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Participatory on-farm evaluation and demonstration of improved dual purpose chicken production technology in South Omo zone, Ethiopia

Hando Dilamo Adila
Jinka Agricultural Research Center; P.O.Box. 96, Jinka, Ethiopia

Corresponding Author: **Hando Dilamo Adila**

Abstract
The demonstration was conducted with aim to introduce the improved chicken production technology and evaluate production performance under farmers' management condition. Total of 4 kebeles and 40 participant women farmers were selected purposively. Training was offered to participant women and key stakeholders. About 20 to 30 numbers of improved 45-day old chicks were disseminated to each participant. Frequent follow-up, periodic evaluation and monitoring was undertaken by researchers and stakeholders. Chicken mortality and weight gain data were collected at different growth stages and at fist clutch frequency of laying and weight of eggs were recorded. Farmers' perception and feedbacks were also collected during field visits. Three-point likert-scale ranking, cost-benefit and descriptive statistical analyses were used to analyze the data. The results revealed that, eggs production performance of the breed was reached on average 5 eggs per week, when supplementary feeds were provided. Out of 261 total chicken deaths recorded, 64.37% and 35.63% were caused by disease and mismanagement respectively. Moreover, household rearing about 25 chickens could gain average net income of 13,846.37 Birr/year on semi-intensive production system. Therefore, scaling-up of improved koekoek chicken breed with its full package improves poultry productivity in areas with similar agro-ecologies.

Keywords: Demonstration, Koekoek, Likert-Scale and Pre-Extension

1. Background and Justification

Poultry play an extremely significant role in providing both food and income to smallholder farmers and countless communities in the majority of developing countries. In rural Africa, chickens are more abundant than any other species of livestock, mainly existing as a plentiful source of meat and eggs for home consumption. Village poultry production is important in the national economy of developing countries and its role in improving the nutritional status and incomes of many small farmers and landless communities (Fisseha *et al*., 2010) [2]. There are about 50.38 million chickens in Ethiopia of which 96.9% (indigenous), 0 .54 % (hybrid) and 2.56% (exotic) of the total poultry (CSA, 2013) [1]. Indigenous chickens in Ethiopia are found in large numbers and distributed across different agro-ecologies, indicating that they are important avian resources reared as a source of animal protein and income to many of the rural populations (Fisseha *et al*., 2010) [2].

In South Omo zone; Beneatsemay and Jinka Zuria woredas where the study was undertaken, very limited demonstration was carried out so far on improved poultry breed. Almost all poultry breeds in the areas were local type and this has its own impact on the egg and meat production of the poultry. Directly, or indirectly, low poultry production has negative influence on food security of the smallholder farmers in the study areas. Even though local poultry breed have better disease resistance and low feed consumption, their egg and meat production potential is very low as compared to the exotic breeds. Introducing the best breed for farmers that can easily managed in terms of feed consumption, hardiness and relatively better adaptability, high productivity efficiency and vaccination and low susceptibility to disease would increase income from this practice. Taking in to into account the prominent issue of feed shortage for participant farmers, the best options is to introduce and demonstrate breeds with overall efficiency showing high levels of production versus relatively low levels of feed intake. Therefore, the demonstration was mainly conducted to introduce improved koekoek chicken production technology, to evaluate production performances of the breed under farmers' management condition and to assess farmer' perception towards the improved chicken breeds in the areas.

2. Materials and methods

2.1 Description of study area

South Omo zone is a home for 16 tribes (ethnic groups) is one of the 14 administrative zones found in the Southern Nations, Nationalities, and People's Regional State in Ethiopia. It has lowest altitude about 376m a.s.l at the Southern extreme of the zone near Lake Rudolf and highest altitude at Shengama 3418m a.s.l in South Ari wereda. Its temperature ranges on average 10.10^{o}c-35.5^{o}c whereas the total land area of the zone is 22,360.76 km^{2} with mean annual rainfall of 400-1600ml.

The main food sources for households in the zone are products purchased from market livestock products and own crops. Livestock and livestock product sales generate the bulk of household cash income, supplemented with honey sales. Cash crop production and casual work are relatively less practiced as cash income sources in the zone.

