

Full Length Research Paper

Comparative test of the two final commercial dual-purpose breeds during early growth performance under on-farm management conditions in two districts of Jimma Zone, Ethiopia

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This study was conducted to evaluate the production and reproduction performance of chicken breed under semi-scavenging system of Seka Chekorsa and Omo Nada districts of Jimma Zone. A total of 800 day old chicks were obtained from Debre Zeit Agricultural Research center. 50 day old chicks were distributed with hay box brooder, and the experiment was arranged in a nested design. The result of the current study indicated that male chickens of both breeds in this study reached sexual maturity and slaughter weight within four months in both districts and mature body weights of 1831.25 and 1569.18 g at Seka and 1615.00 and 1586.25g in Omo Nada, respectively for Lohmann dual and Dominant red barred. Although there was no statistically significant difference between the two breeds, Lohmann dual breeds attained age at first egg within 148 days and Dominant red barred (162.25 days) breeds in Seka Chekorsa and 157.50 and 160.25 days, respectively for lohmann and Dominant red barred in Omo Nada district. In general, the current study indicated good performance of Lohmann dual breeds while it needs further study to conclude number of eggs per clutch, number of eggs per hen per year and hatchability for both breeds in both study districts. So this study might be good to consider in the future in other areas.

Key words: Dual purpose breed, on farm evaluation, semi-scavenging, Omo Nada, Seka Chekorsa.

INTRODUCTION

Poultry production is one of the key livestock subsectors of Ethiopia. It plays important roles in terms of generating employment opportunities, improving family nutrition, and empowering women. It is a suitable business for poor

households due to the small quantity of land needed and low investment costs required to start up and run the operation. About 56% (9.6 million) of Ethiopian households have poultry holdings with varying range of

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flock size. However, about 80% of the households with poultry keep from 1 to 9 chickens (FAO, 2019).

The total chicken population in the country is estimated to be 56.06 million and 88.19% of this population consists of indigenous chickens characterized by slow growth, late maturity and low production performance such as longer age at first laying, low number of eggs per clutch and hybrid chicken contributes 6.45% and exotic breeds of chicken constituted 5.36% of the poultry population (CSA, 2018). The major targets are set for livestock production during the period of GTP II in which total egg production is projected to increase from 163 million in 2014/15 to 3,938 million by the end of the plan period.

The average number egg-laying period per hen per year is about 4, 4 and 1 for the local, hybrid and exotic breeds, respectively. The average length of a single egg-laying period per hen is estimated to be about 21, 45 and 169 days for local, hybrid and exotic breeds, in that order. The average number of eggs laid per hen per egg-laying period in the country is about 12, 38 and 133 eggs, correspondingly (CSA, 2018). Indigenous flocks are slow in growth rates and very poor in egg productivity. Mean body weights at 8 and 16 weeks of age could be as low as 242 and 621 g, respectively (Nigussie, 2011). Although large numbers of chicken were recorded in Ethiopia; their production and reproduction performance was low. There is notable demand for poultry products associated with the increase in family income. To meet the ever-increasing demand for meat and eggs, introduction of superior/exotic breed has been proposed as one of the plausible option (Haftu, 2016).

In an effort to avail high yielding and alternative dual purpose poultry breeds to village poultry production system, two self-reproducing dual purpose chicken breeds were introduced: Red barred D922 and Lohmann Dual. Commercial breeding companies produced dual purpose breeds (DPB) using crosses of meat and layer lines, such as Lohmann Dual (LD) (Lohmann Tierzucht, Cuxhaven), Dominant Red Barred (Grimaud Frères, France) using the sex-linked dwarf gen. This major gen reduced the body weight of the females by about 25% while the males grow at a normal rate. Lohmann Dual as the name implies is the strain developed by Lohmann Tierzucht for dual purpose birds. The chickens have white feathers and lay eggs lighter in shell color as compared to normal brown eggs. Lohmann dual combines good laying performance with an acceptable gain on meat (Urselmans et al., 2015). Fed with broiler diets for 70 days, the Lohmann dual cockerels attained a live body weight of 3 kg. The weight of the carcass was around 2 kg. Performance tests have shown that Lohmann Duals have sufficient performance in meat and egg production (Urselmans et al., 2015). Dominant red barred are provided by DOMINANT CZ company and have good feather cover, high egg production, 300 eggs

