



Research Article

A study on management systems and performances of local chicken kept under smallholder farmers: The case of Jimmahorro district of Kelem Wollega Zone Western Oromia, Ethiopia

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Abstract

This study was conducted in Jimma Horro District of Kellem Wollega Zone of Ethiopia to assess management systems, productive and Reproductive performances of chickens. Three Kebeles (the smallest administrative unit of Ethiopia) from each agro-ecologies of the district were purposively selected of which a total of 165 respondents; 55 from each agro-ecology were used for data collection. The average number of chickens kept per household is similar ($P \geq 0.05$) in all agro-ecologies with an overall average of 12.04 ± 0.1 chickens. The study revealed the percentage flock structure of the area is about 29.4, 23.3 and 16.9, 16.4 and 14.1% for hens, chicks, pullets, cocks and cockerels respectively for highland, mid-altitude and lowland. Average age at maturity for cockerels and age at first lay for pullets were similar ($P \geq 0.05$) in all agro-ecologies and this is 7.3 and 6.9 months respectively. Local pullets and cockerels at maturity reach a weight of about 1.2 to 1.6 and 0.7 to 1.4 kg with overall average weight of 1.4 and 1.08 kg respectively. The average number of laying clutch per year is 2.9 and the average number of eggs laid per clutch was 12.3. These were similar ($P \geq 0.05$) across the three agro-ecologies. The average number eggs laid per hen is similar ($P \geq 0.05$) in highland and mid-altitude and the overall number of eggs laid per hen per year is 39.8 ranging from 30 to 50 eggs but, the difference seems wider ($P \leq 0.05$) from low land. The hatchability of incubated eggs has shown a significant difference ($P \leq 0.01$) among the agro-ecologies. The highest being observed in highland and the least was reported from the lowland. Generally, the study revealed poor housing and feeding system and low productive and reproductive performances of local chickens which need to be improved to improve the livelihoods and best nutrition of the local people.

Introduction

Agriculture is the back bone of Ethiopian economy where the sector contributes about 42.3% to the total Gross Domestic product (GDP), (World Bank, 2014). Livestock sector as integral part of agriculture contributes about 40% of agricultural GDP and quarter (26.4%) of national GDP (ILRI, 2016). In terms of number, Ethiopia has the largest livestock population in Africa

and it is home to 56.71 million cattle, 29.33 million sheep, 29.11 million goats, 2.03 million horses, 7.43 million donkeys, 0.4 million mules, 1.16 million camels and 56.8 million chicken [1]. Smallholder societies throughout the world in general and developing countries in particular use chicken for multipurpose uses including: a source of income and means to ensure food security; cultural and social values such as ritual sacrifice and symbolism, gifts to strength social bonds, and source of economic empowerment for women [2].



About 95.9% of chicken populations of Ethiopia are local breeds and the rest are exotic and hybrids [3]. Chickens play crucial roles in the livelihood of resource-challenged families of the country. According to Mamo, *et al.* [4] chicken production has socio-cultural and economic benefits especially in the rural communities of the country. Traditional/village chicken production system is the dominant system practiced by almost every rural household of Ethiopia (Alemayehu, *et al.* 2015) and it covers more than 90% of the total chicken meat and egg produced in the country [5]. In Ethiopia, about 99% of the total national chicken products (eggs and meat) are contributed by indigenous chickens kept under village management system while the remaining 1% is obtained from intensively kept exotic breed of chickens [6].

In Ethiopia there is a high demand for animal protein, which could be easily met by chicken. However, the performance of chickens in Ethiopia is poor and consequently the demand for chicken products is not met (WPSA, 2013). Research reports from some parts of Ethiopia indicated that, the local chicken breeds have low production and reproduction performances (slow growth rate, late maturity, few egg yields, small-sized eggs, high mortality rate, extended reproductive cycle and extended inter-clutch length) [4,5,7,8]. The use of existing potential of indigenous genetic resources needs comprehensive study of the management systems and performances of chickens at different areas and agro-ecologies and this need to be exhaustively studied for future improvement of the economy of small holder farmers and nutrition of the poor families of the country. However, no detailed study was conducted in western part of the country in general and Jimma Horro District in particular. Therefore, this study was carried out to determine the impact of natural, socio-economic and management factors on the level of reproductive and productive performance of indigenous chicken in Jimma Horro District of Kellem Wollega zone of Ethiopia.

