Global Journal of Science Frontier Research: D
Agriculture and Veterinary
Volume 18 Issue 3 Version 1.0 Year 2018
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Evaluation and Demonstration of Potchefstroom Koekoek Chicken in and Around Mehoni areas of Southern Tigray Zone, Ethiopia

By Atsbaha Hailemariam, Angesom Taye, Haftom Miglas, Challa Edea, Alemayehu Amare, Tadios Habte, Bethelihem Siyum & Dawd Ibrahim
Ethiopian Agricultural Research Institute

Abstract- The evaluation and demonstration of Potchefstroom Koekoek Chicken were conducted in and around Mehoni Areas of Southern Tigray Zone, Ethiopia. Participant farmers were selected purposively based on their interest to construct poultry house; to cover other relevant poultry package costs, record the required data and to the most was identified by Mehoni Agricultural Research Center in Collaboration with the Raya Azebo Woreda Bureau of Agriculture and Rural Development Poultry experts based on the information given by national poultry research coordinating team (DZARC Poultry Team). The Survival of chicks during the first eight weeks of brooding using 40-watt bulb and traditional pot heater at farmers management condition were 82.86% (319 were survived out 385). On average about 94.56% of the chicken were survived to up to 2nd eight weeks of age while the overall survivability has attained to be 78.18% in the study areas.

Keywords: koekoek breed, survivability, egg production, scavenging, challenge, opportunity, perception and farmer's management.

GJSFR-D Classification: FOR Code: 300599

Strictly as per the compliance and regulations of:

Evaluation and Demonstration of Potchefstroom Koekoek Chicken in and Around Mehoni areas of Southern Tigray Zone, Ethiopia

Atsbaha Hailemariam [α], Angesom Taye [σ], Haftom Miglas [ρ], Challa Edea [ω], Alemayehu Amare [¥], Tadios Habte [§], Bethelihem Siyum [χ] & Dawd Ibrahim [ν]

Abstract- The evaluation and demonstration of Potchefstroom Koekoek Chicken were conducted in and around Mehoni Areas of Southern Tigray Zone, Ethiopia. Participant farmers were selected purposively based on their interest to construct poultry house; to cover other relevant poultry package costs, record the required data and to the most was identified by Mehoni Agricultural Research Center in Collaboration with the Raya Azebo Woreda Bureau of Agriculture and Rural Development Poultry experts based on the information given by national poultry research coordinating team (DZARC Poultry Team). The Survival of chicks during the first eight weeks of brooding using 40-watt bulb and traditional pot heater at farmers management condition were 82.86% (319 were survived out 385). On average about 94.56% of the chicken were survived to up to 2nd eight weeks of age while the overall survivability has attained to be 78.18% in the study areas. The average age at first egg laying was found to be 6.48 months and average weight of eggs at first laying and 5% production stage was 39.01g and 40.30g. Similarly, the average weight of egg of each participant farmers at 50% and Peak egg production stage was approved to be 43.93g and 48.77g, respectively. The average weight of male and female Koekoek chicken at 20 and 72 weeks of age was 1.40kg, 1.01kg, 2.70kg and 1.46kg respectively. The egg production per chicken has ranged from 124 to 186 with an average of 156.29 under scavenging farm condition. The average feed supplementation per chicken per day was 54.21g up to the intended production stage (72 weeks of age). The average profit of each participating farmers in the entire study period was 8927.34 Birr. Based on the result of the study, the major challenges were Transport stress and mechanical damage, Predator attack and flood, Shortage and cost of local and formulated feeds (drought existed), insufficient management(more emphasis to irrigation) and Diseases. On the other hand, the main opportunities of the Koekoek for the participants were income earning, survivability and adaptability of Koekoek and provision of training and experience sharing (capacity building). The participant farmers (71.42%) considered the Koekoek an excellent breed in the scavenging condition while other stakeholders ranked and put their perception with the accepted range (at least good). All in all, it can be concluded that the Koekoek breed has got acceptance in the areas and recommended to be disseminated to similar farming conditions with tackling ahead of the above-mentioned challenges.

Keywords: koekoek breed, survivability, egg production, scavenging, challenge, opportunity, perception and farmer's management.

