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Full Length Research Paper

Village chicken breeding practices, objectives and farmers' trait preferences in western zone of Tigray, Northern Ethiopia

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The survey aimed at assessing village chicken breeding objectives, trait preferences and priority traits of farmers for improvement through breeding in western Tigray. Multi stage sampling procedures were employed to select sample weredas, kebeles and respondents where three rural weredas, nine kebeles and 385 respondents were selected by purposive, stratified purposive and purposive random sampling techniques, respectively. Pretested questionnaire and focus group discussions were employed to generate data. Breeding practices were analyzed using descriptive statistics of SPSS 16. Kruskal Wall's test of SPSS 16 was employed to test qualitative variable proportion difference across agroecologies. Ranking index was employed to rank all identified breeding objectives, trait preferences and preferred traits for improvement. Income and ceremony were the first prioritized breeding objectives. Plumage color (1st) and egg laid/clutch (2nd) were the major farmers 'trait preferences. Egg laid/clutch (1st) and growth (2nd) were the most preferred traits to be improved. Comprehensible knowledge on breeding practices, objectives and trait preferences of chicken owners are indispensable for development of holistic and sustainable genetic improvement and conservation programs. Hence, breeding objectives and trait preference should incorporate in designing agroecologically friendly and sustainable genetic improvement breeding programs to assure sustainable utilization, improvement and conservation of indigenous chickens.

Key words: Breeding practices, Breeding objectives, Trait preference

INTRODUCTION

Village chickens fulfill many roles in the livelihood of rural households predominantly resource poor farmers who are below the poverty line. Globally, indigenous chicken production system is recognized as a strategy means for capital build up, poverty, malnutrition and hunger reduction among the resources poor households owing to their short repro duction cycles, low inputs production requirements, their good scavenging ability and adaptability to harsh and wide production environments (Besbes, 2009). Moreover, local chickens poses high genetic diversity for many traits and are therefore serve as genetic reservoirs resources for present and future genetic improvements of local chickens (Dana et al., 2010., Emebet et al., 2014.) and they are potential sources of hardiness genes or traits that should conserved for future use in response to the dynamic nature of the world.

On top of these merits, village poultry can provide the start of the owner climbing the "livestock ladders'' leading to other livestock species such as goats and cattle or serve as "transport (transitional) bridge" from small livestock to large livestock species production (Dolberg, 2003). Ethiopia has an estimated of 51.35 million with indigenous chicken of non-descriptive breeds accounting 96.83%, hybrid chicken 2.37% and exotic breeds 0.8% (Central Statistics Agency 2013). Moreover, 97.3% of indigenous chickens have been distributed in different agro-ecological zones of Ethiopia (Central Statistics Authority 2011) and this wide distribution

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indicates their adaptive potential to different environmental conditions, diseases and other stresses (Halima, 2007).

Indigenous chickens have played infinite roles in the livelihood of Ethiopian households mainly for these below poverty line. However, the productive performance of local chickens is disproportional with their size and their low performances have masked their potential to boost the living standards of their owners and contribute to rural developments.

Efforts to improve the performance of local chickens through cross breeding with exotic breeds were not successful (Dana et al., 2010) which are attributed to the dissemination ofinappropriate technologi es without understanding of production environments under which indigenous chickens are raised and the lack of information on breeding objectives and farmers' trait preferences. In Ethiopia like other developing countries, agro-ecologically based breeding programs for indigenous chicken breeds are lacking (Dana et al., 2010).

Base line information on production circumstances, indigenous breeding practices, breeding objectives and farmers' trait preferences require for designing, planning and implementing agro-ecologically friendly and sustainable and holistic genetic improvement programme s of indigenous chickens so as to ensure sustainable improvement, utilization and conservation of indigenous chicken genetic resources and to uplift their contributions to improve the livelihoods of small scale farmers and to rural developments as whole. No or little studies on these areas have been done in Tigray region and in particular in Western zone of Tigray. Thus, it was from the expectations to bridge this research gap that the current study was designed with assessing breeding practices, objectives and farmers' trait preferences of local chickens under scavenging production systems in western zone of Tigray.

