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Production and Reproduction Performance of Backyard Poultry In Central Zone of Tigray, Ethiopia

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Abstract
The study was conducted in lowland and midland agro-ecological zones of central Tigray, in northern Ethiopia with the objective of characterization of village poultry marketing system under rural household management. A total of 160 households and 50% of them were female headed households. Data were collected using semi structured questionnaire and monitoring individual households. Chi- square test was employed for ordinal and nominal data. ANOVA was also employed for continuous data. Average age at first mating of cockerels was 26 and average age at first egg of local pullets was 27.2 weeks. Average egg production per year was 43.4 eggs for local hens, 81.4 eggs for cross breed hens and 144.3 eggs for exotic hens. Average number of eggs set for incubation per broody hen was 10.2±0.23 eggs with hatchability of 82.5% and 88.85% in lowland and midland agro-ecologies, respectively. The average survival rate of chicks was 61.95% in lowland and 69.4% in midland agro-ecology. Average weight of cocks, hens, cockerels and pullets was 1.69 kg, 1.37 kg, 1.024 kg and 1.02 kg, respectively in lowland and 1.81 kg, 1.356 kg, 1.119 kg and 1.064 kg, respectively in midland. Generally egg production hatchability and survival of chickens varied with agro-ecology.
Keywords: Mortality; Hatchability; Predators; Disease

1. Introduction

Poultry production is an important sector in Ethiopia where chickens and their products are important sources of food and income. Ethiopian chickens are estimated to be over 56 million, and almost every family in the rural areas of the country practice traditional chicken production system (Solomon, 2003). Poultry production systems in Ethiopia show a clear distinction between traditional, low input systems on the one hand and modern production systems using relatively advanced technology on the other hand (Alemu, 1995). The chickens in free-range and backyard production systems are a function of natural selection which are mainly local or indigenous breeds. As a result the performance of chickens under rural conditions remain generally poor as evidenced by highly pronounced broodiness, slow growth rates, small body size and low production of meat and eggs (Gausi *et al*., 2004). Even with its challenges, backyard poultry production, which is still important in low-income food-deficit countries, is an appropriate system to supply the fast-growing human population with high quality protein (Tadelle *et al*., 2003a). Moreover, indigenous chickens are known for their merits such as broodiness behavior with high fertility and hatchability, disease resistance thermo tolerant, good egg and meat flavor, hard eggshells, productivity at zero or minimal feed supplementation and high dressing percentage (Abera, 2000) that matches with the poor family poultry production systems. However, the indigenous chickens have been neglected in areas of scientific research on identifying distinct line breeds and its characterization, production performance, potential improvement and system development efforts.

Objective

- To assess flock composition and flock dynamics of rural poultry production in male and female headed households in the lowland and midland agro-ecological zones in central Tigray.
- To explore the production performance of rural chickens
- To identify the major constraints and opportunities of rural poultry production in male and female headed households in the lowland and midland agro-ecological zones in central Tigray.

2. Materials and Methods

The study was conducted in central Tigray, Northern Ethiopia which is locate between $13^0$15’ and $14^0$39’ North latitude, and between 38^0 34’ and $39^0$25’ East longitude. Two sample districts, namely Adwa and Merebleke, were selected using systematic random sampling method. The study area (central zone of Tigray) was stratified into two agro-ecologies as midland and lowland based on their altitude and as customarily used by the local administration and bureau of agriculture. A total of 160 sample farmers, 80 from each district, 40 male and 40 female headed households were selected randomly using lottery method from those households reared at least one chicken in the year. Data like production and reproduction performance, hatchability, poultry loss and survival rate of chickens were collected using repeated farm recording methods and pre-tested formal semi-structured questionnaire. In addition four focus group discussions with an average group size of 16 individuals were conducted with key-informants (model farmers, elders, women association leaders, experts from Agriculture and Rural Development and Relief Society of Tigray office, administrative bodies, youths and extension workers) in both agro-ecological zones. Tape recorder was used to record the forwarded ideas during

the group discussion. Statistical analysis were made using JMP5 (SAS, 2002). Descriptive statistics such as mean, range and percentile were used. Chi- square test was employed for ordinal and nominal data such as Egg production, chicken loss and hatchability. ANOVA was also employed for continuous data type like body weight and sexual maturity.

3. Result and Discussion

3.1. Sexual maturity

Average age at first mating of cockerels was 26 weeks for local, 24.9 weeks for cross and 25.2 weeks for exotic breeds and there was no significant difference between lowland and midland agro-ecology (Table 1). A bit faster age of sexual maturity of cockerels (24.6 weeks) was reported by Fisseha *et al*. (2010) in North West Ethiopia, similarly Halima *et al*. (2007), reported that Pullets and cocks reached sexual maturity at an age ranging from 20 to 24 weeks Western Gojam. Kugonza *et al*. (2008) also reported that sexual maturity of male Chickens in Eastern Uganda was 5.5 months (22weeks).

