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Performance evaluation of selected exotic chicken breeds under farmers management in Derashe and Konso Zones, SNNPR, Ethiopia

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Abstract

This study was conducted under on-farm conditions, as farmer-led experimentation; in two target areas (Karat town and Gidole town) of Konso Zone and Derashe Zone, South Ethiopia with the objective of evaluating and comparing the production performance of Koekoek and Sasso chicken breeds under different locations and on farm management systems to establish breed suitability under varying conditions. In this study, the growth of chickens was mostly affected by the environment which reflects their differences in response to location factors. In general, the observed final bodyweight attained by Sasso during the growing phase in the present study was 2.5± 14.9 gram. The current study's findings regarding the egg production attribute indicate that the interplay between location and breed has an impact on the age at which the first egg is laid. Koekoek chickens matured around 11 days earlier than Sasso chickens in the Karat town whereas Sasso chickens matured about 13 days earlier in the Gidole town. In the current study, both the growing and laying stages showed higher chicken mortality rates in the low land area than in the highland area. Poor management techniques (inadequate feeding) of the birds observed in the lowland areas as opposed to the highland areas may be to blame for this.

Keyword: Koekoek; Sasso; Production; Management; Agro Ecology

1. Introduction

The majority of households in Ethiopia's rural, urban, and peri-urban areas raise chickens, which, like in other developing nations, allows farmers to reap the benefits of high-quality protein in the form of eggs and meat from only scavenging feed resources [1]. Even though there are a lot of chickens (59.495 million), Ethiopia only produces 13,111 metric tonnes of meat and 54,395 metric tonnes of eggs each year [2]. The fact that the average per capita consumption of chicken products is less than 1 kg, one of the lowest in the world, shows that there is a significant mismatch between the supply and demand of poultry products (meat and eggs) in the nation [3; 4].

For the past decades, low production performances of indigenous chickens have been enforced to introduce exotic breeds to improve their performance through crossbreeding with exotic chicken strains, which could not be successful. It may be due to, dissemination of inappropriate technologies without an understanding of production environments under which indigenous chickens are kept and lack of information on breeding objectives and farmers' trait preferences [5]. Even though Exotic temperate breeds have fast growth rates and better egg production potential when we compare with existing indigenous chickens; they demanded high feed quality and quantity, veterinary, energy cost, and poorly adapted to the low-input chicken management systems which dominate the rural area of the country [6].

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Sasso and Koekoe chickens have been recently introduced in Ethiopia to support poverty reduction, productivity growth and increased household animal protein intake. Sasso has been introduced in the country by Ethio chicken Company, while Koekoe has been introduced by Debrezeit Agricultural Research Center.

The two breeds are now being popularized in the country and are distributed to farmers by poultry multiplication agencies in Ethiopia.

There is scientific and documented evidence of differences in the performance of different breeds in different environments and management conditions [7; 8].

An animal of good genetic potential may perform poorly when the production environment is not favorable due to the negative interaction between the animal's genes and its environment. This is because management practices may vary as a result of different production environments and constantly changing climatic conditions leading to variability in animal performance. It is imperative to test the performance of these two breeds under the varying environmental conditions to ascertain their suitability. Locations as defined by rainfall, temperature, vegetation type, soil type and topography was found to be a significant source of variation in growth and egg production performance in some studies [9; 10].

Similarly, the management condition as defined by level of nutrition, health care and housing also influence the variation in animal performance [11; 12].

It is critical, then, to be aware of any interaction that affects performance and to develop an efficient strategy of genetic management accordingly. Therefore, the objective of this study was to evaluate the performance of the two breeds under different locations to establish breed suitability under varying conditions and recommend the most suitable breed for a particular environment. Moreover, results from this study will assist in providing inputs in the designing of appropriate breeding programs for the improvement of chickens.

Objectives

To evaluate and compare the production performance of Koekoek and Sasso chicken breeds under different locations and on farm management systems to establish breed suitability under varying conditions.

2. Materials and methods

2.1. Description of the Study Area

This study was conducted under on-farm conditions, as farmer-led experimentation; in two target areas (Karat town and Gidole town) of Konso Zone and Derashe Zone, South Ethiopia. These districts were selected based on number of chickens, number of households rearing chicken, availability of feed resources for chicken and diversity across the region and strategically selected for their accessibility and safe for research work.