per year, higher egg weight at the start of laying period, high number of hatching eggs and strong day old chicks (<http://dominant-cz.cz> pas). The performance of these chickens should be known under farmers' management condition before wider distribution to villages. Demonstration and evaluation of new chicken strains in villages in semi-scavenging production system is crucial to enhance the production and productivity of chicken throughout the zone and beyond. Hence, this study was designed to test these breeds in two woredas of Jimma zone. Therefore, the objective of this study is to evaluate the production and reproduction performance of red barred D922 and Lohmann Dual purpose chicken breeds under semi-scavenging system of Jimma Zone.

MATERIALS AND METHODS

Descriptions of the study area

The field experiment was conducted in two different districts namely Seka Chekorsa and Omo Nada out of 18 districts in Jimma Zone. The study areas were selected purposely on the basis of accessibility to road which enables close supervision of the experiment and high crop production potential areas.

Seka Chekorsa

Seka Chekorsa is a district in Jimma zone located at a distance of 355 km, southwest of Addis Ababa. The district is located at an altitude ranging between 1580 and 2560 meters above sea level. The district receives mean annual rainfall, ranging between 1,200 and 2,800 mm. The mean minimum and maximum daily temperatures of the area are 12.6 and 29.1°C, respectively. The district is suitable for livestock keeping and reported to have a total human population of 210,176, of whom 52.4% are males, and females 47.6% and nearly 4% of the population are urban dwellers (Seka Chekorsa District Finance and Economy Office Data, 2015). Cereal grains, enset, beans and sweet potatoes are widely grown. The district is divided into two agro-ecological zones; Dega (highland) and Woinadega (mid land), accounting for about 18 and 82% of the total land area, respectively. The rainfall pattern is unimodal, starting in March to April and reaching its peak in between July and September (Seka Chekorsa District Agriculture and Environmental Protection Data, 2013).

Omo Nada

It is a district available in the eastern side of Jimma town within Jimma zone Oromia regional state and is located at a distance of 285 km from Addis Ababa, on the road to Jimma. Omo Nada is bordered on the south by the Gojeb River which separates it from the Southern Nations, Nationalities and Peoples Region (SNNPR), on the west by Dedo, on the northwest by Kersa, on the north by Tiro Afeta, on the northeast by Sokoru, and on the east by the Omo River which separates it from the SNNPR. Teff and wheat are important cash crops. The altitude of this district ranges from 1000 to 3340 meters above sea level. According to the District Finance and Economy Office Data, 2015, total population for this district is 272,990 (152,709 men and 120,281 women); 12,215 or 4.92% of its population were urban dwellers. Geographically, it is located 30°N

