this question were displeased with the services of animal health officials. The dearth in knowledge on grasscutters of veterinarians and para-professionals they encountered were, to these respondents, unforgiveable. They argued animal health officials, especially veterinarians, ought to do more in providing solutions to the medical needs of their animals. Only 31.6 % of all respondents regarded the services received as at least good. The assessment of the perceived quality of accessibility and provided veterinary services irrespective of the significance is essential. It is therefore expedient for the Veterinary Service Directorate (VSD) of Ghana and the various veterinary institutions to consider the teaching of grasscutter farming and disease control either through continuous professional development courses or in schools. Further studies assessing the competencies of veterinary professionals and students in Ghana in grasscutter farming is necessitated.

Table 6. Perception of veterinary services and zoonoses

Variable	Characteristics	Percentage (%)
	Once a year	5.3
	Biannual	10.5
	Quarterly	5.3
Access to veterinary Service	Yes	44.7
	No	55.3
Type of veterinary professional	Vet Dr	13.2
	Para-professional	21.1
	Both	13.2
	Not applicable	52.6
Any diagnosis made	Yes	7.9
	No	39.5
	Not applicable	52.6
Assessing the veterinary services	Very good	13.2
	Good	18.4
	Bad	23.7
	Cannot rate	44.7
Knowledge of zoonosis	Yes	39.5
	No	60.5

It has been established that grasscutters are carriers of several infectious agents of relevance to humans (Opara & Fagbemi, 2008). The presence of Ebola in some parts of West Africa in 2014 (Tenkorang, 2018) which was linked to wildlife including grasscutters increased the awareness of people to zoonotic diseases. Other zoonotic diseases that grasscutters are implicated as the host include trypanosomiasis, babesiosis, plasmodiasis, leptospirosis and some gastrointestinal helminths (e.g., *Ascaris* sp., *Trichostrongylus* sp., *Fasciola* sp., *Schistosoma* sp., *Taenia* sp. and *Acanthocephalan* sp.) (Opara 2012; Futagbi *et al*., 2010). It is however interesting to note that only 39.5% (Table 5) of the respondents believe that they can either contract or transmit diseases to their grasscutters amidst the recent outbreak of ebola where bush meat was incriminated as a possible source of infection (Onyekuru *et al*.,2020). The remaining 68% of these respondents could name at least one zoonotic disease; Ebola, tuberculosis, rabies and worms. There was no statistical relationship between the knowledge of zoonoses by a respondent and the belonging of the respondent to an association or accessibility to veterinary personnel. That less than half of the respondents were aware of the possibility of acquiring an infection from the grasscutters is not encouraging in our opinion. It is therefore essential for veterinarians and association leaders to increase education on zoonoses and proper ways farmers can protect themselves against these diseases.

Marketing information

The average price of grasscutters and the perception of the interviewees about the availability of a viable market for grasscutter meat were explored. One of the 38 respondents, with 5 months' experience in grasscutter farming, was not sure about the availability of market. The rest unanimously agreed the market was large and the current farmers were incapable of satisfying the demand. The profitability of grasscutter farming has been confirmed by Uka *et al*. (2021) who realised a net positive return and significant variables (including amount of credit used, price of mature grasscutter, number of competitors and value of asset) that influence the franchise. The farmers relied on word-of-mouth as the major way of advertisement. Social media platforms (Facebook and WhatsApp) and/or sign boards were also used. The market universe for the grasscutter farmers comprised of fellow farmers or first-time farmers, chop bars (restaurants) and individuals. Preliminary information acquired from some of the respondents intimated they did not work with bigger restaurants and other foreign organisations, as may be the case in Nigeria and Benin, because they either lacked the capacity or feared being cheated.