Average age at first egg was 27.2 weeks for local breeds ranged from 24 to 28 weeks, 25.7 for cross breeds ranged from 24 to 27 weeks and 25.4 for exotic breads ranged from 24 to 27 weeks. There was significant difference ($P<0.05$) on sexual maturity of both exotic, cross and local pullets between lowland and midland agroecology. Maturity of chickens was late in lowland than in midland agroecology. This might be attributed to the management practice like feeding, housing and health care of the farmers. Relatively better feeding and housing management was observed in midland agro-ecology. Sexual maturity of chickens always depends on chicken management and overall production systems of the households mainly on feeding and disease management practices.

Table 1. Sexual maturity of chickens in male and female headed households in lowland and midland agroecology of central Tigray

Variables	Lowland		Midland		P value
	MHH	FHH	MHH	FHH	
Age at first mating in weeks (Mean±SE)					
Local	26±0.17^{a}	25.8±0.18^{a}	25.8±0.18^{a}	26.2±0.17^{a}	0.3175
Cross	24.8±0.21^{ab}	25.3±0.21^{a}	24.5±0.21^{b}	24.7±0.21^{b}	0.0548
Exotic (RIR)	25.8±0.32^{a}	25±0.32^{ab}	24.8±0.32^{b}	25.2±0.32^{ab}	0.1599
Age at first Egg in weeks (Mean±SE)					
Local	27.4±0.11^{a}	27.5±0.13^{a}	26.8±0.13^{b}	27±0.1^{b}	0.0001
Cross	25.5±0.18^{b}	26.1±0.18^{a}	25.5±0.18^{b}	25.7±0.18^{ab}	0.0305
Exotic (RIR)	25.7±0.24^{a}	25.9±0.24^{a}	24.9±0.24^{b}	25.3±0.24^{ab}	0.0261

-Least sq means with different superscripts within the row are significantly different, (P<0.05)
MHH= Male headed households, FHH= Female headed households

This result was similar with 6.8 months reported by Tadelle *et al*. (2003b) and 6.5 months (26 weeks) reported by Kugonza *et al*. (2008) in Eastern Uganda but somewhat longer than the reported 5.9 months by Bogale (2008) in Fogera woreda and 168 days (24 weeks) by Benabdeljelil *et al*. (2001) in Morocco.

About 64.4% of the respondents had their own breeding cock and 71.1% of which were local breeds, 18.3% cross and 10.6% were exotic breeds (Rhode Island Red). Regarding source of cocks, 58.3% home grown, 31% purchased from market or neighboring farmers and the rest 10.7% received from GOs and NGOs (Table 2).

Table 2. Ownership of breeding cocks in male and female headed households in lowland and midland agroecological zones of central Tigray.

Variables	Lowland		Midland		X^2 value	P value
	MHH (%) (n=40)	FHH (%) (n=40)	MHH (%) (n=40)	FHH (%) (n=40)		
Owner ship of breeding cock						
Yes	57.5	67.5	60	72.5	2.5	0.4745
No	42.5	32.5	40	27.5		
Source of cocks						
Home grown	73.9	63	50	48.3		
Market purchase	13.05	22.2	41.7	44.8	8.56	0.1997
Received from GOs or NGOs	13.05	14.8	8.3	6.9		
Breed of cocks						
Local	69.6	64.3	70.8	79.3		
Cross	17.4	21.4	20.8	13.8	2.26	0.8938
Exotic (RIR)	13	14.3	8.4	6.9		

MHH= male headed households, FHH= Female headed households, n= number

3.2. Egg production

Average number of eggs laid per hen per clutch was 13.6 for local hens ranged from 9 to 18 eggs, 25.7 for cross breed hens ranged from 15 to 35 eggs and 44.4 for exotic breeds ranged from 30 to 65 eggs (Table 3). Egg production of exotic breed and cross breed chickens was significantly higher (P<0.01) in midland than lowland. This difference could be due to the less resistance of these chickens to high temperature in lowland which may affect their productivity. In addition the management level of the farmers may create difference in the production potential of the chickens, for example the management level and egg production of the households were positively correlated (r=0.53; n= 160). This indicates that the low production and productivity of the chickens in the area is attributed to the poor management practice of the farmers. Similarly, Mwalusanya *et al.* (2004) reported that, the low productivity of chickens in Tanzania was partly due to the prevailing poor management practices, in particular the lack of proper health care, poor nutrition and housing.

The average number of clutches per year per hen was 3.2 for local hens ranged from 2 to 5 with an average clutch length of 21.6 days ranged from 15 to 28 days, 3.1 for cross breed hens ranged from 2 to 4 with an average clutch length of 31.6 days ranged from 18 to 40 days and 3.2 for exotic breeds with average clutch length 44.4 days.