2.2. Experimental design and sampling procedure

The experiment was arranged in a 2x2 factorial design involving two breeds (Koekoe and Sasso) and two study areas (Gidole town and Karat Town). Selection of villages and households participating in the study was done in collaboration with district and kebele livestock officers. In each study area, two villages were purposively selected, and from each village, 3 farmers were involved in the study. i.e,. 12 households. Criteria for a household to be included in the study area was willingness to participate in the research project and the ability to provide all necessary management for chicken including housing, supplementary feeding, health care, etc. Each participating farmers in the village was received 50 birds of mixed sex (25 koekoe and 25 sasso).

2.3. Disease Prevention and Control

Disease prevention and control action was undertaken using our research center health researchers. Those health experts provided vaccination against poultry iseases such as Marex at day one, New castle/HB1 at day three, Newcastle/HB1 and Gumboro at day seven, Gumboro at day fourteen, Newcastle/Lasota at twenty one day, Gumboro and fowltyphoid at twenty seven day and Gumboro at thirty five day old based on veterinary vaccination schedules. Medication was provided depending on the occurrence of specific disease symptom.

2.4. Experimental Birds and their Management

Evaluated Breeds: Two breeds were used for on-farm breed evaluations.

Sasso, a commercial breed originating from France, in 1950s a person (serge Perrault) from south France wanted to preserve the traditional chicken breed. His work led to the development of the SASSO T line, a project by a cooperative of farmers in the same area led to the creation of SASSO when they were involved in the development of the "label rouge" specifications for traditional chicken.

Koekoek is a south African breed of chicken, developed in the 1960s at the Potchefstroom agricultural college in the city of Potchefstroom by Chris Marais. It was developed by cross breeding number of breeds (black australop, white leghorn and barred Plymouth rock).

A total of 600-day old chicks of Sasso and Koekoek breed were purchased from Hawassa poultry center. Transportation of day old chickens was under taken to the study areas and distributed to the selected farmers the same day at their gate. Each participant farmers have received 50 chicks (25 koekoek and 25 sasso). Commercial starter feeds were provided *ad libitum* for the first two weeks of brooding. Thereafter, feed was provided based on recommendation. Water was provided *ad libitum* throughout the brooding period. Brooding was done by using Solomon hay box brooder. Training on proper management of the birds and data recording was provided to participating farmers and four livestock field officers, two for each location. Apart from data recording, district officers were also responsible for super visiting and advising farmers on all management aspect of the birds.

2.5. Data collection

Data on growth, egg production and mortality were recorded at different age, it is up to 20th week of age for male, while for female records were extended up to 52 weeks to capture egg production data. The following parameters were recorded.

- **Body weight (BW)** at different ages; birds were weighted individually using a digital weighting scale at 1st week (to obtain initial body weight) and then at 8, 12, 16, and 20 weeks of age.
- **Total weight gain (TWG)** was calculated as the difference between initial body weight at 1st week and the final body weight at 20 weeks of age.
- **Age at first egg** was taken as the number of days between hatching date and data of the first egg (i.e., 5% flock egg production)
- Similarly, **age at peak egg production** was taken as the age at maximum weekly % egg production.
- **Hen housed egg production (HHEP)** was calculated by dividing the total number of eggs laid by the number of hens housed at the start of lay.
- **Hen day egg production (HDEP)** was calculated by dividing the number of eggs by the number of hens surviving on that particular day.
- **Egg production rate**; the average for the whole egg-laying period of HDEP was calculated in percentage and termed as egg production rate.
- **Mortality** and disease occurrence were recorded as they occurred during both growing and laying periods.

2.6. Statistical data Analysis

The analysis model for performance data includes the environment effect to compare body weight, egg production and egg weight variation among breeds and between districts. Two-way interactions (breed £ location) analysis was used to know the performance of various parameters for the on-farm test. Study areas were used as a block because a number of environmental factors and each individual household farms distributed within the towns were used as experimental units. General Linear Models (GLM) procedure of SAS (2009) by considering breeds and locations as fixed effects and their interaction.

The effect of strain, location, and strain by location interaction were included in the model. The model for the on-farm test was:

$$Yijk = \mu+Ti+\beta j+T\beta ij+\varepsilon ijk$$

• where; Yijk is the observation of k in breed i and study area j, μ is the overall mean of a parameter (body weight, egg production, egg weight, and survivability) measured of the ith group of strains and jth study area, Ti is the effect of breed

(Koekok and Sasso), βj is the effect of study area (Karat town and Gidole town), Tβij is the interaction effect of breed and study area, εijk is the random error.