I. Background and Justification

Poultry is the largest livestock group in the world estimated to be about 23.39 billion consisting mainly of chickens, ducks and turkeys (FAO, 2011; FAO, 2007) and has remained to be important in the improvement of food security and livelihood (Zemelak et al., 2016; Halima et al., 2007; Malago et al., 2014) and contributing about 28-30% of all animal protein consumed in the world (FAO., 2011; Shapiro *et al*., 2015). The chicken population in Ethiopia is estimated to be 59.5 million; 54.1 million are indigenous, 2.6 million exotic and 2.8 million hybrid and contributing 90.85%, 4.39% and 4.76% of the country's poultry population, respectively (CSA, 2016/17).

Poultry is necessary in supporting the livelihoods of poor farmers, consumers, traders and laborers throughout Ethiopia. Small-scale poultry rearing can be financially beneficial whatever the stock (indigenous or commercial) is used. Village poultry makes a substantial contribution to household food security throughout the developing world. Small-scale poultry is capable of contributing significantly to poverty alleviation and food security in remote and disadvantaged groups. Small-scale poultry production ranges from small semi-scavenging flocks of 10 to 30 indigenous breed birds in rural villages to 300 to 500 commercial improved breed birds managed with family labor in small-scale semi-commercial production systems. Small-scale poultry is a valuable asset to the local human population in many countries despite its relatively low productive performance of 40 to 60 eggs per year and 1.5 to 1.7 kg body weight at maturity. Chicken production has a major role in the economy of developing countries particularly to women. Several programs, in Ethiopia and else-where, have attempted to improve chicken production as a means to reduce poverty (Etalem *et al*., 2016-2030: Wondmeneh *et al.,*2011) and thereby ensuring a relatively safe level of

Author α σ ρ ω: Ethiopian Institute of Agricultural Research, Mehoni Agricultural Research center, P.O.Box 71, Maichew, Ethiopia.
e-mail: Atsbaba@yahoo.com
Author ¥ § χ ν: Ethiopian Institute of Agricultural Research, Debrezeit Agricultural Research Center, Bishoftu, Ethiopia.

living standard which now becomes the current continental and global issue.

A recent study by Nigussie *et al*, (2010), ascertained that the significance of enhancing strong linkages and the need to follow modernly integrated and holistic technology packages dissemination approaches by certain socio-economic and physical environments.

There was no information weather Koekoek breeds of chicken could survive and produce using locally available feeds under farmer's management condition in and around Mehoni areas of Southern Tigray. Therefore evaluation and demonstration of this chicken breed in this area using locally available feeds (scavenging conditions) supported by supplementation was proposed as important to enhance the production and productivity of chicken in the study areas.

a) Objectives of the study

i. *General Objective*

To enhance a small scale commercial poultry production packages to improve rural livelihood and nutrition quality

a. *Specific Objectives*

To Evaluate and demonstrate the performance of the Koekoek chicken under farmers management condition

- To promote and disseminate the approved technology of the chicken to the users
- To increase the income of farmers secured from these chickens and their products
- To identify the challenges and opportunities for demonstration and dissemination of Koekoek breeds
- To see farmer's perception to the introduced improved dual-purpose Koekoek breeds

II. Materials and Methods

a) Description of the study area

Mehoni Town is located in Raya-azebo woreda of southern zone of Tigray region between latitude and longitude of $12^0$47'56" North and 39^0 38'38" East and it is about 112km far away from Mekelle city. The elevation of the area ranges from 694-2367m.a.s.l having an average elevation of 1700masl. The woreda has high livestock potential of above 250,000 including Cattle, Poultry, Sheep, Goat, Donkey, Mule, and Camel which shows potentiality of the Woreda for animal production. The temperature ranges from 16 to 25°C with rain fall ranging 490mm to 680mm (RWARDA, 2016/17).

The Mixed cropping system is mainly practiced in Raya Azebo Woreda. Sorghum, Maize, teff, barley, coffee, chat, fruits and vegetables are the most widely cultivated crops in the district. Chat (Munera chat), fruits and vegetables are important cash crops under farmer and investment condition.

b) Participant household selection

The Evaluation and demonstration were conducted in Raya Azebo Woreda in three Kebelle namely Tsigea, Genete and Kukufto. Participant farmers were selected purposively in collaboration with Raya Azebo Woreda. Accordingly poultry house, cover all the associated package costs and record the required data heater preparation., seven farmers were found fulfilled the required preconditions; house construction, feeding and watering materials, litter materials preparation and cost to buy chicks. Then the day-old Koekoek chicken was distributed among those farmers at their gate with starter ration and some medication materials.

c) Disease prevention and control

The health follows up aspect was undertaken using the Raya Azebo Woreda livestock health expert after participation in the training of the Koekoek technology. Plus, the trained health experts provided vaccination against poultry diseases 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 fowl typhoid at twenty seven day and Gumboro at thirty five day old.