Table 3. Egg production performance of chickens male and female headed households in lowland and midland agroecological zones of central Tigray.

Variables	Lowland		Midland		P value
	MHH	FHH	MHH	FHH	
Average clutch number/year (Mean±SE)					
Local	3.2±0.06^{a}	3.15±0.07^{a}	3.2±0.07^{a}	3.2±0.06^{a}	0.9123
Cross	3.2±0.18^{ab}	2.7±0.18^{b}	3.1±0.18^{ab}	3.3±0.18^{a}	0.1478
Exotic (RIR)	3±0.11^{b}	3.2±0.11^{ab}	3.3±0.11^{a}	3.26±0.11^{ab}	0.1920
Clutch length in days (Mean+SE)					
Local	21.1±.35^{b}	22.3±0.39^{a}	21.7±0.4^{ab}	21.5±0.33^{ab}	0.1621
Cross	28.5±1.1^{b}	28.9±1.1^{b}	34.7±1.1^{a}	34.5±1.1^{a}	<0.0001
Exotic	43.2±1.4^{a}	42.7±1.4^{a}	44.9±1.4^{a}	46.6±1.4^{a}	0.2220
Egg production/clutch/hen (Mean±SE)					
Local	13.4±0.25^{ab}	14.1±0.28^{a}	13.7±0.28^{ab}	13.3±0.24^{b}	0.1361
Cross	22.4±1.1^{b}	24.6±1.1^{b}	31.5±1.1^{a}	31.2±1.1^{a}	<0.0001
Exotic (RIR)	40.3±1.4^{bc}	36.7±1.4^{c}	44.0±1.4^{ab}	46.3±1.4^{a}	<0.0001
Average egg production/year/hen (Mean±SE)					
Local	43±1.2^{a}	44.3±1.3^{a}	43.7±1.3^{a}	42.7±1.1^{a}	0.8254
Cross	71.7±4.4^{b}	65.3±4.4^{b}	96.3±4.4^{a}	100.8±4.4^{a}	<0.0001
Exotic (RIR)	120±5.1^{b}	117.2±5.1^{b}	146±5.1^{a}	150.3±5.1^{a}	<0.0001

-Least sq. means with different superscripts within a row are significantly different, (P<0.05).
MHH= male headed households, FHH= Female headed households, n= number

Relatively small number of clutch per year (2 to 3) but longer clutch size (69 days) was reported by Kugonza *et al*. (2008) in Eastern Uganda. In addition 4 cycles of broodiness were recorded per year in hens with an average duration of 12 to 15 days per clutch in Kashmir (Iqbal and Pampori, 2008).

Clutch length in cross breed hens was significantly longer (P<0.001) in midland (34.6 days) than lowland agro-ecology (28.7 days). This result might be attributed to the difference in management practice of the farmers living in lowland and midland agro-ecology. As explained by the key informants in the group discussion, clutch number and clutch length of exotic breed hens were hardly identified by the farmers because, it was very difficult for the farmers to know whether the interruption of egg production is due to nature of the hen or shortage of feed because exotic breeds are sensitive to feed shortage. Average egg production per year per hen was 43.4 eggs for local hens, 81.4 eggs for cross breed hens and 144.3 eggs for exotic hens.

Egg production of exotic breed and cross breed chickens was significantly (P<0.01) higher in midland than in lowland. This could be due to the management level of the farmers and the high temperature in lowland by itself might have a negative effect on the production performance of the exotic hens. In line with this a study conducted at the College of Agriculture, Alemaya, has indicated that the average annual egg production of a native chicken was 40 eggs under farmer's management (Tadelle *et al*., 2000) but higher egg production, 54.3 eggs/year/hen was reported by Abraham and Yayneshet (2010) for local hens and 185 eggs for exotic (Rhode Island Red) breeds similarly large number of eggs (78 eggs/hen/year) was reported by Benabdeljelil *et al*. (2001) for local hens in Morocco. From the result of this study, we can conclude that exotic and cross breed chickens can produce large number of eggs than local breeds mainly in midland agro-ecology in the presence of adequate amount of feed.

