

*Full Length Research Paper*

# **Popularization of Koekoek poultry breed for enhancing livelihood of poor households: A case of Southern Tigray, Ethiopia**

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**Demonstration of Koekoek breed was conducted at Raya-Azebo and Enda-Mehoni Woredas with 10 poor households with the objective of increasing the productivity of poultry thereby improving livelihood of the resource poor farmers in Ethiopia. Koekoek breed had significantly ( $P<0.05$ ) superior on number of eggs laid per clutch (26 egg/clutch) as compared to local breed (15 egg/clutch). Beside this, the Koekoek breed is also superior in both sexes (male 2.6 kg and female 1.9 kg) on yearly body weights as compared to local breed. Koekoeks breed had significant ( $P<0.05$ ) mean scored of 6 over local breed on production and reproduction performance. The farmers perceived that Koekoek breed had superior traits on body weight, number of eggs laid per month, egg size, vent size and marketability weight of egg. However, local breed was as superior as Koekoek breed on tail height, body color, leg length and color. The breed is now playing a great role as source of cash income to the beneficiary households and covers various expenses such as educational expense, saving, routine daily life expense, house equipments, electronic device sheep and feeds. Also, the breed is being disseminated to large number of farmers through the farmer to farmer dissemination approach. Beneficiary farmers are selling eggs to their neighbors and the male Koekoeks are playing roles as community based breed improvement. Hence, efforts should be made by the extension and other actors to further scale out the breeds.**

**Key words:** Body weight, chicken, egg, farmers, local.

## **INTRODUCTION**

According to the CSA (2009, 2010), the total poultry population at country level is estimated to be about 42 million and with regard to breed, 40.63 million (96.61%), 231,478 (0.55%), and 1.19 million (2.84%) of the total

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poultry were reported to be indigenous, hybrid and exotic, respectively. Chicken production in Ethiopia has been contributing a lot to improving nutrition, gender participation and income for rural communities of a country (Mengesha and Tsega, 2011; Aklilu, 2007; Mengesha, 2006). The importance of village poultry production in the national economy of developing countries and its role in improving the nutritional status and incomes of many small farmers and landless communities has been recognized by various scholars and rural development agencies for the last few decades (Abera and Tegene, 2011; Fisseha et al., 2010). For instance, there are about 42 million chickens in Ethiopia of which 96.6% are local chickens (CSA, 2009, 2010), indicating the significance of indigenous chickens as potential Farm Animal Genetic Resources of the country.

Considerable variation in genetic and morphology of indigenous chickens in Ethiopia is potential resource (Mammo and Tsega, 2011) for improvements. Chicken production in Ethiopia has been contributing a lot to improving nutrition, gender participation and income for rural communities of a country (Mammo and Tsega, 2011). The impact of village chicken in the national economy of developing countries and its role in improving the nutritional status, income, food security and livelihood of many smallholders is significant owing to its low cost of production (Abubakar et al., 2007). Sonaiya and Swan (2004) reported that indigenous village chicken, in Ethiopia attains sexual maturity at an average of 7 months. The output from traditional production sector is low as compared to their contribution to the local chicken population. The average annual egg production ranges from 34 to 80 eggs per hen with a very small size of about 45 g egg (Mwalusanya et al., 2002), long age of sexual maturity, long brooding length, and small egg size. Similarly, productivity of local chickens is poor in the tropics attributed by low genetic potential, feed problems and diseases (Alexander, 2001). Although, it is an appropriate system, a periodic disease outbreaks and inadequacy of Scavenging Feed Source (SFS) are common limiting factors that affect performances of village chickens in Ethiopia (Mengesha et al., 2008a). Consequently, there has been a gradual decline in a country's poultry populations. To improving these chicken ecotypes, efforts on traditional selection, crossing and genomic approaches were being started in Ethiopia. Therefore, operational research project aimed to popularize Koekoek poultry breed for improving local poultry breed as well as enhancing livelihood of disadvantaged households in south zone of Tigray region.