MATERIALS AND METHODS

Description of study area

The study was conducted in three rural weredas (Kafta Humera, Welkait & Tsegede) of Western Zone of Tigray Regional State, North West Ethiopia. It is one of the five administrative zones of Tigray regional state and it has four (4) districts (Setit Humera, Kafta Humera, Welkait and Tsegede) comprising of 81 kebeles with 77 rural kebeles (24, 25 and 28 kebeles from Kafta Humera, Tsegede and Welkait weredas, respectively) and 4 urban kebeles with distance range of 580–750 km from Mekelle, the capital city of Tigray. Setit Humera was not included in the study because it is represented by Kafta Humera. It covers an area of 1.5 million hectare with Kafta Humera accounts 48.13%, Setit Humera accounts 0.82%, Tsegede accounts 23.43% and Welkait accounts 27.62% (Humera Agricultural Research Center, 2003). The total cultivated land of the zone is 573,285 hectares (38.2%) while the uncultivated land accounts 927,000 hectares (62.8%). 341,195.25 hectares (36.8%) of the uncultivated land is covered by different plant species excluding Bowsellia and Acacia Senegal While 185,510 hectares (20%) of the unfarmed land is solely covered by both Bowsellia and Acacia Senegal. The zone consists of three agro-ecological zones namely lowland (75%), midland (15.7%) & highland (9.3%). The geographical location of the zone is 13°42′ to 14°28′ north latitude and 36°23′ to 37°31′ east longitude (Mekonnen et al., 2011).

The annual rainfall of the zone ranges from 600 mm to 1800 mm while the annual temperature ranges from 27^0c to 45 ^{0}c in the lowland areas (Kolla) and 10^0c to 22 ^{0}c in both midland and highland areas of the zone. The altitude of the zone ranges from 500- 3008 m.a.s.l. The zone shares borders with Tahtay Adibayo, Tselemti and Asgede Tsimbla in the East, Sudan in West, Amhara region in South and Eritrea in the North. The study area represents a remote, tropical climate where extensive agriculture is performed manually by large numbers of migrant laborers.

Throughout the zone, livestock agriculture is the predominant economic activity with about 95% of the total population engaged directly or indirectly in it (Mekonnen, et al. 2011). Main cattle breeds raised in the Western Zone are the local Arado (in both high land and mid land areas) and Begait cattle (in lowland areas). Semi-intensive production is practiced in Humera district, which is more urban, while extensive production system is dominant in the Welkait and Tsegede districts. The main crops cultivated in the lowland areas of the zone are sesame, cotton and sorghum while teff, wheat, barley, noug, lentils, finger millet, field peas and fababeans are cultivated crops in both midland and high land areas of the zone.

Sampling techniques

Three rural (welkait, Tsegede & Kafta Humera) weredas were purposely selected. All kebeles (smallest administrative units in Ethiopia) of three weredas were stratified in to three agro-ecological zones namely lowland, midland and highland. Based on the village poultry population density, chicken production potential and road accessisibilty, four, three and two kebeles were purposely selected from lowland, midland and highland agro-ecologies, respectively. A total of 385 local chicken producers were selected from household package beneficiary's registration book of each selected kebele using purposive random sampling technique. Required number of respondents

per a sample kebele was determined by proportionate sampling technique based on the households' size of the sample kebeles.

Sample size determination

Required total respondents were determined using the formula (Cochran, W. G. 1963) for infinite population (infinite population ≥ 50,000).

$N_o = [Z^2pq] / e^2$, Where N_o = required sample size

Z^2 =is the abscissa of the normal curve that cuts off an area at the tails (1-α); (95% = 1.96)

e = is the margin of error (eg. ±0.05%, margin of error for confidence level of 95%)

p = is the degree of variability in the attributes being measured refers to the distribution of attributes in the population q = 1-p.

Required number of respondents per a selected kebele was determined by proportionate sampling technique as follows:

W= [A/B] x N_o, where A=Total number of households living per single selected kebele, B= Total sum of households living in all selected sample kebeles and N_o = the total required calculated sample size.

Data collection

Data on household characteristics, breeding practices, breeding objectives and farmers' trait preferences of local chickens under free scavenging production system were collected through individual interview using pretested questionnaire and this was augmented or enriched with one focus group discussion per agro-ecology with 10-12 discussants per each group.

Statistical analysis

Breeding and selection practices and criterias were analyzed using descriptive statistics of frequency procedures and cross-tabulation of SPSS version 16 (SPSS. 2007). The Kruskal-Wallis Test option of the non-parametric tests of SPSS 16 was employed to test the effects of the agro-ecology on the proportion of breeding and selection practices and criterias.

Ranking of poultry breeding objectives and trait preferences

Identified village chicken breeding objectives and farmers' trait preferences during the individual interviews were prepared into separate flip charts and presented to each group for rating them according to their order of importance. The rank of breeding objectives and trait preferences and prioritized traits to be improved through genetic improvement interventions from individual respondent obtained through direct interview in the survey was analyzed using Ranking index:

Index =Σ (n x number of HHs ranked 1st) + (n-1) x number of HHs ranked 2nd) + …+ 1 x number of HHs ranked last) for one trait divided by the Σ (n x number of HHs ranked 1st + (n-1) x number of HHs ranked 2nd +…. +1x number of HHs ranked last) for all traits, and where n = number of traits under consideration. The variable with the highest index value is the highest economically important (Kosgey, I .S. 2004).