d) Experimental Birds and their Management

A total of 385-day old chicks of "Potchefstroom Koekoek" breed were purchased from Debre Zeit Agricultural Research Center and transported to the three Kebeles (Tsigea, Genete, and KuKufto Kebelles) of Raya Azebo woreda and distributed to the selected farmers the same day at their gate. Each participant farmers have received 55 chicks. Brooding was done using 40- watt bulb and supported locally made pot heater. Data collection formats were prepared and given to each participant to record all the required data.

e) Data collected

The amount and type of feed offered, body weight gain, egg production, egg weight, disease symptom and medication cost, mortality and its cause, income from live chicken and egg sale.

f) Data analysis

The data were collected and recorded regularly using Microsoft Excel and SPSS software were used as tools for this data analysis. Besides; index method (Musa *et al.*, 2006) was used for data requiring ranking.

III. Result and Discussion

a) Survivability of Koekoek at Mehoni

The Koekoek chicken survivability rate from day old until the first eight weeks was observed to be 82.86% in the study areas. The Survivability rate from Day old until the 1st eight weeks age was 82.86% with a mortality rate of 17.14%. Plus, the survivability rate from

the start of egg laying up to the 2nd eight weeks of age was 94.56 with a mortality rate of 5.64%. The average survivability of the Koekoek chicken has become 78.18% with a mortality rate of 21.72% among the participants in the study areas. This has shown that the a mortality rate in the first eight weeks was higher (17.14%) than from the 2nd eight weeks onwards (5.64%) (Table1). The performance evaluation and demonstration of Koekoek at Areka areas of SNNPR of Ethiopia has shown the survivability at be 79.8% and 93.1%, at 1st and 2nd eight weeks, respectively (Aman Getiso *et al.*, 2016).The survivability of Koekoek at Jimma zone of south western Ethiopia was 53.5% at farmer management condition at Mana district (Kassa *et al.*, 2016).

The survivability of the chicken in the 1st and 2nd eight weeks varied between farmers ranging from 43 (mortality=12) to 48 (mortality=7) and 43 (mortality=12) to 47 (mortality=8)) from the distributed 55 chicks/farmer, respectively. This difference in survivability among participant farmers was due to distant transport stress and mechanical damage, Predator attack (wild cat) (in Tsigea Kebelle), the variation in management (sticky flea in some) from farmer to farmer, diseases, and appropriate poultry house constructing problem (flood experienced in some) was observed as the major causes of mortality in this study.

Table 1: Survivability of Koekoek chicken at the age of 1st and 2nd eight weeks of age

Participants	Day old chicks distributed	Survivability in the 1st eight weeks	Survivability in the 2nd eight weeks	Overall survivability
BH	55	48	47	47
LK	55	45	43	43
MA	55	44	40	40
HH	55	48	45	45
EI	55	45	43	43
TA	55	46	43	43
MY	55	43	40	40
Total	385	319	301	301
Average (%)	100	82.86	94.56	78.18

b) *Number of pullets reached Age at first lay, age at first lay and weight of the egg*

The average number of Koekoek chickens reached first lay was reported to be 25.71 in the study areas. The average age of first laying recorded was 6.48 months, and the average weight of eggs at first laying was 39.01 g taking the egg weight at first day of lay at each participant (Table 2). Age at first egg laying of Koekoek chicken was 5.33 in Ada"a district while the average egg weight recorded was 48.84± 6.77g in Lume district (Desalew, 2012).

Table 2: Average age and weight of egg at first lay of Kokeoek under farmer's management

Participants	Number pullets reached AFL	Average age at first lay (Month)	Wt. of egg at first age of lay (g)
BH	28	5.7	41.9
LK	29	6.1	40.6
MA	22	6.8	38.4
HH	27	6.4	44.2
EI	24	6.9	35.8
TA	24	7.2	34.7
MY	26	6.3	37.5
Average	25.71	6.48	39.01

c) *Egg Weight at different production stages*

The average egg weight at initial laying stage (5% production stage) was observed 40.30g. This is almost similar to the weight achieved at Areka areas (40.2gm) (Aman *et al.,* 2016) but lower in weight than that of Dessalew (2012) which was (48.84± 6.77). As indicated in table 3, the increase in egg weight was observed as the production stage increases from 5% to peak stage (48.77gm). The average weight (48.77g) recorded at peak stage in this study under scavenging was slightly lower than that of DZARC evaluation (51.9g) under intensive production system.