## MATERIALS AND METHODS

### Area description

Raya-Azebo woreda has altitude ranging from 930 to 1800 m above

sea level. It covers three climatic zones: lowland (18.6%), midland (80%) and highland (1.4%). The woreda receives annual average rainfall of 400 to 700 mm. Farming activities depend on the February to May *Belg* and the July to September *Kiremti* rains. The main crops cultivated are sorghum, teff and maize. Sorghum is the staple food and teff is produced for both food and cash income. Enda-Mekoni woreda is situated from 1800 to 3925 m above sea level and found in 662 km from Addis Ababa and 120 km from the Regional capital, Mekelle. The woreda consists of 19 rural kebeles and 2 urban kebeles. Topography of the area can be classified as very steep 65%, steep 12%, gentle 15% and valley 8%. Average land holding is about 0.5 with a minimum and maximum of 0.25 and 0.75 ha, respectively. The study area has a range of annual rainfall of 650 to 950 mm. The study area has *Belg* (small rains) and *Keremti* (long rainy season) which are the two cropping seasons. The dominant soil type in the woreda plains is clay, loam and sandy soils. The mean annual temperature of the woreda is between 12 and 18°C.

### Beneficiary selection procedure

A total of 10 poor household who were recipient of the Productive Safety Net Program (PSNP) and interested to join the program were selected and out of the total 6 of them were women. A total of 195 Koekoek breed were distributed in both agro ecology in 2012. Beneficiaries' farmers were up graded by three fold (40) in 2013 by distributed off spring chicken. The experience of the households, availability of enough space for housing with a run, living standard and initiations were considered as selection criteria. Practical and theoretical training was provided to woreda experts, development agents and farmers which enabled them to develop skill on the general management practices of poultry production. There were also regular backstopping to the target farmers by the researchers and development agents on how to follow up the health of the chickens, how to keep the poultry house clean and dry, how to keep records of eggs produced and other essential management practices. For male Koekoek distribution selection of farmers was done based on farmers who had above six local hens and willingness to participate in community based breeding strategies. Each farmer received one male Koekoek breed for community breeding purpose.

### Data collection and analysis

Biological data such as number of egg, hen and cock weight, egg weight, egg height, egg diameter, albumine and yolk weight, albumine weight, yolk weight were collected. Farmer's perception was collected through participatory rural appraisal approach using group discussion on 30 farmers household (16 males and 14 females). Collected data were analyzed using SPSS version 20 and means comparison was tested using t-test of Independent Samples Test with Levene's Test for Equality of Variances.

$$Y_{ij} = \mu + T_i + e_{ij},$$

where Y is the dependant variable,  $\mu$  = overall mean,  $T_k$  = treatment effect, and  $e_{ij}$  = random error

## RESULTS AND DISCUSSION

### Production performances of Koekoek breed

Among the delivered chicken (F1 generation) a total of

**Table 1.** Production performance of Koekoek and local chickens.

Parameter	Poultry breed		SED	P-value	t-value	
	Local	Koekoek				
Body weight (kg)	Female	2	8	0.05	0.000	-16.3
	Male	1.3 <sup>b</sup>	2.6 <sup>a</sup>	0.076	0.000	-16.5
Egg number/clutch		15 <sup>b</sup>	26 <sup>a</sup>	1.12	0.000	-9.48
Egg weight(gm)		36 <sup>b</sup>	46 <sup>a</sup>	0.0008	0.000	-11.7
Egg height (cm)		4.8 <sup>b</sup>	5 <sup>a</sup>	0.045	0.024	-2.29
Egg diameter (cm)		3.3	4.4	0.67	0.128	-1.52
Albumine and Yolk weight(gm)		25 <sup>b</sup>	36 <sup>a</sup>	0.001	0.000	-8.88
Yolk weight(gm)		14	19	0.0035	0.123	-1.52
Albumine weight		11 <sup>b</sup>	19 <sup>a</sup>	0.0008	0.000	-9.47
Egg Shell weight		11	10	0.0008	0.53	0.626

P<0.05. Significant difference (2-tailed); SED: Standard error difference.