3. Result and discussion

In this study, the growth of chickens was mostly affected by the environment which reflects their differences in response to location factors. The final body weight and weight gain during the growing phase were higher for chickens in the Gidole town than in the Karat town. Such variations might have been caused by differences in feed availability and weather conditions of the two locations. This observation is supported by Goromela et al. [15] who showed that locations have a great influence on the availability of feed resources.

Reports from other studies have shown better feed availability in highland than in lowland areas. For example, Pius and Mbaga [16] reported availability of feed in the cool southern highland than in the central semiarid zone, Tanzania. Also, Alem [17] and Habte et al., [18] reported relatively better performance of both local and exotic breeds in midhighland than in the lowland ecologies of Ethiopia which were attributed to the availability of feeds and favorable environment. Mulugeta et al. [10] also reported better growth performance of DZ-white and improved Horro chickens in the highland than in the lowland area in Ethiopia. Significant breed x location interaction effects were observed for body weight at 12, 16 and 20 weeks of age. The bodyweight of Sasso birds in the Karat town at week 20 was lighter by 13.6% than those Sasso in the Gidole town.

Table 1 LSM ± SE value for body weight (BW in gram) at different ages (week) and total gain (TWG in gram) summarized by breed and location

Fixe effect	**Mean body weight (BW) at different ages (weeks)**						**Total weight gain (TWG)**
	Week 1	Week 4	Week 8	Week 12	Week 16	Week 20	
Breed							
Koekoek	35.4 ± 1.14	362.1 ± 1.9	739.5 ± 4.7^{b}	1069.7 ± 8.3^{b}	1486.9 ± 12.3^{b}	1995.0 ±14.3^{b}	1959.58 ± 14.1^{b}
Sasso	41.3 ± 1.19	436.6 ± 2.3	829.0 ± 5.1^{a}	1243.9 ± 9.2^{a}	1827.1 ± 12.8^{a}	2590.1 ± 15.1^{a}	2548.8 ± 14.9^{a}
p-value	0.4128	0.3927	0.0019	<.0001	<.0001	<.0001	<.0001
Location							
Karat	37.5 ± 1.10	379.3 ± 2.2	771.3 ± 4.9^{b}	1121.2 ± 8.5^{b}	1536.6 ± 12.6^{b}	2178.4 ± 15.8^{b}	2272.1 ± 14.3^{b}
Gidole	37.9 ± 1.15	424.7± 2.4	812.0 ± 5.3^{a}	1203.0 ± 8.9^{a}	1721.3 ± 13.4^{a}	2321.0 ± 15.9^{a}	2321.9 ± 14.6^{a}
p-value	0.3167	0.0836	0.0612	00157	0.0081	0.0088	0.0036

LSM least square mean, SEM standard error of the mean $^{a, b}$ Least square means with superscript letters in common with in a column are significantly different

The lower performance of Sasso in the Karat town depicts sensitivity of the breed to variation in environmental factors and may be attributed to heat stress, inadequate feeding, and limited scavengable feed resources which probably affected negatively the growth performance of the breed. This observation is provided with argument put forwarded by Sanka et al. [19] that Sasso breed has more broiler genes and its heavier , probably needs relatively more feeds to optimally express their genetic potential

On the other hand, the final body weight of Koekoek was similar in the two locations which may imply that the breed was less sensitive to change in the environmental conditions. According to Lozano-Jarmillo et al. [20], variation in productivity among breeds can be attributed to the breeds origin, which can influence the breeds intrinsic response to diverse environmental conditions. Sasso breed is said to have genes associated with homeostatic regulatory functions such as response to hypoxia, cold, and starvation [21]. Hence these factors might have contributed to the Sasso breed maintaining its body weight regardless of the agro-ecologies under the present study.