RESULT AND DISCUSSION

Mating system and Culling Practice

The proportion of local chicken producers who practiced controlled and uncontrolled natural mating systems was significantly different across the agro ecologies ($p<0.05$) (Table1). Overall, the survey indicated that 3.6% of the respondents practiced control mating while the remaining 96.4% of them practiced uncontrolled mating system because of free scavenging production system. culling poor productive (43.9%) was the first most frequent way of mating control of farmers' flock followed by retaining best cocks and layers for further breeding (36.9%), cull at early age (13.2%) and preventing mate (6%) in the study area (Table 1).

This result was in line with the findings of (Addisu et al. 2013) in North Wollo zone of Amhara Regional state which revealed that 89.2% of village chicken owners had uncontrolled natural mating system while 10.79% of them had practiced mate control of their flocks through either retaining best indigenous or exotic cocks with layers (52.79%), preventing mate (24.37%), cull at early age (19.19%) or culling poor productive (3.55%). However, this result contradicted with the findings of (Nigussie, D. 2011) which revealed that there was no systematic in any regions of Ethiopia. In another study conducted in Dale, Wonsho and Loka Abaya weredas of SNNPRS revealed that free-range feeding practice attributed to indiscriminate mating of cocks and hens (Mekonnen G. 2007).

The analyses of culling practices of village chicken owners showed that all respondents had culling practices of unwanted chickens from their flocks either by poor productivity (47.3%), poor productivity and sickness (22.9%) or poor productivity and old age and sickness (17.7%) were the major determinant factors for culling unwanted chickens from a given flock of village chicken producers in the study area (Table 2).This result corroborated the findi ngs of [16] who reported that sickness (36.1%), frequent broodiness (22.8%), sickness and old age (12.2%), lack

Table 1: Mating system and practices, breeding methods, inbreeding concept and selection criteria for chicken breeding

Variable	Agro- ecological zones					
	Highland n (%)	Midland n (%)	Lowland n (%)	Total n (%)	X2-test	p-value
Mating system					**11.996(*)**	**0.002**
Control mating	-	2(1.5)	12(7.5)	14(3.6)		
Uncontrolled mating	94(100)	129(98.5)	148(92.5)	371(96.4)		
Ways of mating control for improvement					**2.319(n)**	**0.314**
Culling poor productive	37(39.4)	56(42.7)	76(47.5)	169(43.9)		
Cull at early age	10(10.6)	20(15.3)	12(13.1)	51(13.2)		
Retaining of best ones	41(43.6)	46(35.1)	55(34.4)	142(36.9)		
Preventing mating	6(6.4)	9(6.9)	8(5)	23(6)		
Breeding practice					**1.406(n)**	**0.495**
yes	94(100)	131(100)	159(99.4)	384(99.7)		
no	-	-	1(0.6)	1(0.3)		
Breeding methods					**0.674(n)**	**0.714**
Importing exotic	-	1(0.8)	1(0.6)	2(0.5)		
Improving indigenous	94(100)	130(99.2)	159(99.4)	383(99.5)		
Ways of improving indigenous chickens					**3.118(n)**	**0.210**
Cross breeding	5(5.3)	9(6.9)	26(16.2)	40(10.4)		
Line breeding	89(94.7)	118(90.1)	125(78.1)	332(86.2)		
Both	-	4(3.1)	9(5.6)	13(3.4)		
Chicken selection practices for improvement					**0.00(ns)**	**1.00**
yes	94(100)	131(100)	160(100)	385(100)		
no	-	-	-	-		
Selection criteria						
Plumage color					**2.238(n)**	**0.327**
Yes	94(100)	128(97.7)	158(98.8)	380(98.7)		
No	-	3(2.3)	2(1.2)	2(1.3)		
Rank of plumage colors on basis of prefer.					1.544(s)	0.462
Red(1st), *Gebsima* (2nd), *Anbesima* (3rd), *Kokima* (4th), *Zagrama* (5th), *Netch Teterma* (6th), *key Teterma* (7th), *Seran* (8th), *black Teterma* (9th), *Netch* (10th) & black (11th)	93(98.9)	128(97.7)	157(98.1)	378(98.2)		
Red(1st), *Gebsima* (2nd) &*Anbesima* (3rd)	1(1.1)	-	1(0.6)	2(0.5)		
Body weight	94(100)	131(100)	160(100)	385(100)	0.00(ns)	1.00
Heavy	94(100)	131(100)	160(100)	385(100)	0.00(ns)	1.00
Egg yield (production)	94(100)	131(100)	160(100)	385(100)	0.00(ns)	1.00
Broody behavior	94(100)	131(100)	160(100)	385(100)	0.00(ns)	1.00
Slow brooding behavior	94(100)	131(100)	160(100)	385(100)	0.00(ns)	1.00
Mothering ability	94(100)	131(100)	160(100)	385(100)	0.00(ns)	1.00
Preference of mothering ability characteristics					9.391(*)	0.009
Good hatching history	50(53.2)	79(60.3)	112(70)	241(62.2)		
Good protector from predators / aggressive weaning	-	-	1(0.6)	1(0.3)		
Good hatching history & good protector from predators / aggressive weaning the bird	44(46.8)	34(26)	41(25.6)	119(30.9)		
Good feeder & hatching history	-	10(7.6)	3(1.9)	13(3.4)		
Good feeder ,hatching history &protector from predators	-	8(6.1)	2(1.2)	10(2.6)		
Good ability of setting ,feeder ,hatching history & protection from predators	-	-	1(0.6)	1(0.3)		
Comb type					3.598(ns)	0.16
Yes	92(97.9)	126(96.2)	159(99.4)	377(97.9)		
No	2(2.1)	5(3.8)	1(0.6)	8(2.1%)		
Preference of comb types					2.776(ns)	0.250
Single	-	1(0.8)	1(0.6)	2(0.5)		
Double	92(97.9)	125(95.4)	158 (98.8)	375(97.4)		
Sex (both male & female)	94(100)	131(100)	160(100)	385(100)	0.00(ns)	1.00
Inbreeding concept					5.669(ns)	0.059
Yes	-	-	4(2.5)	4(1)		
No	94(100)	131(100)	156(97.5)	381(99)		