Table 3: Egg Weight at Different Production Stages

Participants	Wt. of at 5% of egg production (g)	Wt. of at 50% of egg production (g)	Wt. of at peak egg production (g)
BH	43.4	46.4	52.6
LK	41.7	43.2	47.8
MA	39.6	45.1	48.4
HH	45.9	47.2	51.7
EI	37.1	43.6	49.1
TA	36.4	41.3	46.5
MY	37.9	40.7	45.3
Average	40.30	43.93	48.77

d) Eggs/Day/chicken/participants and Eggs/hen/participant/year

The egg production ranges from 124 to 186 among the seven Koekoek chicken rearing participants under farmers management condition. Similarly, the average pullet numbers of the participant farmers were 25.71 producing on average 0.54 eggs/day with average egg production of 156.29 in the entire annual production (52 weeks of production phase).

Table 4: Number of pullets reached egg laying, Eggs/Day/chicken and Eggs/hen

Participants	Pullet reached for egg laying	Eggs/day/chicken	Eggs/hen/year
BH	28	0.65	186
LK	29	0.59	172
MA	22	0.55	158
HH	27	0.57	165
EI	24	0.47	136
TA	24	0.53	153
MY	26	0.43	124
Average	25.71	0.54	156.29

e) Body weight gain

The average body weights recorded in the first twenty weeks of age was 1.01kg in the case of the female chicken and 1.40kg for the males. Besides, the average body weight gain at 72 weeks of age was 1.46 for the female and 2.70 for the male in the study areas (Table 5).

Table 5: Body weight gain of chicken at the different stage of growth

Participants	Female at 20 weeks in kg	Male at 20 weeks in kg	Female at 72 weeks in kg	Male at 72 weeks in kg
BH	1.12	1.57	1.61	2.93
LK	1.08	1.52	1.54	2.82
MA	1.05	1.43	1.47	2.68
HH	1.09	1.36	1.51	2.79
EI	0.967	1.29	1.38	2.58
TA	0.938	1.38	1.44	2.45
MY	0.848	1.24	1.26	2.41
Average	1.01	1.40	1.46	2.70

f) Feed Supplementation

A balanced ration provided from DZARC was fed to the chicken in the first eight weeks of age. After fully utilization of this commercial balanced ration, the farmers was advised to buy feed ration from nearby feed processing plants (Bokra union at maichew) and/or prepare feeds from locally available feed materials which include maize, sorghum, tomato, potato, wheat bran, groundnut cake, vegetables, kitchen leftovers, salt and lime stone based on different stages of development (grower and layer stages). The overall average amount of supplemental feed used in this study were recorded 54.21g/day/chicken irrespective of the two phases (grower and layer stages) which is bellow their requirements both in quantity and quality (Table 6). Scavenging was the major means of satisfying their nutrient requirements enabling to express their natural behavior such as dust bathing besides getting access to insects, worms and other leftovers around the homestead in the study areas.

Table 6: Amount of feed supplementation for Koekoek in the study areas

Participants	The range of supplemented feed(g/bird/day)	The average of supplementation of feed in each participant (g/bird/day)
BH	50-75	67.00
LK	40-70	60.25
MA	40-65	50.00
HH	40-70	55.00
EI	35-70	52.5
TA	30-60	50.25
MY	35-50	44.5
Average		54.21

g) Perception of Various stakeholders to the Koekoek technology in the study areas

Most of the participant farmers were glad about the delivery of the Koekoek technology with 71.42%, 14.29%, 14.29% scored excellent, very good and good, respectively. However, the farmers complained about the color of the breed (feel as if interbreed with wild birds) intending more awareness creation and the continuous sources of the Koekoek breed and poultry feed also mattered. The Zonal and woreda heads and the experts were in doubt about the continuity and availability of the breed and poultry feeds.

The zonal and agricultural office heads and experts had explained as excellent (50.20%), very good (29.40%) and good (23.40%) showing their opinion as accepted to the Koekoek technology delivery and demonstration in the study areas. Similarly, the Tigray agricultural research institute Alamata agricultural research center has agreed to the delivery and demonstration of the Koekoek technology at farmer management conditions. Finally, a The Ethiopian Broadcast and Tigray TV participant were happy with the technology delivery and opinion of the participant farmers during their interview about the Koekoek technology and had disseminated the technology through media and other information delivery sources (websites) (Table 7).