3.3. Hatchability and survival rate of chicks

In both agroecologies the average number of eggs set for incubation per broody hen was 10.2 eggs with hatchability of 85.8% for local eggs and 78.97% for cross breed eggs (Table 4). The hatchability of local and cross breed eggs was 82.5% and 72.5% in lowland areas and 88.9% and 85.5% in midland areas. This might be attributed to the high temperature in lowland that may affect the quality of the eggs and in addition broody hens would be restless during high temperature. This is in line with the reported 82.6% hatchability for local eggs in Bure wereda (Fisseha *et al*., 2010), 89.1% in Southern Ethiopia (Mekonnen, 2007) in addition, 90% of egg hatchability in Eastern Uganda (Kugonza *et al*., 2008), and 83.6% hatchability in Tanzania was reported by Mwalusanya *et al*. (2004) but higher than the reported 70.5% hatching rate (Tadelle *et al*., 2003b) and 78.6 % hatchability of local eggs reported by Abraham and Yayneshet (2010) for Northern Ethiopia, 61.8% hatchability in Botswana (Aganga *et al*., 2000) and the hatchability ranged 77% to 81% in Kashmir (Iqbal and Pampori, 2008). This variation might be due to the difference in management practices of the poultry producers in the different climatic zones. Chicks reached grower stage 8 weeks (survival rate) were 65.8% and 63.7% for local and cross breed chicks, respectively. There was significant difference (P<0.05) in survival of local and cross breed chicks between lowland and midland agro-ecology. This could be due to the difference in disease prevalence rate and management practice of the farmers in the area. This is lower than the reported 75% of the chicks survived the brooding period in Sudan (Khalafalla *et al*., 2001), but higher than the reported 60.5% of birds reached grower stage in Bure wereda (Fisseha *et al*., 2010), 51.3% average survival rate of chicks in Ethiopia (Tadelle *et al*., 2003b) and about 44.2 % mortality of chicks (55.8 % survived) reported by Abraham and Yayneshet (2010) for Northern Ethiopia. In addition, the overall mean chick survival rate to 10 weeks of age in Tanzania was 59.7% (Mwalusanya *et al*., 2004).

Table 4. Hatchability and survival of chicks in male and female headed households in lowland and midland agroecological zones of central Tigray

Variables	Lowland		Midland		X^2 value	P value
	MHH (%) (n=40)	FHH (%) (n=40)	MHH (%) (n=40)	FHH (%) (n=40)		
Average eggs set for incubation (Mean±SE)						
Local	10.2±0.21[a]	10.3±0.24[a]	10.2±0.24[a]	10.2±0.2[a]		0.9706
Cross	8.1±0.29[ab]	7.3±0.29[b]	8.9±0.29[a]	8.7±0.29[a]		0.0017
Hatchability						
Local	82.1	82.96	88.3	89.4	37.74	<0.0001
Cross	72.8	72.1	86.7	84.2	21.06	0.0002
Survival of chicks to 8 weeks of age						
Local	62.5	61.4	70.2	68.6	8.39	0.0172
Cross	60.7	55.4	69.6	69.2	10.06	0.0071

-Least sq means with different superscripts within a row are significantly different, (P<0.05).

MHH= male headed households, FHH= Female headed households, n= number

3.4. Body weight of indigenous chickens

The average weight of mature males (cocks) was significantly higher (P<0.05) in midland (1.812) kg than in lowland (1.694) agro-ecology (Table 5). But similar body weight of hens (1.37 kg and 1.356 kg), cockerels (1.024 kg and 1.119 kg) and pullets (1.021 kg and 1.064 kg) was recorded in lowland and midland agroecology, respectively. The substantial differences in body weight observed for the different classes could be attributed to non genetic factors like supplementary feeding, watering and health care. The average weight of mature males (cocks) in this study is higher than the average weight (1.5 kg) of the indigenous chicken of the Central Highlands of Ethiopia (Alemu and Tadelle, 1997) and lower than the mean weight (2049.07gm) of indigenous chicken in Northwest Ethiopia (Halima *et al*., 2007). Moreover the reported mean weight of mature male (1.6 kg) and female (1.3kg) chicken in Southern Ethiopia was lower than this result but the mean weight of grower male (1.05 kg) and female (1.04 kg) chicken in that area (Mekonnen, 2007) was similar to this result.

Table 9. Body weight of indigenous chickens in lowland and midland agroecology

Body weight in (kg)	Lowland Mean±SE	Midland Mean±SE	P value
Grower male (cockerel)	1.024±0.03[a]	1.119±0.03[a]	0.0511
Grower female (pullet)	1.021±0.03[a]	1.064±0.03[a]	0.3441
Mature male (cock)	1.694±0.03[b]	1.812±0.03[a]	0.0167
Mature female (hen)	1.370 ±0.04[a]	1.356±0.04[a]	0.8220

-Least sq. means with different superscripts wit in a row are significantly different, (P<0.05).

4. Conclusion

Despite the management gaps of the producers in rearing poultry, relatively promising performance of the local chickens in midland agro-ecology was observed which is explained in terms of high hatchability, survival and resistance to disease and feed shortage. This study shows that, egg production, hatchability and survival of chickens varied with agro-ecology. The exotic breed chickens are appreciated for their more egg production but sensitive to disease, predators and feed shortage. Average body weight of matured and grower chickens in both agro-ecological zones of the study area was small in compare to the weight of chickens kept in intensive production system.

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