Materials and methods

Description of study areas

The study was conducted in Jima Horro District of Kellem Wollega Zone. Jimma Horro district is located at 641 km West of Addis Ababa the capital city of Ethiopia. The district is located at an altitude range of 1400 to 2200 meters above sea level. The average annual minimum and maximum temperature of the district is 18°C, and 27°C, respectively and the annual rainfall ranges from 700 to 1000mm. The livestock resource of the study district comprises of 66267 cattle, 19421 sheep, 13647 goats, 257 horses, 6809 mules, 9873 donkeys, and 68401 chickens. The total human population of the district is 56403, of which 50% is reported to be male [9,10].

Data collection

Selection of the study areas: For the study three Kebeles (the smallest administrative unit in Ethiopia) were selected. Accordingly Nunu from lowland, Ilukitaye from mid-altitude and Tibe from highland were purposively selected for the study based on the agro-ecology, their representativeness, accessibility and practices of chicken production.

Households sampling techniques: A rapid informal field survey and group discussion with the District livestock and fishery office experts and knowledgeable farmers were conducted to have reconnaissance information about the study areas and to select study areas according to their agro-ecologies. With the help of development agents all the chicken owners of selected areas were listed. Then the total numbers of households to be interviewed were estimated to be taken proportionally from each study area. Accordingly 55 farmers were estimated to be selected from each study area. After knowing the total number of farmer's selection of individual farmers for interview was conducted randomly. Data was generated by administrating a pre-tested structured questionnaire using an enumerator which was led by close visits and supervisions by the researcher in order to improve the quality of data collected by selected enumerators.

Statistical analysis

Data collected through questionnaire, observation, and interviews were analyzed by descriptive statistics using Statistical Package For Social Sciences (SPSS) version 20. The results of numerical collected data were analyzed using Analysis of Variance (ANOVA) following the General Linear Model Procedure of the Statistical Analysis System [11] at $\alpha = 0.05$. Mean separation was done for results with significant variations.

Results

Household characteristics of respondents

Household characteristics of surveyed households are presented in (Table 1) below. About 72.1% were males and 27.9% were females. Most of the surveyed households had formal education which extends from elementary school to college level and less number about 23.6% were illiterate. About 83.6% and 16.4% of the respondents reported to having experience of 2 to 14 and 15 to 40 years in chicken rearing, respectively.

Occupation of respondents

The occupation of the surveyed households is presented in Figure 1. Farming/cultivation, trading, mining and labour

Table 1: Demographic characteristics of respondents of the study areas in percent (%).

Variable	Agro ecology			
	Highland (Tibe) (N=55)	Mid- altitude (Ilukitaye) (N=55)	Lowland (Nunu) (N=55)	over all (N=165)
Sex of respondent				
Male	67	75	75	72
Female	33	25	25	28
Educational background				
Illiterate	18	25	27	24
Read and write	45	31	24	33
Grade 5-8	20	31	14	22
Grade 9-12	13	13	22	16
College and above	4	0	13	5

N= Number of Respondents



employments were the major economic activities of the respondents, of which farming or agriculture is the dominant (91.5%). Few of the surveyed households were engaged in petty trading and mining as indicated in Figure 1.

Landholding and land use patterns

Land size and land-use patterns of surveyed households are summarized and presented in (Table 2). The average land-holding of the surveyed households were 2±0.2, 1.9±0.1 and 0.8±0.1 ha/hh for highland, mid-altitude and low land respectively with an overall mean of 1.53 ha/hh in the district. Large portion of private lands of the surveyed households is allocated for the cultivation of crops with less is allocated for grazing.

Livestock holding

The livestock holding and livestock structure of surveyed households is summarized and presented in Table 3 below. Most of the surveyed holds hold Cattle, sheep, goats, donkeys and chickens. Almost all the livestock reared in the study areas are local breeds.

Flock structure

Flock structure is described in terms of the number and proportion of the different age groups and sex in a flock is presented and summarized in Table 4, Figure 2 respectively. The study revealed that the largest flock size holding per household is 15.78±1.9 ranging from 3-105 for highland, 13.75±1.45 ranging from 2-60 for mid-altitude and the smallest flock size was observed 6.6±0.65 (ranging 2-20) in low land areas. The study also revealed overall average number of chicken per household was 12.04 which range from 2 -105.