2.2 Site and farmers selection

The selection of site for pre-extension demonstration of improved dual purpose koekoek chicken was undertaken through participating experts and corresponding administrative bodies from office of livestock and fisheries in zonal and woreda level. First, two target woredas namely Bene-Tsemay and Jinka town were selected by considering the areas where adaptation trial of the koekoek chicken breed was conducted and potential for poultry production in the zone. The totals of four peri-urban kebeles (two kebeles from each woredas) were purposively selected. Participant farmers' selection was undertaken by pre-extension demonstration (PED) researchers jointly with the respective woredas' and kebeles' livestock experts, development agents (DAs), and administrative bodies based on willingness to participate, construct poultry house, ability to feed and conduct all necessary management practices. Finally, a total of 40 participants women (10 women from each kebele) were selected purposively.

2.3 Implementation procedures

Participatory approach was followed on pre-extension demonstration of improved dual purpose koekok chicken breed in the area. Model farmers, kebeles administrators, participant farmers and members of farmers research and extension group (FREGs) in the areas were involved during awareness creation and practical training and finally, field visit was conducted in the target kebeles.

2.4 Training

The training was mainly focused on; house construction, management/ cure taking practices, and its contribution to household incomes and nutrition. Totally, 95 (male=49 and female = 46) participants were participated on the training conducted at each kebele. The training was organized by Jinka Agricultural research Center (JARC) jointly in collaboration with office of livestock and fishery in both Zonal and the respective woredas.

2.5 Housing and chicks distribution

Traditionally, no specific poultry housing system was practiced in the target woredas. Prior to distribution of chicks to participant farmers, researchers jointly with the respective kebele's development agents and administrator ensured whether poultry house had been constructed or not according to the standard given during theoretical training. All host farmers constructed a poultry house by their own through giving due consideration for minimum space required for chickens that can be kept during constructing. The poultry houses were constructed by participant farmers, and hence, there was among farmers in types and size of house this is mainly due to socio-economic status and availability of construction materials in the localities of each household. Besides, totally 1000 (one thousand) forty five (45) – day old chicks were distributed to 40 (forty) selected women farmers and each farmers got 20 to 30 chicks based on the size of poultry house they own.

2.6 Types of data and data collection methods

Both qualitative and quantitative data were collected using appropriate data collection tools. The qualitative data such as farmer's perceptions were collected using likert items statements rated on a three-point likert scales, and all necessary feedbacks were collected using check lists and observation during follow up and monitoring. The quantitative data such as body weight at different growth stage, numbers of chicken died due to different cases, age at fist egg laying, weight of eggs, frequency of egg laying within a month and cost of feed and medicine by recording through measuring and counting.

3. Methods of data analysis

The quantitative data were analyzed using simple descriptive statistics such as mean and percentage and standard deviation. Three-point Likert-scale were assigned the values of 3 (very good), 2(satisfactory) and 1(poor) to rate the performances of improved koekoek chicken technology. The mean rank values range from 2 to 2.5 and 2.51 to 3 indicate that the performance of the technology were perceived as satisfactory and very good respectively, whereas the mean rank value less than 2.00 implies that the performances of the technology were decided to be poor in the area. Similarly, all important feedbacks were collected from participants and summarized qualitatively.

4. Result and discussion

4.1 Farmers' perception on improved dual purpose koekoek chicken breed

The results from likert-scale ranking of farmer's perception towards improved dual purpose koekoek chicken breed revealed that the breed had been positively perceived by farmers due to its good resistance to /disease, scavenging behavior, growth performance and early maturity status as relative to local breed. Similarly, egg laying frequency, color and size of eggs and marketability of eggs and chickens were preferred by farmers. Color of the chickens, meat quality and test of the eggs were the most liked characteristics of the technology by the participant farmers in the area as indicated in table 1 below.

Table 1: Farmer's perception on characteristics of improved koekoek chicken technology (N=22)

Attributes of improved chicken breed	Mean rank	Std. Dev.
Growth performance	2.77	0. 43
Disease resistance	2.77	0.46
Resistance to scavengers	2.86	0.35
Maturity period	2.64	0.49
Egg laying frequency	2.55	0.51
Food consumption status	2.82	0.39
Chicken color	3.00	0.00
Egg color	2.91	0.29
Egg size	2.32	0.48
Marketability of chicken	2.82	0.39
Marketability of eggs	2.91	0.29
Test of egg	3.00	0.00
Meat quality	3.00	0.00

NB. Mean is measured on a 3-point likert scale, the rank 3 being very good, 2 being satisfactory and 1 being poor.