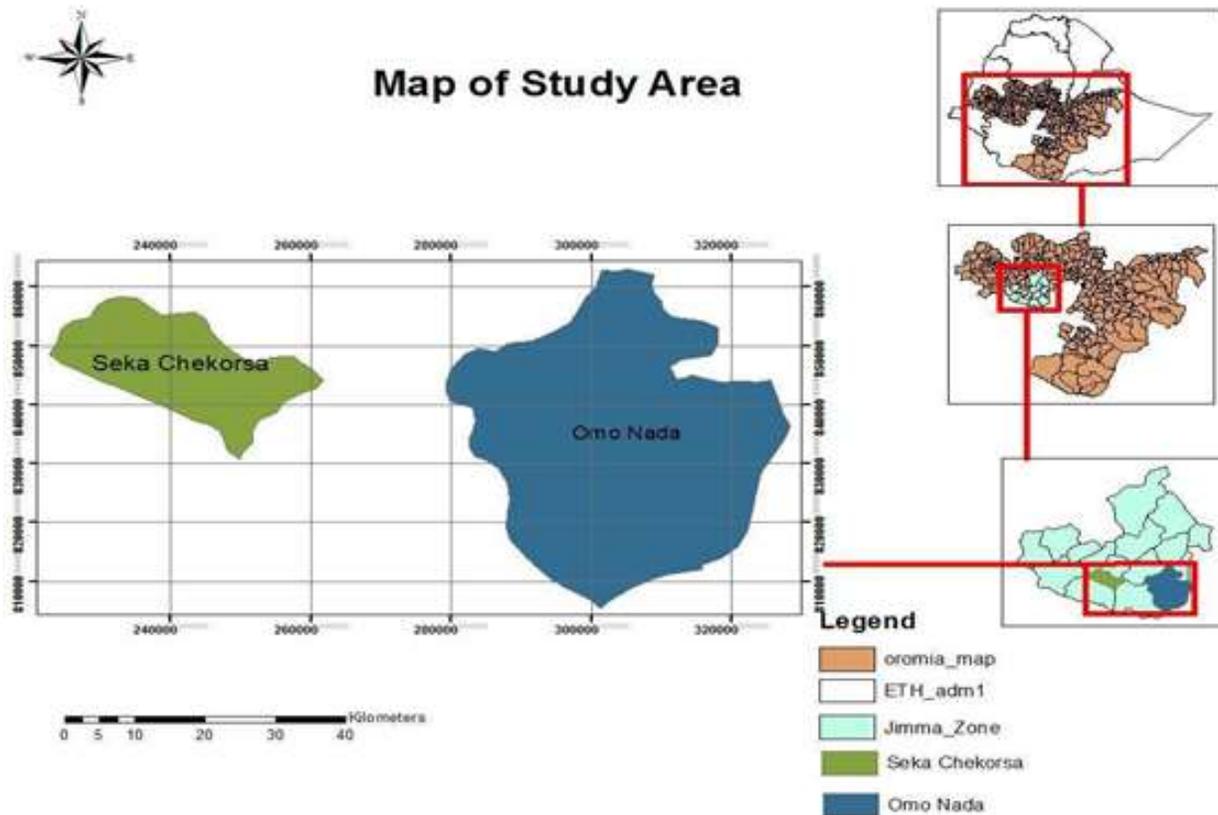


Figure 1. Map of the study area.

370 15' latitude and longitudes (<https://en.wikipedia.org/wiki/OmoNada>, 12/07/2017). According to the District Livestock and Fishery Office, Omo Nada covers an area of 165,602.66 ha (Figure 1).

Sample size and sampling techniques

Totally 30 farmers from both study districts were asked for their past experience whether they have kept exotic chickens. Accordingly, 15 farmers were asked in each district. From 15 farmers questioned in Omo Nada District 53.3% (8) farmers were non-experienced and 46.7% (7) farmers were experienced. From 53.3% of non-experienced farmers 50% (4) farmers voluntarily construct house and cover other costs needed, and from 46.7% of experienced farmers 57% (4) farmers voluntarily construct houses and manage the experimental chicks. Similarly, in Seka Chekorsa district out of the 15 farmers questioned 53.3% (8) were experienced and 46.7% (7) were non-experienced. Accordingly, from 53.3% of experienced farmers 50% (4) farmers voluntarily cover the input costs including house construction, and similarly from 46.7% of non-experienced farmers 57% (4) voluntarily input costs needed from farmers. Based on the questionnaire, eight farmers from Seka Chekorsa District and eight farmers from Omo Nada District were selected in consultation with Seka Chekorsa and Omo Nada district Livestock and Fishery Resource Development Office. Participating households and developmental agents (DAs) were trained on the construction of house, and use of hay box brooder, health, feeding and data recordings before the commencement of the experiment.

Management of experimental chicken

A total of 800 day old chicks vaccinated against Marek's disease and Newcastle (400 Red barred D922 and 400 Lohmann Dual purpose chicks) were obtained from DebreZeit Agricultural Research Center (DZARC) and transported to the testing sites of Seka Chekorsa and Omo Nada district. They were brooded using two hay box brooder of 50 chick capacity (30 cm * 57 cm * 57 cm for heat provider and 30 cm * 127 cm * 127 cm for feeding and day time stay for the first 8 weeks' (Solomon, 2012). Separate house was constructed as recommended and the farmers were provided with commercial feed and trained for management of experimental chicks.

Data collection and parameters estimated

Data were collected on daily feed intake, body weight was recorded at day old, and every week (from week 1-8) brooding, during growing (10-16 weeks at two weeks' interval) period using electronic balance of 25 kg capacity. Daily body weight gain (difference in body weight values between two consecutive measurements divided by the number of days), feed provided, hen day egg production, hen housed egg production.