The overall structure of chickens holding of the surveyed households of the study district is depicted in Figure 2 below.



Figure 1: Occupation of surveyed households.

Table 2: Average landholding (ha) and land use pattern of the surveyed households.

Land use	Highland	Mid- altitude	Lowland	Over all(N=165)
	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Total land	2±0.20	1.9±0.10	0.8±0.10	1.53±0.10
Annual crop	1.01±0.10	1.04±0.10	0.41±0.04	0.82±0.10
Perennial crop	0.61±0.10	0.5±0.004	0.27±0.03	0.46±0.03
Grazing	0.34±0.10	0.3±0.30	0.19±0.10	0.27±0.03
Fallow	0.04±0.20	0.08±0.20	0.01±0.10	0.04±0.10

N: Number of Respondents; %: Percent.

Table 3: Species and number of livestock holding of the surveyed households in percent (%).

Variable	Agro ecology			Over all(N=165)
	Highland (55)	Mid- altitude (55)	Low land (55)	
	Mean±SE	Mean±SE	Mean±SE	Mean±SE
Cow	2.8±0.2	2.6±0.3	1.25±0.2	2.2±0.1
Oxen	1.8±0.2	2±0.3	0.78±0.1	1.53±0.1
Calf	1.98±0.2	1.8±0.2	0.73±0.1	1.5±0.1
Heifers	1.85±0.9	1.96±0.3	0.67±0.1	1.5±0.1
Bull	1.53±0.2	1.73±0.2	0.64±0.2	1.3±0.1
Sheep	3.07±0.3	2.35±0.3	0.62±0.2	2±0.2
Goat	0.15±0.1	0.4±0.1	0.6±0.1	0.4±0.1
Donkey	0.73±0.1	0.58±0.1	0.31±0.1	0.54±0.1
Chicken	15.78±1.9	13.75±1.5	6.6±0.7	12.04±0.1

Table 4: Flock size and flock structure in number.

Agro ecology	Cock Mean±SE	Hen Mean±SE	Pullate Mean±SE	Cockerels Mean±SE	Chicks Mean±SE	Over all Mean	Range
High land	2.9±0.58	4.05±0.7	3.29±0.8	2.95±0.9	4.35±0.5	15.78±1.8	3-105
Mid- altitude	2.04±0.1	3.40±0.3	2.33±0.3	1.75±0.2	2.69±0.3	13.75±1.4	2-60
Low land	0.93±0.4	3.16±0.2	0.49±0.1	0.38±0.1	1.38±0.4	6.6±0.7	2-20
Over all mean	1.96±0.3	3.54±0.3	2.04±0.3	1.69±0.3	2.81±0.2	12.04±0.9	2-105

Proportion of Chicken in the Surved Area

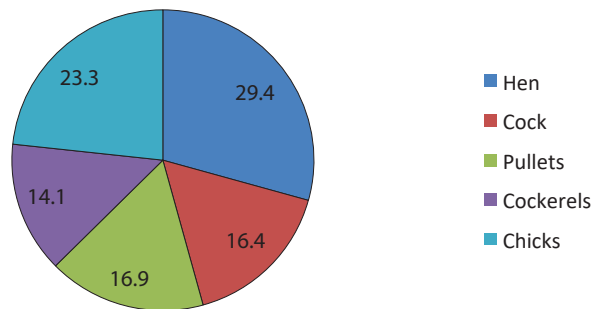


Figure 2: The overall Flock structure surveyed household's holding.

Surveyed households hold a higher proportion of hens which accounted for 29.4% followed by chicks (23.3%) and pullets (16.9%).

Intra-household dynamics and labor profile

Intra household decision-making power over chicken management among family members is summarized and depicted in (Figure 3). The study indicates that construction of shelter and perches is totally managed by male households, in 94% of surveyed households cleaning chicken houses and in 88.5% of surveyed households feeding of chickens is managed by both female and children members of the households. The ownership pattern which is usually related to decision making in selling and consumption of chicken and eggs is majority (73%) is managed by females only and in a few surveyed households (27%) is managed by male households.

