

*Full Length Research Paper*

# **Production performance evaluation of koekoek chicken under farmer management practice in Tigray region, northern Ethiopia**

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The objective of the study was to introduce and evaluate production performance of Koekoek chicken under smallholder farmers' management practice and enhance their household income. This on farm experiment was conducted in eastern and south eastern zone of Tigray region. About 53 food insecure smallholder farmers were selected in collaboration with the experts and village administrators. Eighty seven percent of the beneficiaries were female headed householders and the remaining 13% were male headed housed holders. Each farmer received 20 koekoek chicks 45 days old, which were grown under on-station to decrease chicken mortality. Data on live weight, egg weight, egg color, sexual maturity, hatchability, adaptability and the overall farmers' perception on breed were collected by preparing checklist points. The collected data were analyzed using SPSS software. The breed was adaptable to both zones and non-selective for feed. It was also good scavenger and it could survive and give good production (meat and egg) under farmers' management practice. The average weight was recorded as 1.33, 1.87 and 2.47 kg at five, eight and twelve month's age for male koekoek, respectively, whereas 1.2, 1.64 and 1.59 kg was recorded for female at five, eight and twelve months age, respectively. The decrease in body weight of female indicates that layers chicken have decrease in weight at the time of laying and when their age increased. Sexual maturity of both male and female koekoek chickens were at 6 months. Egg production potential of the chicken was ranging from 180-240 hen<sup>-1</sup> year<sup>-1</sup> depending on the farmers management practice mainly feeding, watering and housing. Egg weight of the koekoek chicken range from 50.63 to 53.67 g. About 87.5% of the eggs were brown and the remaining 12.5% were white. This breed has good acceptance in terms of their body weight, egg weight, adaptability to wide climatic conditions, feeding behavior and their color which has a market value. Therefore, this breed is suitable and recommended for scavenging and semi-scavenging chicken production system.

**Key words:** Adaptability, dual chicken, exotic chicken breed.

## **INTRODUCTION**

In Ethiopia, chickens are widely distributed in almost every rural family, in some private chicken producers and governmental institutions like universities and agricultural research centers. Currently, because of the shortage of

cultivating land, lack of grazing land, rapid population growth and urbanization, unemployment of youth and high protein demand of humans, chicken has become the most preferred animal. Chickens are also used as

sources of meat and egg, cash income mainly for rural poor farmers and their faces as animal feed and organic fertilizer. But in rural areas of Ethiopia, smallholder farmers consider chicken production as a side line activity in addition to their main agricultural farming like cropping and other livestock production; so, the production is mainly for home consumption. Chicken meat is nutritionally rich, providing protein, fats, minerals and vitamins and can be a good source of cheap nutrition for resource poor people, the sick, malnourished and children under the age of five (Tadelle, 1996).

In Ethiopia, the chicken population is estimated to be 59.38 million, 96.9% of which consists of local breed types under individual farm household management with poor housing, feeding and veterinary service and the remaining 2.56 and 0.54% are exotic and cross breed chickens, respectively (CSA 2012). Similarly, recent sample survey is also indicating that total chicken population of the country is estimated to be 59.5 million and out of these, 90.85% are indigenous, 4.39% exotic and 4.76% crossbred chicken breeds (CSA, 2017). Though, there is huge chicken population with diversified chicken ecotypes and some improved breeds like horro, their production potential is limited because of poor husbandry practice and low emphasis given to genetic improvement of the indigenous chicken ecotypes. As a result, the country is enforced to introduce some improved exotic breeds to improve the livelihood of the rural poor farmers and koekoek is one of the introduced chicken breed with the objective to fill this gap.

Koekoek hens lay brown egg, about 196 eggs per year with an average egg weight of 55.7g under intensive management system (Globbelaar et al., 2010). Similar egg weight and egg production of Rhode Island Red ( $185 \pm 8.82$  and  $52.5 \pm 2.83$ ) and White leghorn chicken breeds ( $173 \pm 9.35$  and  $52.1 \pm 3.00$ g) are reported respectively by Lemlem and Tesfay (2010). However, egg production of the local chicken ecotypes is 48 eggs per year under extensive production system (CSA, 2017). Similarly, according to Lemlem and Tesfay (2010) report, egg production potential of local chicken is  $54.3 \pm 8.25$  and egg weighs  $42.2 \pm 2.65$  g. However, they can lay up to 100 eggs per year under improved management system (Negussie and Ogle, 1999) but it depends on the chicken ecotypes. According to Wondmeneh et al. (2016) report, improved local horro breed can produce about  $171 \pm 0.57$  and  $149 \pm 0.88$  eggs per year under on-station and on-farm performance evaluation, respectively. They also added that average egg weight for improved horro under on station performance is  $52.3 \pm 0.3$  g. Similarly, egg production performance of unimproved horro chicken is  $66.5 \pm 2.5$  eggs per year under improved management