Experimental design

Three stage nested design was used for this experiment. Accordingly, status was nested within the district in which each level

of status was nested within each level of districts; similarly breed was nested under status nested within districts in which each level of breed was nested under each level of status. The experiment was arranged by assigning randomly chicken from two breeds to a total of 16 farmers selected from two districts, which were grouped into two as farmers having experience and not having experience.

Statistical analysis

Data collected were subjected to Analysis of Variance (ANOVA) using generalized linear model of statistical analysis system (SAS) version 9.2 (SAS, 2008). Proc GLM Since all the levels of factors under study were fixed, $H_0: \tau_i = 0$ is tested by $MS \tau_i / MSE$ and $H_0: \beta_j(i) = 0$ is tested by $MS \beta_j(i) / MSE$. Least significance difference test was used to separate the means that showed significant difference (5%) at five percent significant level. Data collected on hen housed egg production (HHEP), and Hen day egg production (HDEP) were analyzed using chi-square test for association. The model for this experiment was as follows: The model used,

$$yijkl = \mu + wx + ti + \beta_j(i) + k(ij) + \epsilon(ijk)$$

Where, $yijkl$ =the observation taken, μ =the overall mean wx = regression coefficient of initial weight (day old body weight) t_i =the i^{th} fixed effect of district, $i=1,2$ $\beta_j(i)$ =the j^{th} level of status nested with in i^{th} level of district, $j=1,2$ $k(ij)$ =the k^{th} level of breed nested with in j^{th} level of status nested with in i^{th} level of district, $k=1,2$ $\epsilon(ijk)$ =error term. The farmers nested with in j^{th} status assumed to have followed the same management.

RESULTS AND DISCUSSION

Growth performance

Body weight

The body weight measurements of study breeds in Seka Chekorsa and Omo Nada districts are presented in Table 1. There was significant ($p < 0.05$) difference between two breeds at 4, 8, and 12 weeks in both study districts. This could be attributed to the genotypic difference of breeds and farmers' management differences. There was significantly ($p < 0.05$) higher body weight of LD (274.5, and 653.75 g) breeds than DRB (239.5 and 576.00 g) at week 4 and 8 in Seka District. Similarly, in Omo Nada District LD (323.75 and 739.25 g) males attained more than DRB (228.00 and 540.00 g) at 4 and 8 weeks. But in both study districts DRB females attained (838.75 and 937.25 g), respectively at Seka Chekorsa and Omo Nada districts at 12 weeks.

The result of current study indicated that male chickens of both breeds in this study reached sexual maturity and slaughter weight within 4 months with mature body weights of 1831.25 and 1569.50 g in Seka chekorsa whereas 1615.00 and 1586.25 g in Omo Nada, respectively for LD and DRB breeds. The average slaughter age for exotic broiler chicken breeds is between 40-45 days, whereas indigenous breeds are usually slaughtered between 8 to 12 months. Average slaughter weight, for both indigenous and exotic broiler breeds, is about 1300

g (Francom and Counselor, 2017). The body weight development in these two breeds indicates that the breeds have a good potential for meat production. This might be associated with the genetic potential for fast growth in the breeds used in current study.

Mean age at slaughter weight of 1500 g of the male chickens of the Gomma Woreda was reported 8.62 months (Meseret, 2010) was lower than current finding even though it doubled the average slaughter age of current breeds. This might be due to easy awareness of farmers, the suitability of the agro ecology, types of crops cultivated and the potential of breeds in current study to attain higher slaughter weight in lower growth period in comparison to indigenous and dual purpose chickens introduced earlier. The average body weight recorded in the first 20 weeks of age was 1030 g in the case of female chicken at 20 weeks as indicated by Kasa and Saba (2016) for koekoek breed. This is also slightly similar to the result of current study for LD breed in both study districts but lower than body weight for DRB female. This might be due to good management of farmers, crop type cultivated and breeds genotypic ability to gain more weight in this study.