Performances of indigenous chickens

Age at sexual maturity: Surveyed households reported age



at sexual maturity as age at first egg and age at first mate for female and male chickens respectively. Accordingly, the average age is estimated to be 7.3 months ranging from 6 to 9 months for cockerels and it is estimated to be 6.9 months ranging from 5 to 9 for pullets (Table 5).

Productive performance of indigenous chickens: Productive performances of indigenous chickens were evaluated under farmer management conditions in terms of the average number of eggs laid per hen per year, number of clutches per year, number of eggs laid per clutch, number of eggs set for incubation per hen, hatchability of set eggs and mortality rate of hatched chicks. The present study result revealed that no significant ($P \geq 0.05$) difference in weight was reported at maturity for the difference in altitude for both pullets and cockerels. The average weight of pullets and cockerels at maturity age is 1.4 and 1.08 kilograms respectively. The clutch number, number of eggs laid per clutch and per year, eggs set per hen and mortality of hatched chicks also did not have shown any significant difference ($p \geq 0.05$) across the difference in agro-ecology of the study areas. According to the observation of the respondents the number of eggs laid per hen per year were similar ($P \geq 0.05$) in between highland and mid-altitude but, the difference was significant ($P \leq 0.05$) in lowland and the numbers were 40.4 ± 0.5 , 40.1 ± 0.5 and 38.6 ± 0.5 for highland, mid altitude and lowland with an overall average of 39.8 ranging from 30-50 eggs. Similarly, the hatchability of eggs set decreased significantly ($P \leq 0.01$) from highland to low land.

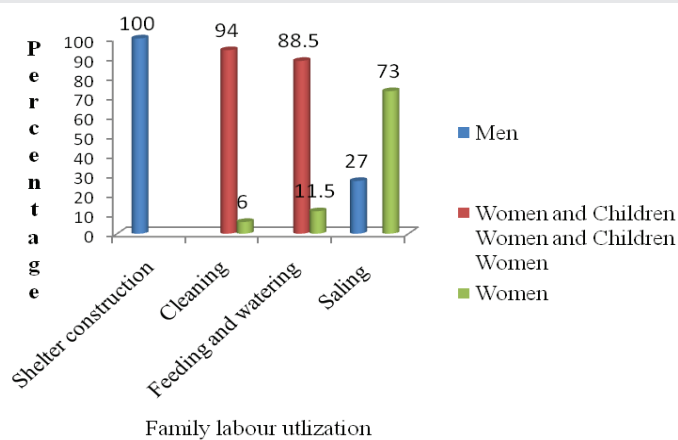


Figure 3: Percentage intra household decision-making power among different family members.

Socio- economic importance of chicken: The socio economic importance of chicken in the present study area was studied and summarized in Table 6. The result indicates the similarity in egg and reared chicken utilization across the three agro-ecologies of the district. About 35% of eggs produced in the areas are mainly used for incubation, about 20% for home consumption and about 45% is used for sale. Home reared chickens are mainly used for replacement stock, sale and home consumption purposes. The purpose of egg production in the study areas is summarized in (Table 6). A large portion (45%) egg collected is used for income generation, about 35% used for incubation and about 20% used for home consumption.

Discussion

The present study was conducted in three agro-ecologies of JimmaHorro District, in Western part of Ethiopia. The study revealed that the average land holding per household of the study district is 1.53ha ranging from 2 ± 0.2 in highland to 0.8 ± 0.1 ha in lowland. The larger land holding observed in highland is due to more practice of cultivation of crops than the lowland dwellers where large communal grazing and forest persist. The overall average land holding per household of the study district is comparable with reported result 1.4 ha for Lume and 1.1ha reported for Ada'a districts of Ethiopia [7] and this was lower than 4.2 ha reported for Central rift valley areas of Ethiopia [12]. Furthermore, average land holding per household reported in the current study was higher than the national average which is below 1ha per household [1]. The average number of chickens held per households reported for the present study area is found to be higher (15.78 ± 1.9) in highland as compared to the lowland (6.6 ± 0.7) areas. This result was higher than the average flock size of 9.2 and 8.8 chickens/household reported for Dale district and Awasazuria [13,14] respectively and the overall average flock size reported in this study (12.04 chicken/household) was higher than the national report (4.1 chickens per households) and that of 3.6 chicken per households of Oromia Regional state of Ethiopia [15]. Nevertheless, the value reported in the present study area is lower than the reports of Eugene, et al. (2004) who reported for Philippines, Sewannyana, et al. [16] of Uganda, and Khalafalla, et al. [17] of Sudan who reported the mean flock sizes of 19, 18 and 22 per household respectively. The result is also larger than household chicken flock size 1 to 95 reported for Africa [18].

