International Journal of Theoretical & Applied Sciences, 12(2): 11-18(2020)

ISSN No. (Print): 0975-1718
ISSN No. (Online): 2249-3247

Evaluation and Demonstration of Dual Purpose Chicken "Potchefstroom Koikoek" at Selected districts of Gamo Gofa Zone, SNNPR, Ethiopia

Mekete Manjura, Hana Tadesse, Berekete Zeleke and Mesfin Gambura
Southern Agricultural Research Institute. P.O. Box 06 Hawassa, Ethiopia.
Arbaminch Agricultural Research Center. P.O. Box 2228 Arbaminch, Ethiopia.

(Corresponding author: Mekete Manjura)
(Received 19 May, 2020, accepted 25 September, 2020)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The evaluation and demonstration was conducted in Gamog of a zone, at Mirab Abaya district, Arbaminch zuria district and Arbaminch town with the objectives of evaluating and demonstrating the performance of Dual Purpose Chicken "Potchefstroom Koikoek" under farmers management condition and to evaluate economic feasibility of raising Potchefstroomkoekoek chicken breed. Participants were selected purposively on the basis of willingness to construct poultry house; to cover all the associated package costs and record the required data and most of the research work was done by Arbaminch Agricultural Research Center in Collaboration with the Identified district Bureau of livestock fishery Poultry experts based on the information given by national poultry research coordinating team (DZARC Poultry Team). Survival of chicks during the first 8 weeks at farmers management condition was 87.4% (437 were survived out 500). Mortality reduced from 12.6% to 8.2% and on average about 91.7% of the chicken were survived to the laying age. The average age at first egg laying was 143 days and average weight of eggs at first laying was 38.38g. The average weight of male and female chicken at 20 weeks of age was 1.62 kg and 1.09 kg, respectively.

Keywords: Potchefstroom Koekoek chicken breed, Mortality, Weight at 20 weeks of age, age at first egg laying.

I. BACKGROUND AND JUSTIFICATION

Poultry population in Ethiopia is estimated to be about 56.53 million, of which 95.86%, 2.79% and 1.35 % indigenous, hybrid and exotic breeds, respectively (CSA, 2015) [10]. Rural poultry production system is dominated by indigenous chickens and made significant contribution to poverty alleviation in many developing countries (Alders and Pym, 2009) [2] and well adapted to harsh environmental conditions (Melesse, 2010) [1]. Poultry (chicken) production plays a significant role in the supply of human food (eggs and meat) in rural and urban area and as a source of income, especially to small holder farmers (Dawit *et al*, 2008) [11]. About 95.86% of the total national poultry products (eggs and meat) are contributed by indigenous chickens kept under traditional management system while the remaining 1.35% are obtained from intensively kept exotic breed of chickens and 2.79% are obtained from hybrids (CSA, 2015) [10]. From the total population of chicken in Ethiopia, 99% are raised under the traditional back yard system of management, while 1% is under intensive management system. The traditional poultry production system is characterized by small flock sizes, low input and output and periodic devastation of the flock by disease (Demeke, 2007) [16]. It has been reported by researchers that the main problem of indigenous chickens in the tropics is that they are poor producer of egg and meat (Alemu 1995; Tadelle *et al*., 2000) [5, 15]. But even if they show low productivity, they are well adapted to the tropics, resistant to poor management, feed shortages and tolerate some of the most common diseases and parasites. On the other hand, improved exotic chickens produce higher number of eggs and more meat than the indigenous chicken breeds, but tropical climate is a great challenge. Regarding the production potential of indigenous birds, Alem, (2014) [3] study carried out around Central Tigray area indicated that the average annual egg production of the indigenous chicken was between 35-41eggs under village based production conditions. The overall mean ages at sexual maturity for male and female local chickens were 5.6 and 5.5 months, respectively (Alemayehu *et al*., 2015) [4]. However, their productive and reproductive performance is very poor than exotic chickens.

Therefore, in Ethiopia many works were made at various times to improve village chicken production systems through introduction of exotic chickens like fertile eggs, pullets and cocks (Alemu and Tadelle, 1997) [5]. The public agricultural extension program in Ethiopia dates back to 1950s (Gebremedhin *et al*., 2015) [12]. Since then exotic poultry breeds were imported and disseminated to rural poultry producers through on-farm research and public extension programs to improve the egg and meat production in Ethiopia. There is no documented evidence how exotic breeds were chosen by the public extension body or whether the choice was supported by studies of the adaptability of the breeds under local conditions (Tadelle *et al*., 2000) [15].