In general, the observed final bodyweight attained by Sasso during the growing phase in the present study is below the range of 2.7 ± 0.53 kg and 2.98 ± 0.7 kg for the same breed reported by Aman et al. [25] in Ethiopia. Similarly, the final bodyweight of Koekoek in the present study is lower than 2.6 kg reported by Sharma et al. [22] at 25 weeks of age but higher than Aman *et al.* [23] who reported that a body weight of 1.5kg and 1.1kg for male and female at 20th week of age under scavenging condition at Areka town, SNNPR. Availability of scavengable feed resources, age of recording, and frequency of supplementing the birds are the possible reason for those differences between the result of the present study and that of other authors. For example, in the present study supplementation was done infrequently depending on the availabile feeds given that most of the rural households are poor. On the contrary, the study of Aman et al. [24] was somewhat controlled whereby supplementation was done three times per day. Nthimo [25] also reported that a body weight of 1.7kg for Koekoek breed at 26th week of age. Similarly, Aregaw and Mengistu [26] also reported that recorded average body weight was 1.39 kg at 19th weeks of age for Koekoek breeds at on station feeding trial at Haramaya University.

Table 2 LSM ± SEM value for the interaction effect of location and breed on body weight (BW in gram) at different ages (weeks) and total weight gain (TWG in gram)

Age (week)	**Karat**		**Gidole**		**p-value**
	Koekoek	Sasso	Koekoek	Sasso	
BW 4	357.2^{b}	390.7^{ab}	367^{b}	482.5^{a}	0.0462
BW 8	730.8^{b}	811.9^{b}	748.8^{b}	846.1^{a}	0.0463
BW 12	1036.5^{c}	1207.1^{ab}	1102.9^{b}	1280.7^{a}	0.0015
BW 16	1302.4^{c}	1770.8^{ab}	1671.4^{b}	1883.4^{a}	<.0001
BW 20	1863.7^{c}	2493.2^{ab}	2126.3^{b}	2687.0^{a}	<.0001
TWG 20	1823.2	2461.9^{ab}	1981.7^{c}	2645.7^{a}	<.0001

The current study's findings regarding the egg production attribute indicate that the interplay between location and breed has an impact on the age at which the first egg is laid. Koekoek chickens matured around 11 days earlier than Sasso chickens in the Karat town whereas Sasso chickens matured about 13 days earlier in the Gidole town. This suggests that, as was the case for bodyweight discussed earlier in this study, the geographical difference favored the Sasso and Koekoek breeds, respectively, depending on the age at first egg. Assefa et al.'s [27] assertion that the Sasso breed is favored by the lowland environment in terms of age at first egg is at odds with this finding. Since this feature is influenced by a number of environmental factors, including as nutrition, temperature, illness, and management practices [27; 17; 29], such variations are possible.

Table 3 LSM ± SE values for egg production performance summarized by breed and Location

Egg production trait	**Breed**		**p-value**	**Location**		**p-value**
	Koekoe	Sasso		Karat	Gidole	
Age at first egg (days)	180.2 ± 1.5	181.6 ± 1.5	0.5278	179.1 ± 1.5	182.7 ± 1.5	0.0911
Egg production rate (%)	40.8 ± 1.6	45.7 ± 1.6	0.2833	46.2 ± 1.6	40.4 ± 1.7	0.2410
Peak production rate (%)	62.9 ± 3.2	65.6 ± 3.2	0.5724	66.1 ± 3.2	62.4 ±3.3	0.4326
Age at peak production (week)	36.1 ± 0.6	36.5 ± 0.6	0.9120	37.2 ± 0.6	35.7 ± 0.6	0.1052
Hen-day egg production (count)	72.9 ± 2.0	82.6 ± 2.0	0.2409	82.2 ± 2.0	73.3 ± 2.9	0.2732
Hen-housed egg production (count)	52.9 ± 2.0	53.0 ± 2	0.9510	45.4 ± 2.0	45.4 ± 2.0	0.1183

According to Assefa et al. [27] and Kejela [30], respectively, the average ages at first egg of Sasso chickens found in the present study are higher than 155 24.6 days and 5.22 0.43 month (156.6 days). for Ethiopian Sasso chicken. On the other hand, the age at which Koekoek and Sasso chickens laid their first eggs as seen in the current study is comparable to the

general means for Koekoek and Sasso chickens reported by Kidie [29] in the Amhara area of Ethiopia, which are 184 1.6 and 176 1.5, respectively.

Breed, agro-ecology, or breed x site interactions had no effect on egg production rate, peak production rate, or age at peak production. In contrast to the current study, Kidie [29] observed that Koekoek and Sasso hens, respectively, produced eggs at rates of 67.7% and 69.2% under semi-scavenging management in Ethiopia. However. In contrast to the 28.8% and 22.5% egg production rates for Rhode Island Red and Barred Plymouth Rock (BPR) under rural management in Bangladesh, the egg production rate for Koekoek and Sasso chickens in the current study is significantly higher. Koekoek and Sasso's age at peak output, as seen in the current study, is equivalent to the figure of 36 weeks for both breeds given by Kidie [29].