Table 5: Reproductive and productive performances of the local hen in the study kebeles.

Parameter	High land (55)	Mid highland (55)	Lowland (55)	Overall		
	Mean± SE	Mean± SE	Mean± SE	Mean	Range	S.L
Age at maturity of cockerels	7.1±0.1	7.35 ±0.1	7.33±0.1	7.3	9-Jun	NS
Age of 1st egg of pullets	6.95 ±0.03	6.93 ±0.04	6.85±0.1	6.9	9-May	NS
Weight at maturity of cockerels	1.4±0.01	1.39±0.01	1.38±0.01	1.4	1.2-1.6	NS
Weight at 1st egg of pullets	1.07±0.02	1.1±0.02	1.07±0.02	1.08	0.7-1.4	NS
Clutch per year	2.95 ±0.04	2.98±0.04	2.74±0.04	2.9	4-Feb	NS
Egg layed per hen per clutch	12.6±0.1	12.1±0.1	12±0.1	12.3	14-Dec	NS
Egg layed from local/year	40.4±0.5 ^a	40.1±0.5 ^a	38.6±0.5 ^b	39.8	30-50	*
Egg set per hen per clutch	12.6±0.1	12.12±0.1	12±0.1	12.3	14-Dec	NS
Hatchability	85.45±0.6 ^a	82.36±0.6 ^b	79.09±1.3 ^c	82.3	60-90	**
Mortality of chicks	39.8±0.95	41.45±0.9	41.91±0.1	41.1	20-55	NS

S.L: Significance Level; *, = $P \leq 0.05$ **, = $P \leq 0.01$, NS= None Significant; means within a row with different superscript are significantly different at $p \leq 0.05$, Numbers in brackets indicate number of respondents

**Table 6:** Purpose of egg and chicken production of study areas.

Descriptions	Agro- ecologies			
	Highland (N=55)%	Mid- altitude (N=55)%	Low land(N=55)%	Over all(N=165)%
Purposes of eggs				
Hatching	30.9	37.5	36	35
Consumption	23.3	17.8	20	20
Selling	45.8	44.7	44	45
Purpose of chicken				
Replacement	40.16	33.43	30.5	35
Sale	49.93	53.37	49.5	51
Consumption	9.9	13.19	20	14

N: Number of Respondents; %: Percent

Labour is one of the most limiting resources in agricultural activities in small holding rural farmers. Given that the dominant structures for agricultural production are family farms, according to the result of group discussion with local farmers use farm households according to sex and age of the family member. Accordingly, the study revealed that chicken production and product management system is similar across all the study agro-ecologies of the study districts. Chicken house construction was entirely the responsibility of male households of all the surveyed households. Whereas, in 94% surveyed household's house cleaning is managed by both children and female members of the household. Similarly in 88.5% of the surveyed household's provision of feeds and water for chickens is managed by both female households and children of the family. While in the rest of surveyed households house cleaning and provision of feeds and water is managed by females. This finding is also similar with reports of Fisseha (2009) who reported in 97.5% surveyed household's construction of house for chicken was managed by men. He also has reported that in his study area women and children were responsible for cleaning bird's house, provision of supplementary feed to birds and selling of chicken and chicken product is largely managed by females. Similarly Tadelles, et al. [19] reported that the women in central highlands of Ethiopia own and manage birds and control the cash generated from the sale of birds. Similar study results were also reported for other parts of the world (Riise et al., 2004 Abubakar, et al. (2007), who reported that women and children were generally in charge of rural village chicken husbandry practices in developing countries like Nigeria and Cameroon. Chicken in the study areas fulfil multiple roles within household livelihood strategies beyond improving maternal and child nutrition. According to the present finding the women have the possibility of making the decision to sell and/or consume poultry meat and eggs without need to formally negotiate with their husband/partner. This could indicate that, chickens play an important role in women's economy and women's capacity to carry out her responsibility of caring for home and family issues.