There have been efforts on introduction of exotic breeds to the country with four improved breeds (red island rod, australorg, new Hampshire, and white leg horn) where imported from Kenya, Denmark and united states to Jimma and Alemaya in 1953 and 1956 respectively. The supply of improved pullets and cockerels from the government poultry multiplication and breeding centers however was not adequate for the demand. Hence, the MoA can not claim to have had a sustainable and measurable impact on the rural communities that it was expected to serve in the area of poultry production. It seems difficult to expect rapid and positive change through the supply of 3 months old pullets and cockerels from the government poultry multiplication centers (FAO, 1999) [17].

Day old "Potchefstroom Koikoek" during distribution for participants

All these opportunities will provide rooms to undertake intervention in village chicken production system with a gradual intensification processes. Introduction and popularization of best day old proven exotic breeds in rural and peri-urban areas can lead to sustainable improvement of chicken production, house hold income, nutrition and contribution to the regional and national development goal. 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 (Grobbelaar, 2008) [19] which has similar characteristics with Ethiopian indigenous chickens ecotypes and easily manageable at farmers level.

A. General Objective

— To evaluation and demonstrate dual Purpose Chicken "Potchefstroom Koikoek" at GamoGofa area.

(i) Specific objectives

— To evaluate productive and reproductive performances of pure Potchefstroom koekoek chicken breed.

— To evaluate economic feasibility of raising Potchefstroom koekoek chicken breed.

II. MATERIAL AND METHOD

A. Description of the Study Area

The demonstration was conducted at Arbaminch Town, Arbaminch Zuria district and Mirab Abaya district, Gamo Gofa Zone, SNNPR, Ethiopia.

Arba Minch Town is found 505 km away from Addis Ababa and lies between 5°59′ and 6°40´N and 36°31′ and 37°36′Elatitude and longitude ranges, respectively. The district is characterized mostly by flat and undulating land features with an altitude ranging from 1000 up to 1500 m.a.s.l and minimum and maximum temperature 20°C and 25°C, respectively; while average annual rainfall is 1000-1400 mm/year. The town is totally bordered with Abaminchzuria district. It also shares portions of two lakes and their islands, Abaya and Chamo, Nechisar National Park is located between these lakes. (Arba Michtown Agricultural office, 2018).

Arba Minch Zuria is found 505 km away from Addis Ababa and lies between 6°28′ and 6o72´N and 36°38′ and 36°42′E latitude and longitude ranges, respectively. The district is characterized mostly by flat and undulating land features with an altitude ranging from 1001 up to 3480 m.a.s.l and minimum and maximum temperature 13°C and 28°C, respectively; while average annual rainfall is 800-1700 mm/year. The major town in this district is Arbaminch. The district is bordered on the south by the Dirasheworeda, on the west by Bonke, on the north by Dita and Chencha, on the northeast by Mirab Abaya, on the east by the Oromia Region, and on the southeast by the Amaro special woreda. This district also includes portions of two lakes and their islands, Abaya and Chamo, Nechisar National Park is located between these lakes. (Arba Mich Zuria District Agricultural office, 2018).

Mirab Abaya is one of districts of Gamo Gofa zone. It is located at 69km North of A/minch, capital town of the zone and 391 km south of Addis Ababa and lies between 6°38′ and 6°64´N and 37°54′ and 37°83′E latitude and longitude ranges, respectively. The district is characterized mostly by flat and undulating land features with an altitude ranging from 1001 up to 3000 m.a.s.l and minimum and maximum temperature 15°C and 25°C, respectively; while average annual rainfall is 900 mm/year. The major town in this district is Birbir. The districts is bordered on the east by Abaya lake, on the north by the Wolaita Zone, on the south by the Arbaminch zuria district, on the northwest by Kucha district and on the west by Chencha and Boreda districts. The District had an estimated total 81435 head of cattle, 25478 sheep, 30587 goats, 82 horses, 186 mules, 4658 Donkey, 82147 poultry of all species, and 2113 beehives (Mirab Abaya District Agricultural office, 2018).

B. Participant Selection

Participants were selected purposively in collaboration with each district livestock and fishery offices. Ten participants were selected, who fulfilled the required preconditions (willingness to house construction, feeding and watering material preparation and to cover cost to buy chicks). Then training was given on construction of poultry house, health management, feeding and watering management and data recording. Finally day-old Koekoek chicken was distributed among those farmers at their gate with starter ration and some medication materials.