4.2 Growth performance and survival of improved koekoek chickens in the areas

The growth performances and survival rate of chickens were affected on the intensity of management practices by farmers. In the first two months of the age, chickens were confined in the house and allowed to feed on locally formulated feed resources efficiently, to prevent from predatory and also form transmittable diseases. After two months of management majority of farmers had started feeding locally prepared feed once early in the morning, and allowed them to scavenge out door around homestead. The results of this demonstration on survival rate of chickens implied out of 1,000 chicks distributed to the farmers in the areas, The survival rates at different growth stages were about 94.2%, 85.8% and 73.9% in the 2nd, 4th, and 6th months of distribution respectively. The survival rates of chicks had shown variation among different demonstration locations. The survival rate of chicks were higher in Chali and Kako kebeles which account for about 81.14% and 79.6% respectively, on the other hand the survival rates of chicks were relatively lower in Alga and Gertep kebeles with 70.67% and 67.64% respectively as shown in the table 2 below.

Table 2: Survival rate of the chicks at different growth stage

Host kebele	Total no. of chicks disseminated	Total count at the end of 2nd month after distributed				Total count at the end of 4th month after distributed				Total count at the end of 6th month after distributed			
		M	F	T	%	M	F	T	%	M	F	T	%
Alga	300	107	179	286	95.3	93	159	252	84	80	132	212	70.67
Gertep	275	86	171	257	93.5	74	162	236	85.8	65	121	186	67.64
Kako	250	69	165	234	97.3	56	157	213	85.2	47	152	199	79.6
Chali	175	65	100	165	94.3	59	98	157	89.7	49	93	142	81.14
Total	1000	327	615	942	94.2	282	576	858	85.8	241	498	739	73.9

Performance of Productivity of improved Koekoek Chicken in the Areas

The result of this demonstration revealed that the productivity of koekoeck chickens was varied due to variation in management practices. The frequency of egg laying depends on the amount of additional feeds offered to layers. On the contrary to this idea, in the target areas farmers have no experience of regularly providing an additional feeds for their hens. Due to variation in management the hens started egg laying in the age range of 4 to mid of 6 months after dissemination. The frequency of egg laying was on average five eggs per week, if additional feeds were provided whereas it was reduced to three eggs per week without regular supplementation of additional feed. The hens had an average of 9 production cycle /clutch/ per a year in semi scavenging condition in the selected areas. The study reported the average numbers of 21 eggs per a hen per a month/one clutch/. The breed had given yield of 189 eggs per year per hen in the study area. The average body weight gain was recorded as 2240gm and 1740gm at maturity stage (6th month after dissemination) for cocks and hens respectively. The maximum body weight of hens at first egg laying stage was 2200gm in Chali Kebele and the minimum was 1000 gm in Gertep Kebele, whereas the maximum body weight of cocks at maturity stage was 2800gm in Chali Kebele and the minimum was 1300 gm in Alga and Gertep Kebeles. The average weight of 48gm of eggs were recorded at the first laying, whereas the maximum and minimum weights of egg at first egg laying were 52gm and 38gm respectively as showen in the table 3 below.

Table 3: The mean weight of chickens and egg in the demonstrated areas

Nº	Kebeles	Body weight gain of chickens at maturity stage in gram						Weight of eggs at 1st laying in gram		
		Female			Male					
		Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
1	Alga	1566.67	1900	1100	1966.6	2500	1300	45.33	51	38
2	Gertep	1457.14	1900	1000	17852.7	2300	1300	43.57	51	38
3	Kako	1650	2000	1200	1875	2400	1400	43.25	46	40
4	Chali	1740	2200	1400	2240	2800	1800	48	52	43

Mortality status of the improved koekoek chickens

The feedback and follow up of the study indicated that the death of chicken was caused by different factors. Most importantly, a disease such as Newcastle disease, exposure of chickens to mechanical damage and predators while scavenging were reported as major factors that cause death in the study areas. Predators like wild cats (locally known as 'Shelemetmt'), wild birds) and cat were the main causes of death and loss of chickens' especially in the early growth stages. Out of 26.1% of total death recorded about 16.8% of chicken mortality was caused by disease while the remaining 9.3% of death was recoded due to mismanagement practices as indicated in (table 4) below.