Average daily body weight gain

The overall daily body weight gain results of study breeds during 16 weeks are shown in Table 2. There was statistically significant ($p < 0.05$) effects of breed within districts on average daily body weight gain during 4th, 8th week and 12-week weight gains of female, 16-weeks weight gain of male chicken. The result of current study indicated that at weeks 4 and 8 DRB had significantly higher daily body weight gain (10.25, 10.00 g and 11.50, 19.50 g, respectively of DRB and LD breeds at Seka chekorsa District for pooled sex. This might be due to the dwarf gene expression of female LD breeds towards sexual maturity since it is not separated until eight weeks due to difficulty of differentiating sex and are also less competent with male chickens during feeding. Also the result indicated that there was significantly higher daily gain of female DRB breeds at 12th weeks than LD in both districts. Significantly higher daily gain was reported for LD male chicks than DRB at 16th weeks.

Daily feed intake

The daily feed intake measurement of study breeds under current study during brooding period is shown in Table 3, respectively. The result of the current study also showed that there was statistically significant ($p < 0.05$) difference between breeds in feed intake at weeks 1 and 2, in which LD was consumed (17.00 and 20.00 g/day/chick) at Seka Chekorsa district whereas 19.25

Table 1. Mean body weight of study breeds in Seka chekorsa and Omo Nada districts (in g/chicken) Growth period for both sex.

Growth period in weeks	Seka Chekorsa		OmoNada	
	Mean±SE		Mean±SE	
	LD	DRB	LD	DRB
4	274.50±12.6 ^a	239.50±4.50 ^b	323.75±5.72 ^a	228.00±3.34 ^b
8	653.75±11.92 ^a	576.00±14.91 ^b	739.25±54.24 ^a	540.00±16.48 ^b
12(M)	1415.25±40.11 ^a	1094.50±27.21 ^b	1258.25±74.06 ^a	1092.50±21.54 ^b
16(M)	1831.25±91.34	1569.50±18.82	1615.00±48.54	1586.25±30.80
12(F)	803.00±31.12 ^b	838.75±13.30 ^a	782.00±20.80 ^b	937.25±48.79 ^a
16(F)	1098.50±86.76	1159.25±16.43	971.00±29.86	1154.75±25.90
20(F)	1255.00±19.36	1942.93±60.46	1185.00±31.22	1900.00±52.91

M and F indicates male and female; Significance difference at ($p < 0.05$); SE=Standard error. ^{a,b}Different superscripts in the same row indicates LD=Lohmann dual; DRB=Dominant red bared.

Table 2. Mean daily body weight gain of LD and DRB breeds at different ages in Seka chekorsa and OmoNada districts for both sex (in g/chicken/day) .

Growth period in weeks	Seka Chekorsa		OmoNada	
	Mean±SE		Mean±SE	
	LD	DRB	LD	DRB
4	10.0±2.67 ^a	10.25±0.75 ^b	13.25±1.03 ^a	5.25±1.60 ^b
8	11.50±2.10 ^b	19.50±1.55 ^a	10.25±3.06 ^b	13.75±1.65 ^a
12(M)	14.50±0.64	17.25±1.43	7.00±2.04	8.75±0.62
16(M)	20.00±1.91 ^a	18.50±0.64 ^b	13.00±2.04 ^a	6.50±0.86 ^b
12(F)	7.00±1.08 ^b	10.25±0.47 ^a	6.25±1.88 ^b	14.50±1.50 ^a
16(F)	14.00±3.36 ^a	12.50±1.32 ^b	3.25±1.03 ^b	6.75±0.62 ^a

M and F indicates male and female; Significance difference at ($p < 0.05$); SE=Standard error. ^{a,b}Different superscripts in the same row indicates LD=Lohmann dual; DRB=Dominant red bared.

Table 3. Mean daily feed intake of LD and DRB breeds at different ages in Seka Chekorsa and Omo Nada districts for both sex (in g/chicken/day).