C. Disease Prevention and Control

Disease prevention and control action was undertaken using the each district livestock health expert. Those 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 fowltyphoid at twenty seven day and Gumboro at thirty five day old.

D. Experimental Birds and their Management

A total of 500-day old chicks of "Potchefstroom Koekoek" breed were purchased from Debre Zeit Agricultural Research Center. Transportation of day old chickens was under taken to the three districts and distributed to the selected farmers the same day at their gate. Each participant farmers have received 50 chicks. Brooding was done by using Solomon hay box brooder. Data collection formats were prepared and given to each participant to record all the required data. Intensive follow up during the brooding phase and monitoring and evaluation was undertaken by the team

of researchers from Arbaminch Agricultural Research Center.

E. Data collection

Data was collected on mortality (as occurred due to either disease, predator, mechanical or others); age at first egg; Body weight at 20th week, cost of feed/feed ingredients and medicaments; income (from sale of cocks and nonproductive/spent hens).

F. Data Analysis

Descriptive statistics of questionnaire data were analyzed using descriptive statistics of Statistical Package for Social Sciences (SPSS 20.0).

IV. RESULT AND DISCUSSION

A. Mortality

Survival of chicks during the first 8 weeks was 87.4%. On average about 91.7% of the chicken survived to the laying age while mortality reduced from 12.6% to 8.2% (Table 1). The survival rate and mortality was different from farmers to farmers due to variation in management, inappropriate housing, poor watering and feeding condition. In addition to this, Predator attack and distant transport stress during transport of day old chickens from Debrezeitare also reasons for chicken death. The study of Aman *et al*, (2016) [6] at Areka areas of SNNPR of Ethiopia has shown that the Survivability of chicks during the first 8 weeks was 79.8%. On average about 93.1% of the chicken survived to the laying age while mortality reduced from 20.2% to 6.9%. Similarly at Mehoni areas of Southern Tigray Zone, Ethiopia, 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 [8]. In another study the survivability of Koekoek at Jimma zone of south western Ethiopia was 53.5% at farmer management condition at Mana district [13].

B. Age at First Laying and Average Weight of Eggs

Recorded average age of first laying was 143 days. The average weight of eggs at first laying was 38.38 g. This result was slightly similar with Aman *et al.,* (2016) [6], Desalew (2012) [18], Nithimo (2004) [14] Atsbaha *et al*. (2018) [8], Kassa *et al.* (2016) [13] and DZARC Annual Report (2012) who reported that the average age of first laying recorded and average weight of eggs at first laying was 149 days and 40.2g, 153.3 days and 48.8g, 130 days and 55.7g, 194.4 days and 39.01g, 219 days and 150 days at Areka area of SNNP region, Ada‟a and Lume districts, South Africa, Mehoni areas of Southern Tigray Zone, Jimma Zone of South Western Ethiopia and Debrezeit Agricultural Research center, respectively.

C. Weight of Chicken

The average weight of chicken recorded at 20 weeks of age under farmers management condition was 1.62k and 1.09 kg for male and females respectively (Table 3). At Areka town, SNNPR Aman *et al.* (2016) [6] reported that a body weight of 1.5kg and 1.1kg for male and female at 20th week of age. Nthimo (2004) also reported that a body weight of 1.7kg for Koekoek breed at 26th week of age [14]. Similarly, Aregaw and Mengistu (2011) also reported that recorded average body weight was 1.39 kg at 19th weeks of age for Koekoek breeds at on station feeding trial at Haramaya University [7].

In another study Banerjee *et al*. (2013) reported that male and female chickens weighted 1.04kg and 1.01kg of body weight at 15 weeks of age, respectively at Hawassa University in intensive feeding [9]. In general the body weight of koekoek breed achieved in our case was showed there is good potential in that area.

D. Partial Budget Analysis

Cost of feed/feed ingredients; incomes from sale of cocks, unproductive/spent hens were recorded, rough profit was estimated as indicated in table (Table 4). All the costs were recorded based on the current price. The change in net income (NI) was calculated as the difference between the change in total return (TR) and the change in total variable costs (TVC).

Table 1: Recorded Mortality.