85% of the chicken were grown and laid eggs. However, on F2 generation out of the 287 hatched chicken only 65% of the chickens survived. Chickens died mainly due to predators such as snake, eagle, cat and tramping of cattle. However, some chickens died due to diseases like Newcastle disease. The Koekoek poultry breed had good adaptability to highland and lowland agro ecological zone. This implies that the breed were adapted the existing environment with feed and water stress agro-ecology. Koekoek breed had significantly ( $P<0.05$ ) superior on number of egg laid per clutch (26 egg) as compared to local breed (Table 1). Grobbelaar et al. (2010) found that egg production potentials of Potchefstroom Koekoek were 195.9 in 52 weeks. The egg production potential of local chicken is 30 to 60 eggs/year/hen with an average of 38 g egg weight under village management conditions, while exotic breeds produce around 250 eggs/year/hen with around 60 g egg weight (Alganesh et al., 2003) in Ethiopia. Lemlem and Tesfaye (2010) reported 173, 185 and 144 eggs/year/hen for White leghorn, Red Island Red and Fayoumi chicken under village household condition. Similar with the current study, Tsegaw et al. (2013) reported that eggs/clutch/hen on local chicken was in the range of 10 to 22. In line with the report of Mammo et al. (2008) in Jamma, south Wollo and the report of Halima et al. (2007), 9 to 19 eggs in North West Ethiopia. Dessie and Ogle (2001) have reported annual production of 55 to 80 eggs per year in 5 to 6 clutches of 10 to 15 eggs. Beside this, the Koekoek breed is also superior in both sex (male 2.6 kg and female 1.9 kg) on yearly body weights as compared to local breed. However, according Joubert (1996) finding, the Koekoek is classified as a heavy breed, with an average adult body weight varying from 3 to 4 kg for cocks and 2.5 to 3.5 kg for hens. Comparable with the current study, Matbo (1999) found that the mean live weight for cocks and hens of the local breeds were 1.9 and 1.3 kg, respectively. Koekoek breed had

significantly ( $P<0.05$ ) egg height of 5 cm which was 1% longer than the local chicken egg. In addition, Koekoek breed had average of 4.4 cm egg diameter and 46 g egg weight which were 7% higher and 6% heavier than local chicken egg. However, Ramsey et al. (2000) found that higher average egg weight of 55.7 g with brown egg color as compared to the present findings.

#### Farmer perception on Koekoek chicken

Farmer's selection criteria on female chicken for egg laying purpose are shown in Table 2. Based on farmers selection criteria, Koekoek breed had significantly ( $P<0.05$ ) mean score of 6 over local breed on production and reproduction performance (Table 2). However, the farmers perceived negatively on the breed on their cannibalize behavior. Indigenous chicken also had good traits on hatchability, brooding, scavenging ability and resistance to feed, water, disease and parasite as compared to Koekoek chicken. Moreover, farmers notified that Koekoek breed laid two fold egg numbers per clutch as compared to local chicken. However, farmers reported that the breed laid small egg size at the beginning, which later increased with red and white egg color. According to farmer's observation, more than 90% of Koekoek breed egg had good hatchability efficiency. Beside these, farmers also notified that Koekoek breed had early age at first egg laying on average around 8 months as compared to local chickens which is more than a year. According Grobbelaar et al. (2010) finding, the Potchefstroom Koekoek is one of the most promising breeds, it is second to white leghorn, and Fayoumi in terms of hen-housed egg production per hen and hatchability, respectively. Similarly, with the present study, Matbo (1999) found age at first egg ranged between 6 and 8 months. Similarly Demeke (2004) noted that sexual maturity in White Leghorn under intensive and

**Table 2.** Advantage of Koekoek breed over local chicken.

Trait	Farmer preference		SED	P-value	t-value
	Local	Koekoek			
Body weight	2	8			
Age at first egg laying	2	8			
Continue of laying egg	2	8			
Number of egg/month	2	8			
Large wing	2	8			
Thin leg	5	5			
Egg size	2	8			
Hatchability	6	4			
Brooding ability	9	1			
Long tail hire	5	5	-	-	-
Cannibalism	2	8			
Vent size	2	8			
Scavenging ability	8	2			
Resistance to disease and parasite	4	6			
Resistance to feed and water shortage	8	2			
Body color	5	5			
Egg marketability	2	8			
Total score	68	102			
Mean	4 <sup>b</sup>	6 <sup>a</sup>	0.857	0.026	-2.33

P<0.05. Significant difference (2-tailed); SED: Standard error difference.

extensive management ranged from 149 to 169 days, while in Rhode Island Red and Fayoumi crosses under intensive management ranged from 147 to 151 days (Rahman et al., 2004).