Table 7: Perception of Various Stakeholders to the Koekoek technology

Stakeholders	Perception of stakeholders			%
	Excellent	Very good	good	
Participant farmers	71.42	14.29	14.29	100
Zone and woreda administration offices	16.66	66.68	16.66	100
Zone and woreda agricultural office	50.20	29.40	23.40	100
Agricultural research center (Alamata)	2.10	75.80	22.10	100
EBC and TV(Media)	12.70	62.10	25.20	100

h) Partial budget analysis

In computing the partial budget analysis the feed, medication, chicken house maintenance and chicken cost were considered as variable costs whereas the sale of live chicken, eggs and the existing chicken till the time of this data collected were used as an income source. Based on the listed variable costs and the income earned the average income generated per individual farmers were 8927.35 birrs. This was in agreement with the finding at Jimma and Areka that the Koekoek was profitable at farmer management conditions with the reported average profitability of 2731.02 and 1048.90 birr respectively though there was much difference in magnitude of profitability in the study area (Kasa *et al*., 2016: Aman *et al*.,2016). This could be due to the collaboration and improved perception of the stakeholders especially the participant farmers and to the most their voluntarism for the advice given by the researchers at Mehoni Areas. This might also be due to improved management and attractive market for the sale of the live chickens and eggs of the Koekoek breeds available in the study areas.

The change in net income (ΔNI) was calculated as the difference between the change in total return (ΔTR) and the change in total variable costs (TVC)

ΔNI= ΔTR - ΔTVC

ΔNI=96155.40-33664 Ethiopian Birr

ΔNI=62491.40Ethiopian Birr

Average profit/participant=62491.4÷7

Average profit/participant =8927.35 Ethiopian Birr

Table 8a: List and amount of Variable cost for Koekoek chicken technology in Mehoni areas

	List of variable costs					
Participants	Unit	House maintenance	Chick purchase	Feed cost	Medication cost	Total
BH	Birr	1514	300	3550	573	5937
LK	Birr	1007	300	3250	517	5074
MA	Birr	935	300	2750	548	4533
HH	Birr	803	300	2850	496	4449
EI	Birr	689	300	2570	479	4038
TA	Birr	746	300	2630	394	4070
MY	Birr	685	300	2380	398	3763
TVC	Birr	5579	2100	22080	3405	33664
Average						4809.14

Table 8b: List and amount of income earned from Koekoek chicken technology in Mehoni areas

	Lists of incomes						
Participants	Unit	Sale of cocks	Sale of hens	Sale of eggs	Home slaughtered price of chickens	Home consumed price of eggs	Total
BH	Birr	2695.95	2280	12630	380	429	18414.95
LK	Birr	1567.9	2125	12220	340	275	16527.9
MA	Birr	1516.7	1260	8525	280	181.5	11763.2
HH	Birr	1455.6	1800	10867.5	225	297	14420.1
EI	Birr	1394.7	1540	7917.5	140	266.75	11258.95
TA	Birr	1378.9	1650	6855	150	285	10318.90
MY	Birr	1346.4	1610	7825	210	235	11226.40
TR	Birr	11356.15	12265	66840	1725	1969.25	96155.40
Average	Birr	1622.31	1752.14	9548.57	246.43	281.32	13736.49

Depending on the result of this study, the Koekoek chicken has encountered with some difficulties and causes of mortality that are hindering with success desired in the technology demonstration and dissemination. The Main challenges and causes in Koekoek rearing in the areas arise from long transport stress and mechanical damage, predator attack and flood, shortage and cost of local and formulated feeds, insufficient management and diseases/Newcastle (Table 8).

Table 9: Major Challenges/causes of Koekoek technology mortality at Mehoni Areas

Challenges/Causes	1	2	3	4	5	Overall rank
insufficient management	-	-	19.4	50.2	30.40	4
shortage and cost of both local and formulated feeds for Koekoek	21.4	35.7	42.9	-		3
Transport Stress and mechanical damage	64.3	14.3	21.4	-		1
Predator attack and flood	14.3	50	35.7	-		2
Disease/Newcastle	2.40	4.60	3.10	29.20	60.70	5

According to the study, the imminent opportunities for participants of Koekoek technology in the study areas include delivery of Koekoek technology and income earning, adaptability and survivability of Koekoek (Majority) and provision of training/capacity and experience sharing before and after distribution of the Koekoek technology in collaboration of Mehoni Agricultural research center and Debrezeit agricultural research center (Table 9).