Participant	No. of chicken given	Mortality recorded during first 8 weeks	Mortality recorded to the laying age
1	50	5	2
2	50	6	1
3	50	1	2
4	50	1	3
5	**50**	**16**	**8**
6	50	3	4
7	**50**	**20**	**10**
8	50	0	0
9	50	9	5
10	50	2	1

Table 2: Age at First Laying and Average Weight of Eggs.

Participants	No. of female chicken at first egg laying	Age at first egg laying (days)	Wt. of egg at first laying (gm)
1	20	138	39.2
2	16	142	42.5
3	18	131	32.1
4	8	135	36.7
5	11	151	43
6	9	153	41.6
7	6	154	40.9
8	22	142	37
9	5	147	39.8
10	14	138	31

Table 3: Body weight record (at 20 weeks of age).

Participants	No. of chicken sample taken		Average body weight (kg)	
	Male	Female	Male	Female
1.	5	5	1.56	1.12
2.	5	5	1.52	0.95
3.	5	5	1.65	1.28
4.	5	5	1.69	1.22
5.	5	5	1.59	1
6.	5	5	1.68	1
7.	5	5	1.61	1.15
8.	5	5	1.71	1.3
9.	5	5	1.55	0.92
10.	5	5	1.66	1.05

NI = TR – TVC accordingly the average net income from sales of chicken was 2726Birr. This income was only from sales of males and females at the age of 4 months excluding egg production. The findings at Mehoni, Jimma and Arekawere 8927.35, 2453.42 and 1048.90 Birr, respectively Atsbaha *et al*., 2018 [8], Aman *et al*., (2016) [6]. However, there was much difference in magnitude of profitability in the study area, because of the difference on market accessibility.

V. CONCLUSION AND RECOMMENDATION

A. Conclusion

A full package demonstration and evaluation of "Potchefstroom Koekoek" chicken under farmers management condition showed an acceptable performance indicating the possibility of using exotic breeds of chicken with a little additional input on housing, feeding and health management.

Table 4: Partial budget analysis.

			list of costs				Income items		
Participant		House	Chick		Total				
ts	Unit	Construction	Purchase	Feed costs	Variable	Sale of cock	Sale of hen	Total net income	Profit
1.	birr	585	300	690	1575	3180	2030	5210	3635
2.	birr	1150	300	300	1750	3640	1680	5320	3570
3.	birr	900	300	1100	2300	3500	2390	5890	3590
4.	birr	950	300	1230	2480	4120	1280	5400	2920
5.	birr	300	300	700	1300	920	740	1660	360
6.	birr	530	300	960	1790	3960	1420	5380	3590
7.	birr	750	300	500	1550	1190	750	1940	390
8.	birr	1000	300	1650	2950	4730	2160	6890	3940
9.	birr	470	300	600	1370	1890	960	2850	1480
10.	birr	510	300	1050	1860	3870	1775	5645	3785
Average					**1892.5**			**4618.5**	**2726**

The result of the current demonstration showed a good performance of "Potchefstroom Koekoek" under farmers management.

Farmers are aware that this breed can produce more if they are fed and looked after carefully, but majority of the farmers did not provide the recommended management practices. However, the overall productivity of the birds under farmers management condition was not bad but still the current demonstration suggested the importance of keeping such dual purpose chicken for farmers in the study areas.

According to farmers perceptions and observations there was no doubt on breed adaptation. The participants considered the "Potchefstroom Koekoek" as an excellent breed in the scavenging condition while other stakeholders ranked and put their perception with the accepted range (at least good). Depending on the result, the main challenges were Transport stress, Predator attack and flood, insufficient management and Diseases. On the other hand, the major opportunities of the Koekoek for the participants were income earning, survivability and adaptability of Koekoek.

B. Recommendation

— Hence there were some indicating results (Mortality, Weight at 20 weeks of age, age at first egg laying) as compared to local chicken breeds and scaling-up should be done in other areas with proper selection of farmers particularly women and children focused with well designed health care strategies.

— Poultry productivity should be improved through improvement of extension services, improve housing, feeding and genetic potential of local chickens.

— There is a strong need for appropriate intervention in disease and predator control activities so as to reduce chicken mortality and improve productivity through improvement in veterinary and advisory services.

Management of chicken by participants

Conflict of Interests. The authors have not declared any conflict of interests.

ACKNOWLEDGEMENTS

The authors thank the staff members of South Agricultural Research Institute, Arbaminch Agricultural Research Center and experts of Agriculture and Rural Development Office of the study areas for their moral and material support. The authors' appreciation also goes to the local farmers for their valuable information and animal management.