The maturity age which could be defined in terms of age at first egg for females and age at first mating for males is similar ($P \geq 0.05$) across the study agro- ecologies of the district. The overall average age at first egg was 6.9 months ranging from 5-9 months which is comparable with the 5.9 to 7.1, 6.6, 7.1 and

7.1 months age at first egg lay reported for different areas of Ethiopia [13,20]. The study also revealed that local pullets and cockerels at maturity age weigh about 1.2 to 1.6 and 0.7 to 1.4 kg with overall average weight of 1.4 and 1.08 kg respectively. This result was similar ($P \geq 0.05$) for the three agro- ecologies. These results may indicate there is similar feeding and other managing system of chickens in different areas of Ethiopia resulting in late age of maturity and low yield performances of chickens. Similarly, Bogale (2008) indicated that the meat production ability and growth performance of indigenous chicken are limited and grower local males may reach 1.5kg live weight at 6 months of age while females reach about 30% less. According to the observation of surveyed households, the average number of eggs laid per hen per year and the average number of clutch number per year were similar ($P \geq 0.05$) in three of agro- ecologies studied with slight decrease from highland to lowland. The overall number of clutch for the district was 2.9 which are similar with 3.1 reported study result for Uganda (Ssewanyana, et al. 2004). However, the average egg production per hen per clutch was 12.3 which were relatively similar with 12 eggs per hen per clutch reported at national level [15]. The annual number of egg production is 39.7 ranging from 30-50 eggs. This value is lower than the value reported (55.2 eggs/year/head) for Dale district of Ethiopia [13] but similar to value reported (36-42 eggs/year/head) for Ambo [21].

Comparing the three agro- ecologies, chickens in highland relatively had the best performance with the highest egg production of 40.3 eggs/hen/year and also highest hatchability 85.45% which differed significantly ($p < 0.05$) from the other two agro- ecologies. It is believed that the annual egg production in a flock is a function of egg production per hen per clutch, clutch size and the proportion of matured hens in a flock. Hence, the significant variation in annual egg production of highland might be associated with the relatively high egg production per clutch recorded in the areas, which are a function of management and climate of the areas. The hatchability of eggs reported by surveyed households has shown significant difference ($P \leq 0.05$) among the three agro-ecologies covered. The overall average hatchability of incubated eggs by broody hens in the present study area is about 82.3% which is comparable with 82.8% reported by Nigatu and Bezabih [22] and higher than the 72% reported by Yitbarek and Atalel [23], 59.6% by Yitbarek and Zewudu [24] for different areas of Ethiopia. However, the percent hatchability was lower than 89.1% reported by Mokennen [13] in Ethiopia and 84.5% by Hagan, et al. [25] in Ghana. Hatchability often depends on instinct maternal behavior of the hen, degree of management of the hen during brooding and prevalence of predators [25], while survival rate of the hatched chicks depends on prevalence of predation and disease [25]. The present finding is also relatively higher than 69.7% reported by Eugene [26] for Philippines and 78% reported by Khalafalla, et al. [17] for Sudan in village chicken production system. Generally, the present result is within the range reported for family chicken in low income food-deficit countries of Africa, which is 60-95% [18]. Comparing the three agro-ecologies no significant difference ($p > 0.05$) is observed in chick mortality. The results



of this study clearly showed that hatchability seems to be one of the detrimental factors limiting chicken production in JimmaHorro District. The lowest percentage hatchability occur rainy seasons. Almost all the respondents believe that the highest percentage hatchability could be obtained from eggs incubated from October to January. Mean chick mortality (to an age of 8 weeks) of the indigenous chickens of JimmaHorro District was calculated to be 41.06% which was lower the value reported (55) for the Dale District of Ethiopia (55%) Mokonnin [13]. The high rate chick mortality reported in present study report needs to be improved through better feeding and other systems of management [27–30].

Conclusion

There is generally poor housing, feeding and watering system of chicken in the area. The family labor inputs into the rural chicken production system of the area involve the whole family but there is more time and labor demand for women than men. Chicken keeping is a domain of women and children in most of the families. The study also revealed large number of chickens per household with low performance in growth and low number of egg production. Rural poultry- keeping can be used to reduce poverty levels within the women and children in rural areas but, the poor performances needs to be improved through good housing, feeding, health and breeding management.

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