Additionally, breed differences in how chickens behaved to environmental factors affecting egg yield had little effect on total egg yields (combined hen-day and hen-housed egg output). Overall mean egg yields for Fayoumi and RIP reported by Bekele et al. [12] under on-farm management in Southern Ethiopia were 25.12.52 and 12.91.39 eggs, respectively, and 16.73.15 and 6.61.46 eggs, respectively, for Koekoek and Sasso in the present study. Furthermore, the observed egg production for Koekoek (HHEP) in this study is lower than the 86.2525 and 69 eggs for Koekoek and RIR reported by Islam et al. [31] and Sazzad [32] in backyard systems in India and Bangladesh, respectively. Differences in the breeds, the type of management used, such as feeding, and other agro-ecological conditions in the particular location may account for the discrepancy between the results of the present study and those of other authors on egg production attributes.

Table 4 LSM ± SE value for the interaction effects of location and breed on egg production performance

Egg production trait	**Gidole**		**Karat**		**p-value**
	Koekoek	Sasso	Koekoek	Sasso	
Age at first egg (days)	176.0 ± 2.1[b]	189.3 ± 2.1[a]	184.4 ± 2.1[a]	173.8 ± 2.1[b]	<.0001
Egg production rate (%)	41.8 ± 2.3	38.9 ± 2.4	39.9 ± 2.3	52.4 ± 2.3	0.1872
Peak production rate (%)	60.1 ± 4.6	64.7 ± 4.6	65.7 ± 4.6	66.4 ± 4.5	0.6768
Age at peak production (week)	35.5 ± 0.9	36.0 ± 0.9	37.5 ± 0.9	37.0 ± 0.9	0.5766
Hen-day egg production (count)	73.1 ± 4.1	73.6 ± 4.1	91.7 ± 4.0	91.7 ± 4.0	0.2626
Hen-housed egg production (count)	59.3 ± 2.9	61.8 ± 2.9	44.12 ± 2.8	44.1 ± 2.8	0.5195

In the current study, both the growing and laying stages showed higher chicken mortality rates in the low land area than in the highland area. Poor management techniques (inadequate feeding) of the birds observed in the lowland areas as opposed to the highland areas may be to blame for this. This finding is consistent with that of Alem [17] and Mulugeta et al. [11], who also noted higher rates of poultry mortality in Ethiopia's lowlands than in its highlands and middle regions. It should be mentioned that the dry season in the current study's laying period limited the amount of scavenge feed resources available in rural locations. This finding is consistent with that of Kidie [29], who stated that insufficient feeding, particularly during the height of production, may result in a large proportion of death since birds need balanced rations during that time to maintain their bodies and produce eggs. A number of diseases that affect poultry living in scavenging settings in rural regions are also linked to the dry season [33; 17].

As was the case for body weight and age at first egg, the observed reduced mortality of Koekoek than Sasso chickens in the lowland area (growing phase) demonstrates its capacity to flourish well under the lowland environmental conditions. In contrast, the breed may be less adapted to lowland scavenging environments given the high mortality rates for Sasso chickens that have been observed in the lowland area during both the growing and laying phases. This is in line with Kidie's [29] findings that the Amhara region of Ethiopia's Sasso region had higher mortality rates for Sasso chickens than other introduced breeds under on-farm evaluation.

Table 5 Mortality of birds (%) during the growing and laying phase summarized by breed, location and breed within location

Parameters		**Growing phase**			**Laying phase**		
		Mortality	X^2 – test	p-value	Mortality	X^2 – test	p-value
Effect of breed and location							
Breed	Koekoek	17.5	0.9076	0.3408	42.2	0.5533	0.4570
	Sasso	15.5			29.2		
Location	Karat	20.3[a]	12.2019	0.0005	47.1[a]	9.6128	0.0019
	Gidole	12.7[b]			34.6[b]		
Effect of breed within a location							
Karat	Koekoek	24.6	6.7035	0.0096	51.0	1.8581	0.1728
	Sasso	16.0			43.1		
Gidole	Koekoek	10.4	2.6511	0.1035	33.8	0.0896	0.7647
	Sasso	14.9			35.4		

4. Conclusion and Recommendation

The results of the current study show that location considerations influence the performance features of the two breeds. Chicken growth and survival rates seemed to be higher in the highland zone (karat) than in the lowland. Regardless of location, the two breeds' responses to egg production performance are comparable. The study has also demonstrated that location and breed can combine to affect body weight and the age at first egg (age at sexual maturity). Sasso appeared to do better in highland than in lowland regions, whilst Koekoek seemed to maintain its bodyweight wherever it was. Therefore, understanding breed performance in respect to locational differences is essential when supplying farmers with better chicken breeds.