system (Wondmeneh et al., 2016). Whereas, the improved exotic hens can produce up to 250 eggs per year with an average egg weight of 60 g (Alganesh et al., 2003). However, egg weight and egg production can be affected by the breed type and husbandry practice including feeding, watering and housing. Koekoek breed has better production performance than the improved and unimproved local chickens. Hence, introducing these exotic chicken breeds to smallholder farmers is crucial to enhance their household income.

The koekoek chicken breed is important in medium input production system or semi-scavenging production system. It is also a popular breed in South Africa and neighboring countries due to egg and meat production as well as their ability to hatch their own offspring (Globbelaar, 2008) which has similar characteristics with Ethiopian indigenous chickens ecotypes and easily manageable at farmers level. However, their broodiness behavior is observable. Considering the above importance of the breed, it was introduced to eastern and south eastern zones of the Tigray, northern Ethiopia with objectives to evaluate their production performance and adaptability under small holder farmers' management practice and enhance income of smallholder farmers.

## MATERIALS AND METHODS

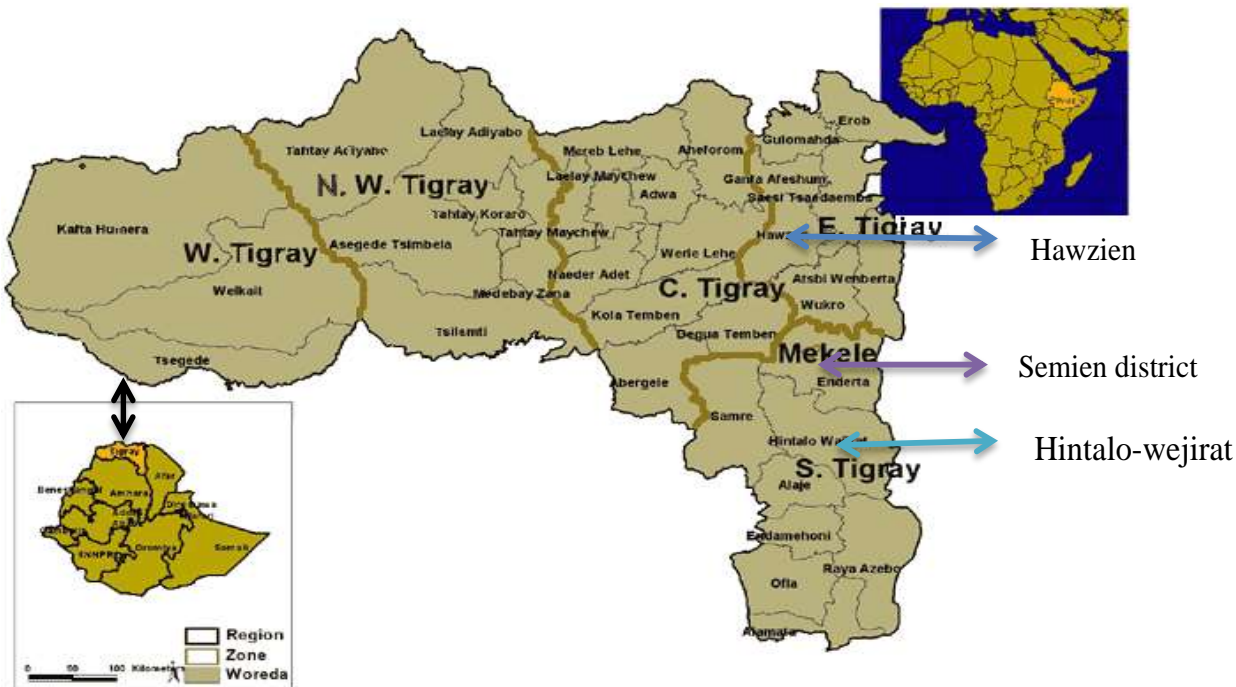
### Study area

This on-farm research was conducted in eastern, south eastern and Mekelle zones of the Tigray regional governmental state. Hawzien district from eastern zone, Hintalo-wejirat districts from south eastern zones and Semien district from Mekelle zones were selected and for the on-farm research. Hayellom and Megab villages from Hawzien, Fikrealem and Adiweyane villages from Hintalo-wejirat and Adikenfero village from Semien district were selected (Figure 1). All villages are categorized under the midland agro-ecology. According to EARO (2000) report, midland agroecology is categorized under the altitude of 1500 to 2500 masl. In all zones, mixed crop-livestock farming is the feature of the area and it is the main occupation and household income source. Chicken production is taken as a side line activity and its product is mainly used as home consumption.