Table 10: Major opportunities of Koekoek technology participants at Mehoni Areas

Opportunities	1	2	3	Overall rank
Delivery of Koekoek and income earning	56.2	15.4	28.4	1
Adaptability and survivability of Koekoek	27.6	46.2	26.2	2
Provision of training and experience sharing	16.2	38.4	45.4	3
Total	100	100	100	

IV. Conclusion and Recommendation

The survival of chicks during the first Eight weeks of brooding using 40-watt bulb and traditional pot heater at farmers management condition was 82.86% (319 were survived out 385). The average age at first egg laying was found to be 6.48 months, and the average weight of eggs at first laying and 5% production stage was 39.01g and 40.30g. Similarly, the average weight of egg of each participant farmers at 50% and Peak egg production stage was approved to be 43.93g, and 48.77g, respectively. The average weight of male and female Koekoek chicken at 20 and 72 weeks of age was 1.40kg, 1.01kg, 2.70kg and 1.46kg respectively. The egg production per chicken has ranged from 124 to 186 with an average of 156.29 under scavenging farm condition. The average feed supplementation per chicken per day was 54.21g up to the intended production stage (72 weeks of age).

The average profit of each participating farmers in the entire study period was 8927.35 Birr. Depending on the result, the main challenges were Transport stress and mechanical damage, Predator attack and flood, Shortage and cost of local and formulated feeds (drought existed), insufficient management(more emphasis to irrigation) and Diseases/Newcastle. On the other hand, the major opportunities of the Koekoek for the participants were income earning, survivability and adaptability of Koekoek and provision of training and experience sharing (capacity building). The participant farmers (71.42%) considered the Koekoek as an excellent breed in the scavenging condition while other stakeholders ranked and put their perception with the accepted range (at least good). Therefore, it can be concluded that the Koekoek breed has got better acceptance and has to be disseminated to similar farming conditions with tackling ahead of the afore mentioned challenges.

Acknowledgments

The authors are grateful to All Mehoni and Debrezeit Agricultural Research Center Staffs for supporting both in technically and financially. We also acknowledged the Tsigea, Genete and Kukufto Kebeles leaders and agriculture office livestock experts for their support during the research works and all participant farmers of Raya azebo woreda who actively participated in this work are heartfelt acknowledged and respected at large.

References Références Referencias

1. Aman, G., Melese Y., Mesfin M., Addisu J., Mebratu A., Asrat T. & Endrias D. 2016. Demonstration and Evaluation of Dual Purpose Chicken "Potchefstroom Koekoek" Packages at Areka areas, SNNPR, Ethiopia: Global Journals Inc. (USA) Online ISSN: 2249-4626 & Print ISSN: 0975-5896.
2. Kasa Biratu & Saba Haile. 2016. Demonstration and Performance Evaluation of "Potchefstroom Koekoek" Chicken Package at Jimma Zone, South Western Ethiopia: Journal of Biology, Agriculture and Healthcare: hISSN 2224-3208 (Paper) ISSN 2225-093X (Online): Vol.6, No.15, 2016.
3. CSA (Central Statistical Authority). 2015/16. Report on livestock and livestock characteristics (private peasant holdings). Agricultural Sample Survey; Federal Democratic Republic of Ethiopia, Addis Ababa Ethiopia.
4. Shapiro, B.I., Gebru, G., Desta, S., Negassa, A., Nigussie, K., Aboset, G. and Mechal, H. 2015. Ethiopia livestock master plan. ILRI Project Report. Nairobi, Kenya: International Livestock Research Institute (ILRI).
5. Etalem T., Emebet M., Tadios H., Wondmeneh E., Akliku N., Alemayehu A., and Tekaleigh Y . 2016-2030. Livestock and Fisheries Research Strategies, Poultry, Fisheries, Apiculture and Sericulture, http://www.eiar.gov.et.
6. Wondmeneh. E., Dawud I and Adey M,. 2011. Comparative Evaluation of Fertility and Hatchability of Horro, Fayoumi, Lohmann Silver and Potchefstroom Koekoek Breeds of Chicken. Asian Journal of Poultry Science.
7. Zemelak G, Luiseno C, Casio W and Gudrun A,. 2016. Characterization of village chicken production systems and challenges across agro-climatic zones in Ethiopia.

Appendix

A/Preparation and distribution of Koekoek chicks

B/Participation of woman in Koekoek demonstration

C/Sample of Weighing of Koekoek at Mehoni areas

D/Sample of egg production of participating farmers from the distributed Koekoek chickens

E/Capacity building (Provision of training on Koekoek production and management) of participating farmers

F/The observation the status of Koekoek breeds followed by discussion with the participants (exposure visit)

This page is intentionally left blank