Growth period in weeks	Seka Chekorsa		OmoNada	
	Mean±SE		Mean±SE	
	LD	DRB	LD	DRB
1	17.00±0.91 ^a	15.25±0.48 ^b	19.25±0.47 ^a	16.25±0.48 ^b
2	20.00±0.40 ^a	17.00±0.40 ^b	20.25±0.25 ^a	17.25±0.25 ^b
3	23.25±1.03	19.75±1.25	20.75±1.65	21.5±0.86
4	28.25±0.62	27.25±0.62	26.00±1.08	25.25±0.25
5	33.50±1.70	35.50±1.75	35.00±1.08	35.25±1.79
6	40.25±1.10	40.25±1.03	41.50±1.19	40.75±1.10
7	42.25±0.47	41.50±1.25	42.50±0.86	41.50±0.64
8	42.25±0.47	41.75±0.62	42.50±0.86	41.75±0.62

LD=Lohmann dual; DRB=Dominant red bared; SE=Standard error; a b Different superscripts in the same row indicates significance difference at ($p < 0.05$).

and 20.25g in Omo Nada district. But DRB consumes (15.25 and 17.00 g/day/chick) in Seka Chekorsa district

and (16.25 and 17.25 g) in Omo Nada District. This lower feed intake in DRB at earlier age might be due to breeds

Table 4. Mean feed conversion ratio of study breeds in Seka Chekorsa and OmoNada districts.

Growth period in weeks	Seka Chekorsa		OmoNada	
	Mean±SE		Mean±SE	
	LD	DRB	LD	DRB
1	4.50±0.57 ^b	4.75±0.50 ^a	6.25±2.21 ^a	4.75±1.5 ^b
2	3.5±0.57	3.25±0.50	2.00±01	2.25±0.50
3	1.75±0.95	2.25±0.05	1.75±0.95	2.00±0.30
4	3.50±3.00	2.50±0.57	2.00±00	4.75±2.36
5	2.25±0.50 ^b	4.75±2.21 ^a	1.50±0.57 ^b	2.75±0.50 ^a
6	3.00±0.81 ^b	3.25±0.50 ^a	2.50±0.57 ^b	5.00±1.15 ^a
7	2.50±0.57 ^b	5.25±1.50 ^a	8.50±1.29 ^a	4.85±0.50 ^b
8	4.25±1.50 ^a	2.25±0.50 ^b	4.50±1.91 ^a	3.25±0.95 ^b

Where SE=standard error; FCR=feed conversion ratio; FI=feed intake; DBWG=daily body weight gain; LD=Lohmann dual; DRB=Dominant red barred; a b Different superscript in the same raw indicates significant difference at $p<0.05$.

genotypic difference as well as farmer's management difference in terms of feed and water provision. The result of current study shows that both breeds in the current study had higher feed intake at 4th and 8th week in comparison to Fayoumi chicken breeds which consumes 16.16 and 23.74 g/day, respectively in 4th and 8th week (Simeamelak et al., 2011). This might be attributed to the higher consuming ability of breeds in the present study and the fact that Fayoumi are light breeds as well as it might be due to good feeder and feeding system undertaken in the current study.

Feed conversion ratio (FCR) of two study breeds

Feed conversion ratios of two study breeds are presented in Table 4. There was significant ($p<0.05$) difference between two study breeds at week 1, 5, 6, 7 and 8 in terms of FCR in both study districts, in which LD (4.25) showed significantly ($p<0.05$) higher feed conversion ratio than DRB (2.25) at week 8 in Seka Chekorsa district. This indicates that DRB breeds are efficient converter of feed into daily body weight gain. This might be attributed to farmer management differences in terms of provision of water and health care. But there was significantly ($p<0.05$) higher feed conversion ratio of DRB at week 1, 5, 6 and 7 in Seka Chekorsa District showing that LD breeds efficiently converted feed intake into daily body weight gain. This might be attributed to higher daily body weight gain of LD breeds in aforementioned respective weeks with slightly similar feed intake with DRB and concluded as LD breed is efficient having the same quantity and suitability of feed provided. In OmoNada district LD breed had significantly ($p<0.05$) higher FCR at weeks 1, 7 and 8 than DRB, implying that LD breed was less efficient in feed conversion than DRB. But DRB breed had higher FCR at weeks 5 and 6 which also similarly shows in turn DRB breeds are less efficient in this week. These

differences might be due to farmers' management in terms of feed and water provision.