Grasscutters can be sold as individual animals or in colonies. A colony, as used by the farmers generally refer to 5 pups (less than 4 months) comprising of 2 males and 3 females. The price of the colony ranged from GHC 400 – GHC 1600 with an average and modal price of GHC 680 and GHC 600 respectively. The adult grasscutter (more than 7months) were sold at a minimum, maximum, average and modal prices of GHC 150, GHC 450, GHC 280 and GHC 250 respectively. The prices of the grasscutter were decided primarily by physical size (not weight) and colour. In terms of colour, premium was given white grasscutters. Very few respondents admitted they considered the cost of inputs, such as feed, labour and transportation, in pricing their grasscutters. The purpose for purchasing the grasscutter also played a relatively significant role. For some respondents, adult animals were sold at a relatively cheaper prices if the animals were meant for breeding. This was seen as a sign of support for upcoming farmers as well as encourage grasscutter farming amongst the youth.

Challenges and suggested solutions

Like other animal farmers, grasscutter farmers are faced with a plethora of problems. The respondents were thus, given the chance to list their top three challenges. They were further asked to propose possible solution to the problems without considering them, the respondents, being given money. Of the identified challenges, the availability of space for farming and expansion, alternate sources of feed (especially during the dry season), means of transportation (especially of feed) and the involvement of the veterinary services were recurrent. These challenges have also been highlighted by Akinola *et al*. (2015) and Adu *et al*. (1999). Other identified challenges were waste management, sources of dedicated labour, streamlining of the prices of grasscutter, problems with exportation of grasscutters (both live and the meat), and

access to loans/capital for expansions. The inclusion of grasscutter farmers in governmental policies e.g., rearing for Food and Jobs, involvement of veterinary services directorate in the education and provision of veterinary help, and good land tenure systems with flexible payment plans were the major solutions proposed.

The involvement of the Central Government (CG) and Non-Governmental Organisations (NGO) in grasscutter farming were also analysed. The aim of the assessment of this parameter was to gauge the involvement of these entities (CG and NGO) in the development and expansion of grasscutter farming in the Southern sector of Ghana with emphasis on the Greater Accra Region. There is ample evidence of the general involvement of NGO in the development of the Northern sector of Ghana (Dery *et al*., 2020) and the efforts of the CG to improve all sectors of the development, especially education and agriculture, in the North is also obvious. Notable NGOs that have been of great help to grasscutter farming include The German Technical Co-operation Sedentary Systems Project (GTZ/SFSP), Heifer International and Japanese International Corporation Agency (JICA) and Grasscutter Initiative for Rural Transformation (GIfT) (Dery *et al*., 2020). GIfT is the only known NGO providing assistance to grasscutter farmers in the Northern sector of Ghana as at the time the study was conducted. A total of 18.4 % of respondents had dealt directly (either approach or being approached) with an NGO or CG within their grasscutter farming carrier prior to meeting the research team. That majority of respondents (at least 83 %) had not been in contact with any NGO and/or the CG representative could stem from the fact that animal-based policies by the CG does not consider grasscutter (palpably absent in Rearing for Food and Jobs), absent of a streamlined and stronger grasscutter farmers' association recognised by the CG, and the fact that development in greater Accra is more infrastructure based than policies. The general perception of poverty levels across the country also positions the Northern sector of Ghana as a viable ground for experimentation and thriving grounds for NGOs. This explains the relative increase in the fraction of farmers that are able to access help from the CG or NGO in the Northern sector as opposed to the Southern sector. As at the publication of this study, an official association for grasscutter farmers in the Greater Accra Region was being formed, with an aim to connect the farmers to the CG, bigger markets and veterinary services.

CONCLUSION

Grasscutter farming in the Greater Accra region of Ghana is increasingly gaining attention as many individuals are beginning to venture into it either as an alternative source of livelihood or full-time job. Regardless of its increasing popularity, the grasscutter industry is plagued with challenges. Primary among them are i) difficulty in getting and cutting fresh grass for the animals especially during the dry season; ii) difficulty in handling some of the animals especially those trapped from the bush; iii) pricing variations and; iv) non-uniformity of information on how to farm the grasscutters possibly due to the unwillingness of some grasscutter farmers to join

farmer's associations. Our study revealed that the future of the grasscutter industry in Accra, Ghana is very bright. This is because of the readily available market of grasscutters where demand continues to exceed supply regardless of the lack of uniformity in pricing.

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