### Selection procedures and technology beneficiaries

At the beginning, close discussion took place in the office of agriculture and rural development experts and village administrators. Farmers who were food in-secured, willing to accept a new technology, interested and had good experience in chicken production and management were selected in collaboration with experts, development agents and village administrators of the respective villages. Then after, about 54 farmers were selected from Hayelom, Megab, Fkirealem, adiweyane and Adikenfero

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**Figure 1.** Map of the study area.  
Source: <http://www.tigraionline.com/tigrayGIF.gif>.

villages. In the first four villages, 10 farmers were selected from each village and given 20 chicks for each, whereas at Adi-kenfero village, a total of 14 farmers were selected and given 10 chicks for each. Chicks were grown at on-station till 45 days age to decrease chick mortality under farmer's management practice. Out of the beneficiaries, 87% were female headed households and the remaining 13% were male headed households. This encourages participation of female headed households in the on-farm research and females are the main actor in traditional chicken production system in the region.

#### Animal management and diet

Farmers fed their chickens using locally available feed resources such as maize, wheat, waste vegetables and some well-experienced farmers start to supplement their chickens using animal byproducts such as bone meal by grinding it into small pieces and some calcium sources of feed such as sand and calcium carbonate. Chickens were vaccinated against common chicken diseases of the area such as new castle disease or locally known as *fengel or kudum*, fowl pox and treated against salmonella and coccidiosis diseases by the help of veterinarians of the district. Beneficiaries were given training on chicken production system and their management including feeding, housing and animal health care.

#### Live weight, egg weight and production

Live weight of the chickens was taken at 5, 8 and 12 months of age. Data on body weight were collected every month and included in the data analysis. Egg weight was also taken and measured using sensitive balance. Egg production was collected by enumerators in collaboration with farmers using data collection sheet.

#### Data collection and analysis

Data were collected by preparing checklists and the beneficiaries were interviewed on the adaptability, disease resistant, feeding habit, broody behavior, color preference and other characteristics of the breed. Measurements such as live weight, egg weights and egg production were measured and analyzed using simple descriptive and inferential statistics with the help of SPSS version 20 software.

## RESULTS AND DISCUSSION

#### Adaptability and economic merits of koekoek chicken breed

Potchefstroom Koekoek chicken breed is adaptable to the mid altitude areas of eastern and south eastern zones of Tigray region. They are ideal breed for a free-range environment, especially for the rural communities because they are highly scavengers so that there is no need of confining them to a house. It can cause death due to suffocation, cannibalism due to mineral deficiency and they can also compete with human food. This chicken breed has an observable broody behavior which has similar characteristics with the Ethiopian indigenous chicken breeds. This broody behavior helps farmers to reproduce the breed sustainably under traditional management system.

Both the koekoek and indigenous chicken have broody behavior but comparatively koekoek has low broody behavior than the indigenous one as most hens do not



Local broody hen



Koekoek broody hen



Naturally hatched Koekoek chickens



Koekoek hen gives heat to her babies

**Figure 2.** Broody characteristics of koekoek and indigenous breeds in study districts.

show any sign of broody behavior or not easily observed by the producers (Figure 2). Though broodness behaviour is preferred by the rural farmers, it has negative impact on egg production and this is the main reason for the low egg productivity of the indigenous chicken ecotypes of Ethiopia.

### Production performance of koekoek chicken

The production performances of Koekoek chicken under the farmer management are presented in Table 1. The average body weight of the male was 1.3, 1.9 and 2.5 kg 5 months, 8 months and yearling age, respectively. Similarly, average weight of the female chickens was 1.2, 1.6 and 1.6 kg with the same ages and condition of male chickens. However, both chickens mature at six months age under farmers' management practice. This result was higher than the value reported by Aman et al. (2016) in the southern part of Ethiopia which was 142 days of age at first egg laying of koekoek chicken and Desalew

(2012) reported 153 days of age at first egg laying of the same breed. Similarly, in South Africa, Koekoek chicken reaches the age of 130 days (Nthimo, 2004). However, management including feeding, watering, housing, veterinary services and environmental conditions could be the main reasons for the lateness or earliness of egg laying. The average body weight attained in this result was similar as reported; 1.5 kg for male and 1.1 kg for female at the age of 5 months (Aman et al., 2016). This might be due to the feeding and management difference of the farmers and locally available feed resources across the study areas.