### Farmer perception on male Koekoek chicken

Farmer's selection criteria for male cock breeding stock are shown in Table 3. According to farmer's perception, male Koekoek breed had scored a mean of 6 over local male chicken on economical traits on body weight and other traits. However, the farmers notified that local chicken had superior on pattern of comb with double comb, tail height, body color, leg length and color as compared to Koekoek.

### Nutrition and socio-economic benefits

Koekoek chickens were found to be suitable dual purpose types which could be kept for both egg production (being good egg layers) and meat (because of their higher body weight). This would enable the family getting protein source easily at house level and mitigate protein deficient for mothers and children. In line with this, the breed contributes social linkage by selling egg and disseminate male Koekoek for community based breeding. Participant's farmers reported that around 272

eggs of Koekoek were distributed to other 123 neighbor's farmers. Beside this, farmers reported that they were starting to save 20 birr/month for 8 months in community saving and credit institution. Selling of egg and live chicken of Koekoek breed contributed to household's asset building and wellbeing. According to Moreki et al. (2001), family chicken are rarely the sole means of livelihood for the family, but is one of a number of integrated farming activities contributing to the overall well-being of the households. Chicken are widespread in Ethiopia and almost every rural family owns chicken, which provide a valuable source of family protein and income (Tadelle et al., 2003a). Farmers also reported that due to Koekoek chicken and their high egg production performance, they were able to cover expense of educational and routine daily life and were able to bought electronic device (DVD), feed and live animals such as sheep. The impact of village chicken in the national economy of developing countries and its role in improving the nutritional status, income, food security, and livelihood of many smallholders is significant owing to its low cost of production (Abubakar et al., 2007).

### Conclusion

Poor households benefited in terms of nutrition, social and economical from popularization of Koekoek breed. This increased the self-confidence of the beneficiaries

**Table 3.** Criteria selection for male breeding stock.

Trait	Farmer scored		SDE	P-value	t-value
	Koekoek	Local			
Body weight	8	2			
Double comb/Domedom	2	8			
Height	8	2			
Long tail feather	8	2	-	-	-
Thin leg with smooth and red color	5	5			
Body color	5	5			
Total scored	36	24			
Mean	6	4	1.41	0.188	-1.41

P<0.05. Significant difference (2-tailed); SED: Standard error difference.

with respect to purchase, build social capital and upgrade of saving culture. Farmers perceived positively on Koekoek breed in terms of egg production and body weight gain. Koekoek breed was superior on the traits of body weight, egg weight, egg production, and marketable preference. Hence, Koekoek poultry breed are easily available in Ethiopia and as such no problem was foreseen for farmers to widely use them. Therefore, popularization of Koekoek poultry breed is very crucial for poor household in improving their livelihood.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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## REFERENCES

- Abera M, Tegene N (2011). Phenotypic and morphological characterization of Indigenous chicken population in Southern region of Ethiopia. *Animal Genetic Resource Information Journal* 49:19-31.
- Abubakar M, Ambali A, Tamjdo T (2007). Rural chicken production: Effects of gender on ownership, and management responsibilities in some parts of Nigeria and Cameroon. *International Journal of Poultry Science* 6(6):413-416.
- Aklilu HM (2007). Village poultry in Ethiopia; socio-technical analysis and learning with farmers. Ph.D. Thesis Wageningen University, Wageningen, Netherlands.
- Alexander DJ (2001). Newcastle disease. *British Poultry Science* 42:5-22.
- Alganesh T, Mawos B, Gizaw K (2003). Survey on traditional livestock production system. *Proceeding 11th Annual Conference of Ethiopian*