Compliance with ethical standards

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Disclosure of Conflict of Interests

The authors have not declared any conflict of interests.

Reference

[1] Habte M, Ameha N and Demeke S 2013 Production performance of local and exotic breeds of chicken at rural household level in Nole Kabba Woreda, Western Wollega, Ethiopia. AfricanJournal of Agricultural Research, 8(11), 1014-1021. www.academicjournals.org/journal/AJAR/article-abstract/E218A0336390

[2] Food and Agriculture Organization (2016) International Egg Commission. Global Egg Production Continues to Grow https://www.internationalegg.com/resource/global-egg-production-continues-to-grow/ Google Scholar

[3] Boere A, Duns H, Kidane D, Vernooij A and Legesse M (2015) Business opportunities report poultry# 3 in the series written for the "Ethiopian Netherlands business event 5–6 November, 19 pages. Rijswijk, The Netherlands. https://www.rvo.nl/sites/default/files/2015/11/Rapport_Poultry_Ethiopi%C3%AB.pdf

[4] Francom M (2017) Ethiopia's Demand for Chicken Meat is Expected to Grow. Global Agricultural Information Network. Ethiopia: https://www.fas.usda.gov/data/ethiopia

[5] Dana N, Van der Waaij LH, Dessie T and van Arendonk JA (2010) Production objectives and trait preferences of village poultry producers of Ethiopia: implications for designing breeding schemes utilizing indigenous chicken genetic resources. Tropical animal health and production, 42(7), pp.1519-1529. https://doi.org/10.1007/s11250-010-9602-6

[6] Teklemariam A (2017) Perception of farmers on exotic chicken breeds and its management condition in North western zone Tigray, Ethiopia. World Scientific News, 86(3), pp.168-179. http://www.worldscientificnews.com

[7] Kemp WM, Batiuk R, Bartleson R, Bergstrom P and 12 others (2005) Habitat requirements for submerged aquatic vege- tation in Chesapeake Bay: water quality, light regime, and physical-chemical factors. Estuaries 27:263– 377

[8] Berhe, E.T. & Gous, R.M.. (2008). Effect of dietary protein content on growth, uniformity and mortality of two commercial broiler strains. South African Journal of Animal Sciences. 38.

[9] Assefa, H., and Melesse, A. (2018b). Morphological and morphometric characterization of indigenous chicken populations in Sheka Zone, South Western Ethiopia. Poultry, Fisheries & Wildlife Sciences, 6(2): 200. https://doi.org/10.4172/2375-446X.1000200

[10] Mulugeta, S. & Goshu, G. & Woldegiorgiss, Wondmeneh. (2020). Growth performance of DZ-white and Improved Horro chicken breeds under different agro-ecological zones of Ethiopia. Journal of Livestock Science. 11. 10.33259/JLivestSci.2020.45-53.

[11] Bekele F, Gjøen H M, Kathle J, Ådnøy T and Abebe G (2009) Genotype X environment interaction in two breeds of chickens kept under two management systems in Southern Ethiopia. Tropical Animal Health and Production 41: 1101- 1114. https://www.researchgate.net/publication/23665839.

[12] Ali S, AM (2010) Family poultry as a tool in alleviating environmental hazards in settled areas of transhumant families in Gezira Scheme Sudan. Asian Journal of Rural Development2: 1-12. Link: https://scialert.net/abstract/?doi=ajrd.2012.1.12

[13] Goromela EH, Kwakkel RP, Verstegen MWA, Katule AM (2006). Strategies to optimize the use of scavengeable feed resource base by smallholders in traditional poultry production systems in Africa: A review. Afr. J. Agric. Res. 1:91-100.

[14] Pius, Lenox & Mbaga, Said. (2018). Variations in village chicken management packages in two agro-ecological zones of Tanzania. International Journal of Livestock Production. 9. 42-49. 10.5897/IJLP2017.0422.