Table 4: Proportion of chicken's mortality due to disease and mismanagement

Kebeles	Total nº of chickens disseminated	Chickens death by disease		Chickens death by mismanagement		Total death	
		N	%	N	%	N	%
Alga	300	61	20.33	27	9	88	29.3
Gertep	275	57	20.73	32	11.64	89	32.36
Kako	250	31	12.4	20	8	51	20.4
Chali	175	19	10.86	14	8	33	18.86
Total	1000	168	16.8	93	9.3	261	26.1

Furthermore, mortality rate of chickens was varied at different growth stages in the demonstration areas. The highest mortality rate of 13.87% was recorded at chicken maturity stage (at the age 6th month after dissemination), out of which 10.49% of death was caused by disease. The study indicated that a highest mortality rate of chickens was recorded at maturity due to disease (table 5) below. This is mainly due to intensive management practices carried out in the first two months of demonstration under confined environment, and then after the chicks were allowed to scavenge out door with minimum supplementation which exposed chicks to disease and other factors.

Table 5: Mortality status of the chickens at different growth stages in the target areas

Host kebele	Nº of chicks Distributed	Percentage of chickens mortality in two months intervals after disseminated																	
		From 1- 2 months interval						From 3 - 4 months interval						From 5 - 6 months interval					
		Disease		Mismanagement		Total		Disease		Mismanagement		Total		Disease		Mismanagement		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Alga	300	2	0.67	12	4	14	4.67	26	9.1	8	2.8	34	11.9	33	13.1	7	2.78	40	15.87
Gertep	275	8	2.9	10	3.64	18	6.55	13	5.06	8	3.1	21	8.17	36	15.25	14	5.9	50	21.19
Kako	250	2	0.8	14	5.6	16	6.4	18	7.69	3	1.28	21	8.97	11	5.16	3	1.41	14	6.57
Chali	175	1	0.57	9	5.14	10	5.7	8	4.85	0	0	8	4.85	10	6.37	5	3.18	15	9.55
Total	1000	13	1.3	45	4.5	58	5.8	65	6.9	19	2.02	84	8.92	90	10.49	29	3.34	119	13.87

Profitability of improved koekoek chicken and its production technology

Poultry production is considered as women's responsibility and used as sources of foods and income. The income comes from sell of eggs, cokes and hens were mainly used as supplementary expenditure for small scale farming households in the area. During cost benefit analysis, poultry house construction costs were considered as a fixed cost and therefore the construction costs were divided by an average service year of the houses for the farmers. Hence the total cost of house construction was divided for five service years of the poultry house before it was added in the total production costs. Accordingly, the result of cost benefit analysis revealed that the net income gain of 13,846.37 birr per year was obtained from the total of 25 improved koekoek chickens farming at household level in semi-intensive poultry production system (table 6 below).

Table 6: Profitability analysis of the improved chicken production

Cost-Benefit Analysis of the Improved Koekeok Chicken Production			
Description		Quantity and its unit price	Total price (Birr)
Cost	45-day old chicks purchase	1000 (count) * 57birr	57,000
	Feeds	3.2 (ton) * 10000birr	32,000
	Medicine	3 (times) * 40HH * 150birr	18,000
	House construction	40*676 birr	27040
		Total cost of production	134,040
Income	Sale of cokes	241 (count) * 385birr	92,785
	Sale of hens	498 (count) * 250birr	124,500
	Sale of eggs	94122 (count) * 5birr	470,610
		Total income gained	687,895
Net Income	Total income - Total cost	687,895 - 134,040	553,855
Net income gained per household is estimated to be 553,855birr / 40HHs = 13,846.375birr			

5. Conclusion and recommendations

Poultry production is characterized as free scavenging, with low feed supply, poor veterinary services, and low productivity of existing local breeds. Low access to improved chicken breeds and lack of information were the main bottlenecks of poultry production in the area. It was concluded that from the farmers perspective point of view farmers', the growth performances and productivity, color of the chicken and test of egg and meat were highly accepted attributes of the koekoek chicken under semi scavenging

production system in the area. Furthermore, its income contributions to the poultry farming households was accounted about 13,846.37 Birr of net income gain per year from owning an average of 25 chickens per household. Enhancing awareness and practical skill of small holder farmers on poultry, feeding and disease prevention, and improving access to improved chickens breeds veterinary services and housing could also increase the production and productivities of poultry as well as income of small holder households in the areas. Therefore, the office of livestock and fisher in the respective woreda should improve access to improved poultry breed and veterinary services in the vicinities. Further research works should be undertaken on disease prevention and control mechanisms to alleviate chicken mortality in the study areas.

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