- Society of Animal production, Addis Ababa, Ethiopia, August 28-30, 2003. pp. 141-150.
- Central Statistical Agency (CSA). (2010). Agricultural sample survey 2010/11: Report on livestock and livestock characteristics, volume II, 2011, Central Statistical Agency (CSA) of the Federal Democratic Republic of Ethiopia Addis Ababa, Ethiopia.
- Demeke S (2004). Egg production performance of local and White Leghorn hens under intensive and rural household conditions in Ethiopia. *Livestock Research for Rural Development* 16(9).
- Dessie T, Ogle B (2001). Village poultry production systems in the Central Highlands of Ethiopia. *Tropical Animal Health and Production* 33:521-537.
- Fisseha M, Abera M, Tadelle D (2010). Assessment of village chicken production system and evaluation of the productive and reproductive performance of local chicken ecotype in Bure district, North West Ethiopia. *African Journal of Agriculture Research* 5:1739-1748.
- Grobelaar J, Sutherland B, Molalagotla N (2010). Egg production potentials of certain indigenous chicken breeds from South Africa. *Animal Genetic Resources* 46:25-32.
- Halima H, Naser F, Van Marle-Koster E, De Kock A (2007) Village-based indigenous chicken production system in north-west Ethiopia. *Journal of Tropical Animal Health and Production* 39:189-197.
- Joubert JJ (1996). The story of the indigenous domestic animals in South Africa. *Agricultural Research Centre, Private Bag X2, Irene, 0062, South Africa.*
- Lemlem A, Tesfaye Y (2010). Performance of exotic and indigenous poultry breeds managed by smallholder farmers in northern Ethiopia. *Livestock Research for Rural Development* 22:133.
- Mammo M, Tsega W (2011). Phenotypic and genotypic characteristics of indigenous chickens in Ethiopia: A review. *African Journal of Agricultural Research* 6:5398-5404.
- Mammo M, Berhan T, Tadelle D (2008). Village chicken characteristics and their seasonal production situation in Jamma District South Wollo Ethiopia. *Livestock Research for Rural Development* 20(7).
- Matbo MMA (1999). Improving the health and productivity of the rural chickens in Africa. pp1-7. Poultry as a tool in poverty eradication and promotion of gender equality. *Proceedings of a Workshop. Report of phase 1 of an Enreca sponsored project. Department of Veterinary Medicine and Public Health, Sokoine University of agriculture. Morogoro. Tanzania.*
- Mengesha M, Tsega W (2011). Phenotypic and genotypic characteristics of indigenous chickens in Ethiopia: A review. *African Journal of Agricultural Research* 6:5398-5404.
- Mengesha M (2006). Survey on village chicken production under traditional management system in Jimma Woreda, South Wollo, Ethiopia. Ph.D. Thesis, Graduate School of Studies, Haramaya University, Ethiopia.
- Mengesha M, Tamir B, Dessie T (2008a). Village chicken characteristics and their seasonal production situation in Jamma District, South Wollo, Ethiopia. *Livestock Research for Rural Development* P 20.

- Moreki J, Petheram R, Tyler L (2001). A study of small-scale poultry production systems in Serowe-Palapye sub-district of Botswana. In: Bour M (ed), Proceedings INFPD workshop, Senegal, 9-13 December 1997. pp. 206-246.
- Mwalusanya K, Mutayoba, M, Olsen M (2002). Productivity of local chicken under villagemanagement condition. *Tropical Animal health and production* 34:405-416.
- Rahman MM, Baqui MA, Howlider MAR (2004). Egg production performance of RIR x Fayoumi and Fayoumi x RIR crossbreed chicken under intensive management in Bangladesh. *Livestock Research for Rural Development* 16(11):92.
- Ramsey K, Harris L, Kotze A (2000). Landrace Breeds: South Africa's indigenous and locally adapted developed farm animals. Ed. Ramsey, Harris & Kotzé. Farm Animal Conservation Trust, Pretoria.
- Sonaiya EB, Swan SEJ (2004). Small-scale poultry production. Food and Agriculture Organization of the United Nations (FAO) Animal Production and Health manual; Rome, 2004.
- Tadelle D, Kijora C, Peters K (2003a). Indigenous chicken ecotypes in Ethiopia: growth and feed utilization potentials. *International Journal of Poultry Science* 2:144-152.
- Tsegaw F, Birhanu A, Tesfu K (2013). Small-scale family poultry production in north Gondar: characteristics, productivity and constraints. *Livestock Research for Rural Development* 25(9).