[15] Alem T (2014) Production and reproduction performance of rural poultry in lowland and midland agro ecological zones of central Tigray, Northern Ethiopia. Afr J Agric Res 9: 3531-3539. Link: https://bit.ly/32lmbGg

[16] Habte T, Amare A, Bettridge J, Collins M, Christley R and Wigley P (2017) Guide to chicken health and management in Ethiopia. International Livestock Research Institute, Nairobi, Kenya, ILRI Manual , 25, pp.1-43. https://core.ac.uk/reader/132697854.

[17] Sanka, Yeremia & Mbaga, Said & Mutayoba, S. & Katule, A. & Goromela, S.. (2020). Evaluation of growth performance of Sasso and Kuroiler chickens fed three diets at varying levels of supplementation under semi-intensive system of production in Tanzania. Tropical Animal Health and Production. 52. 10.1007/s11250-020-02363-x.

[18] Lozano-Jaramillo, M., Alemu, S.W., Dessie, T. et al. Using phenotypic distribution models to predict livestock performance. Sci Rep 9, 15371 (2019). https://doi.org/10.1038/s41598-019-51910-6

[19] Fleming, D. S., Koltes, J. E., Fritz-Waters, E. R., Rothschild, M. F., Schmidt, C. J., Ashwell, C. M., et al. (2016). Single nucleotide variant discovery of highly inbred Leghorn and Fayoumi chicken breeds using pooled whole genome resequencing data reveals insights into phenotype differences. BMC Genomics 17:812. doi: 10.1186/s12864-016-3147-7

[20] Sharma, J., Xie, J., Boggess, M., Galukande, E., Semambo, D. and Sharma, S. (2015). Higher weight gain by Kuroiler chickens than indigenous chickens raised under scavenging conditions by rural households in Uganda. Livestock Research for Rural Development 27(9): 1- 4.

[21] Getiso, Aman & Yilma, Melese & Moliso, Mesfin & Jimma, Addisu & Asrat, Mebratu & Tera, Asrat & Dako, Endrias. (2016). Demonstration and Evaluation of Dual Purpose Chicken " Potchefstroom Koekoek " Packages at Areka areas, SNNPR, Ethiopia. 16. 37-41.

[22] Aman G, Bangu B, Bereket Z, Desta G, Abiti T, et al. (2017) Production performance of Sasso (distributed by ethiochicken private poultry farms) and Bovans brown chickens breed under village production system in three

agro-ecologies of Southern Nations, Nationalities, and Peoples' Regional State (SNNPR), Ethiopia. International Journal of Livestock Production 8: 145-157. Link: https://bit.ly/2JCP7Ry

[23] Nthimo, A.M., 2004. The phenotypic characterization of native Lesetho chickens. PhD thesis, university of the Free State, South Africa. 79p

[24] Aregaw A. and Mengistu U., 2011. Body weight and dry matter intake of Horro, Koekoek and Lohmann silver chicken breeds under intensive management. Haramaya University 28th Annual Research and Extension Review Proceedings. March 2011.

[25] Assefa H, Melesse A, Taye M (2019). Characterization of indigenous chicken production system in Sheka zone, south western Ethiopia. International Journal for Research in Agricultural and Food Science 5(2):1-16.

[26] Zaman, M & Sørensen, P & Howlider, Md. Abdur. (2004). Egg production performance of a breed and three crossbreds under semi- scavenging systems of management. Livestock Research and Rural Development. 16.

[27] Kidie H A 2019 Characterization of chicken production system and on-farm evaluation of introduced exotic chicken breeds in Gondar Zuria and Kalu districts of Amhara region, Ethiopia. MSc. Thesis. Haramaya University, Haramaya, Ethiopia.

[28] Kejela, Yonas. (2020). Production Performance of Chicken under Farmers' Management and Their Roles at Urban Household Economy in Southern Ethiopia. Agricultural Sciences. 11. 178-190. 10.4236/as.2020.112011.

[29] Sazzad M.H. (1992) Comparative study on egg production and feed efficiency of different breeds of poultry under intensive and rural condition in Bangladesh. Livestock Research For Rural Development 4, n. 3.

[30] Mwalusanya N A, Katule A M, Mutayoba S K, Mtambo, M M A, Olsen, J E and Minga, U M 2002 Productivity of local chickens under village management conditions. *Tropical Animal Health and Production* 34: 405-416