The egg production of Koekoek chickens ranges from 180-240 eggs per year depending on the supplementary feed and management of the farmers'. This result is higher than egg production performance of the local chickens which ranges from 40 to 63 eggs per year (Lemlem and Tesfay, 2010) with the average egg weight of  $43.0 \pm 2.24$  g. However, similar egg weight is reported by Nthimo (2004) and Lemlem and Tesfay (2010) on koekoek ( $55.7$  g) and Rhode Island Red ( $52.5 \pm 2.83$  g)

**Table 1.** Production performance evaluation of koekoek chickens under farmer management practice.

Parameter	Male	N	Female	N
Average weight at 5 months old	1.3	35	1.2	36
Average weight at 8 months old	1.9 <sup>a</sup>	18	1.6 <sup>b</sup>	36
Average weight at 12 months old	2.5 <sup>a</sup>	8	1.6 <sup>b</sup>	51
sexual maturity(month)	6		6	
egg production			180-240	
Average egg weight (g)			52.5	
Hatchability in percent (%)			76.5	
Egg color (%)				
Brown			87.5	
White			12.5	

<sup>ab</sup>Means in the same row for each parameter with different superscripts are significantly different (P<0.05).

and white leg horn (52.1±3 g) chickens, respectively. The hatchability of Koekoek chicken egg (76.5%) is similar to local chickens (74-83%) (Lemlem and Tesfay, 2010). In the rural farmers, natural hatching is important for the sustainability of the koekoek breed and breed improvement of the indigenous though it is not economically feasible as compared to artificial hatching machine using incubator as they can loss their time in brooding (21days) and caring for their offsprings.

### Broody behavior

#### *Contribution of poultry in food security*

Koekoek chickens lay an average egg of >180 per hen per year with farmers' management practice. The current average egg price is 3 ETB (\$0.11) so that a farmer who has 10 layers can earn more than 5400 ETB per hen per year. The beneficiaries use the money to purchase feed, food, cover educational expense for children, purchase clothes and agricultural expenses.

### Chicken disease and control measures

The fatal diseases in the specific area were Newcastle disease locally known as fengel or kudum disease, fowl pox, salmonellosis and coccidiosis. These diseases are the most economically important diseases in the study area and results in economic loss in the rural resource poor farmers. Majority of the beneficiaries were aware of the prevention and control mechanisms of the diseases observed in the area. Some farmers vaccinated their chickens against the viral diseases such as new castle disease (NCD) and fowl pox and bacterial diseases such as salmonella and protozoan diseases such as coccidiosis. Ethno-veterinary medicines such as areki

(alcoholic drinks), garlic and others are also practiced as control mechanism of the commons diseases.

Chicken mortality (34.7%) observed under the age of one month was lower than the value reported by Aman et al. (2016) which is 79.8% chicken mortality recorded in the southern part of Ethiopia. This could be due to the seasonal and environmental variation of the study period. Chickens below one month ages are susceptible to disease and predators. The main cause of death for the present study was disease outbreak, defects and predators such as cat, rat, donkeys, etc. This chicken mortality causes economic lose in the rural farmers and the country as a whole.

### CONCLUSIONS AND RECOMMENDATIONS

Koekoek chicken breed is suitable for the semi-scavenging production system, tropically adapted and farmers preferred breed. It is a good scavenger and has an egg production potential of 180-240 eggs per year depending on the management practice. Average weight for male koekoek chicken is recorded as 1.33, 1.87 and 2.47 kg at five, eight and twelve months of age, respectively, and average weight for female chickens is recorded as 1.2, 1.64 and 1.59 kg of the same age with the male. It has an observable broody behavior which is preferred by the rural farmers as farmers have no artificial incubator. Though this behavior is not recommended especially in commercial production system, it is important for sustainability of the breed under traditional production system. It has attractive color, good egg and meat production, adaptive and farmer preferred breed. Therefore, this breed should be introduced into scavenging and semi-scavenging chicken production system. However, introduction of improved breed to chicken producers cannot only make them productive and maximize the chicken production but also, good



housing, feeding, enough veterinary service provision and capacity building to all stakeholders is critical.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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