REFERENCES

[1]. Melesse, A., Getye, Y., Berihun, K., & Banerjee, S. (2013). Effect of feeding graded levels of *Moringa stenopetala* leaf meal on growth performance, carcass traits and some serum biochemical parameters of Koekoek chickens. *Livestock Science*, **157**(2-3), 498-505.

[2]. Alders, R. G., & Pym, R. A. E. (2009). Village poultry: still important to millions, eight thousand years after domestication. *World's Poultry Science Journal*, **65**(2), 181-190.

[3]. Alem, T. (2014). Production and Reproduction Performance of Rural Poultry in Lowland and Midland Agro-Ecological Zones of Central Tigray, Northern Ethiopia. *British JournalofPoultryScience*, **3**(1): 06-14

[4]. Alemayehu A., Yilma, T., Shibeshi Z., & Workneh, T. (2015). Village Chicken Production Systems in Selected Areas of Benishangul-Gumuz, Western Ethiopia. *Asian Journal Poultry, Science*, **9**(3): 123-132.

[5]. Alemu, Y. and Tadelle, D. (1997). Status of poultry research and development in Ethiopia (Research Bulletin No 4). DebreZeit Agricultural Research Centre, Alemaya University of Agriculture: DebreZeit, Ethiopia.

[6]. Aman Getiso, Melese Yilma, Mesfin Mekonnen, Addisu Jimma, Mebratu Asrat, Asrat Tera & Endrias Dako, (2016). Demonstration and Evaluation of Dual Purpose Chicken "Potchefstroom Koekoek" Packages at Areka areas, SNNPR, Ethiopia. Southern Agricultural Research Institute, Ethiopia. *Global Journal of Science Frontier Research: D Agriculture and Veterinary*, **16**(2): 22-24.

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

[8]. Atsbaha Hailemariam, Angesom Taye, Haftom Miglas, Challa Edea, Alemayehu Amare, Tadios Habte, Bethelihem Siyum & Dawd Ibrahim (2018). Evaluation and Demonstration of Potchefstroom Koekoek Chicken in and Around Mehoni areas of Southern Tigray Zone, Ethiopia Ethiopian Agricultural Research Institute. *Global Journal of Science Frontier Research: D Agriculture and Veterinary*, **18**(3): 12-15.

[9]. Banerjee, S., A. Melesse, E. Dotamo, K. Berihun and M. Beyan, (2013). Effect of feeding different dietary protein levels with Iso-Caloric ration on nutrients intake and growth performances of dual-purpose koekoeck chicken breeds. *International Journal Applied Poultry Research*, **2**(2): 27-32.

[10]. CSA (Central Statistical Authority), (2015). Crop and livestock product utilization Agricultural sample survey (September – January, 2014/2015).

[11]. Dawit, A., Tamrat D., Stotaw F., Nzietcheung, & S., Roy, D. (2008). Overview and background paper on Ethiopia's poultry sector. Relevance for HPAI Research in Ethiopia.

[12]. Gebremedhin, B, Hoekstra D., Tegegne A, Shiferaw K., & Bogale, A. (2015). Factors determining household market participation in small ruminant production in the highlands of Ethiopia. *International Livestock Research Institute (ILRI)*, Addis Ababa, Ethiopia Lives Working Paper. https://cgspace.cgiar.org/handle/10568/65204

[13]. 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:* **6**(15): 19-24.

[14]. Nithimo, A.M. (2004). The phenotypic characterization of native Lesetho chickens. Ph.D. thesis, university of the Free State, South Africa.

[15]. Tadelle, D., Alemu Y. and Peters K.J. (2000). Indigenous chicken in Ethiopia: Genetic potential and attempts at improvement. *World's Poultry Science Journal*, **56**(2): 45–54.

[16]. Demeke Solomon (2007) Suitability of hay-box brooding technology to rural household poultry production system. *Livestock Research for Rural Development.* **19**: 10-12.

[17]. FAO, (1999). Animal Genetic Resources Information, No.25, Rome, Italy.

[18]. Desalew Tadesse, Bereket Addis and Shigdaf Mekuriaw, (2014). Study on major causes of chicken mortality and associated risk factors in Bahir Dar ZuriaDistrict, Ethiopia, *African Journal of Agricultural Research.*

[19]. Grobbelaar, J.A.N. (2008). Egg production potentials of four indigenous chicken breeds in South Africa. Pretoria, Tshwane University of Technology. (M. Tech. thesis).