The results of the present study for both breeds in both study districts showed earlier age at first egg (AFE) in comparison to the average age at first egg laying recorded for Koekoek breeds at farmers management condition reported as (219) days (Kasa and Saba, 2016) in Jimma zone. This might be attributed to better managements in the current study. But similar breeds were attained earlier under farmer's management condition (AFE) 142 days at Areka areas, SNNPR, Ethiopia (Aman et al., 2016). The result of the present study for both breeds in both districts was slightly in agreement with the report of 160.5, 165.6 and 153.3 days for Isa brown (IB), Bovans brown (BB) and PK, respectively (Desalew et al., 2013) under village production system in Ada'a and Lume districts of East Shewa, Ethiopia. The current finding for two breeds in both districts also showed earlier AFE than the report of (Aman et al., 2017) 177, 171 and 213 days for Sasso, Bovans brown and local breeds respectively under village production system. This also might be due to breeds in current study can attain sexual maturity earlier and the easy awareness of farmers in this study (Table 5).

Egg production of dominant red barred and Lohmann dual purpose breeds

The hen day and hen housed egg production (%) of two study breeds are presented in Table 6. The hen housed and hen day egg production was 53.8 and 71.4% for LD chicken during two-week period of egg production and this increased to 73.1 and 78.9% respectively during the next two weeks. There were 56.7 and 80.0% hen housed and hen day egg production for DRB during the 1st two weeks of egg laying and which was also increased to 75.3 and 82.4% respectively of hen

Table 5. Age at first egg lay and body weight at first egg laying of study breeds.

Parameter	Seka Chekorsa		OmoNada	
	Mean±SE		Mean±SE	
	LD	DRB	LD	DRB
Age at first egg	148.00±15	162.25±21	157.50±15	160.25±26
Body weight at 1 st egg	1255.00±19.36	1942.93±60.46	1185.00±31.22	1900.00±52.91

LD=Lohmann dual; DRB=Dominant red bared; SE=Standard error; BWT=body weight.

Table 6. Hen day and hen housed egg production (%) of LD and DRB breeds in study districts.

Variable	1st two weeks of egg lay		2nd two weeks of egg lay	
	HDEP%	HHEP%	HDEP%	HHEP%
Breeds				
LD	71.4	53.8	78.9	73.1
DRB	80	56.7	82.4	75.3
X2 -value	0.52	0.45	0.007	0.87
p-value	p>0.05	p>0.05	p>0.05	P>0.05

HDEP=Hen day egg production; HHEP =Hen housed egg production; LD=Lohmann; DRB=Dominant red barred.

housed and hen day egg production during the next two weeks of egg laying.

This result indicates slightly better egg production of DRB chicken in comparison to LD. This might owe to better performing ability of DRB under farmers' condition. The result of the current study indicated better performance of both breeds in comparison to report of 49.3, 54.8 and 44.2 and 49.2% of hen housed and hen day egg production respectively for Fayoumi and Rhode Island Red crosses with local Kei (Misiba and Abera, 2013) at Bersa water shade in Gurage Administrative zone, under farmer's management condition. According to Meseret (2010), the average daily egg production/head of the *Isa Brown* breed and indigenous chickens are reported to be 0.70 and 0.046 eggs per hen per day, which were also lower than that of current finding. This might be due to good performance of breeds in current study under farmer's management system than breeds in previous study. The report of Wondmeneh (2015) indicated 54.83, 51.6 and 37.64% of hen housed egg production for commercial, improved and indigenous chicken respectively at month three under farmer management in Horro district, which was lower than the finding in current study for both breeds in the first one month.

CONCLUSIONS AND RECOMMENDATIONS

The result of the current study indicated good performance of Lohmann dual male in both study districts under farmer management condition in terms of body weight, having increased productivity with improved management

housing, feeding, watering and health care). The result also indicated that male chickens of both breeds in this study reached sexual maturity and slaughter weight within four months in both study districts. There were mature body weights of 1831.25 and 1569.18 g at Seka and 1615.00 and 1586.25 g in Omo Nada, respectively for Lohmann dual and Dominant red barred.

In general, the current study indicated good performance of Lohmann dual in both study districts in terms of body weight and age at sexual maturity under farmers' management condition. There is need for further study to conclude number of eggs per clutch, number of eggs per hen per year, hatchability and farmer preferences for both breeds. The study breed can perform better with good ration and management (using appropriate feeder and waterier). So this study might be good to consider in the future in other areas and the breeds should be distributed in study district. Finally using hay-box brooder is the best choice in the rural area to grow chicks without mother hen.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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