* ($p<0.05$) and ns ($p>0.05$) and n=number of respondents interviewed per agro-ecology

of broodiness (8.3%), old age (7.2%) and lack of broodiness and frequent broodiness (5.6%) were the major factors for culling unwanted chickens from the flocks of farmers in Gomma wereda of Jimma zone.

The survey revealed that only 27% of the respondents culled chickens from their flock based on chicken age. Among these, 13% of the respondents culled chickens whose age was greater than three years while the remaining 13 % of them culled chickens when their age exceeded four years and 1% of them culled chicken when their age exceeded five years (Table 2). Only 42% of the respondents culled chickens when they became sick.

The survey on culling practice of respondent also revealed that utilization ways of culled chickens was significantly different among the three agro ecological zones ($p<0.05$) (Table 2).Chicken p roducers predominantly used culled chickens for home consumption (64.9%), home consumption and selling (24.7%) and selling (10.4%) (Table 2).This showed an agreement with the findings of (Addisu et al., 2013) who reported that slaughtering (53.27%), selling (41.18%) and consumption or selling eggs of unwanted hens (5.56%) were the major uses of culled chickens in North Wollo zone. Likewise, (Bogale, 2008) and (Fisseha, 2009) reported that farmers used culled chicken mainly for home consumption and selling in Fogera (46.5%) and Bure (62. 6%) districts, respectively.

Breeding practice

The analysis of breeding practices of chicken has showed insignificant variability across the agro ecologies ($P>0.05$) (Table1). Overall, 99.7% of the respondents practiced breeding for improving productivity of their flocks either by improving local chickens (99.5%) or by importing exotic breeds (0.5%). Moreover, village chicken owners had also a practice of improving the productivity of their indigenous flocks either by crossbreeding (10.4%), by line breeding (86.2%) or both cross & line breeding (3.4%) (Table 1).

This findings was in line with the result of a study conducted in North Wollo zone of Amhara regional state in which only 17.3% of village chicken producers practiced breeding for improving their chicken either by cross breeding (80%) or by line breeding (20%) (Addisu et al., 2013). However, contrasting results have been reported from Gomma wereda of Jimma zone which stated that village chicken production system was characterized by lack of systematic breeding practices (Meseret, M. 2010). Furthermore, the result of the study conducted by (Nigussie, 2011) in different part of Ethiopia revealed that village chicken breeding was completely uncontrolled and replacement stock produced through natural incubation using broody hens.

The survey also revealed that only 1% of the respondents had an inbreeding concept while the remaining 99% of them had not an inbreeding concept and they replied that the word inbreeding was a new term for them. Agro-ecological wise, all respondents in both highland and midland agro-ecologies had not totally an in breeding concept. However, only 2.5% of the respondents in lowland agro-ecology had an inbreeding concept.

The result of the survey revealed that all of the respondents had selection practices of chicken for breeding and production in the study area (Table 1). It was also found that the proportions of farmers who practiced selection of chickens were not significantly different across the agro-ecological zones. Generally, the result showed that plumage color (98.7%), body weight (100%), egg yield (100%), broody behavior (100%), mothering ability (100%), sex (100%) and comb type (98.4%) were used as selection criteria for selecting chickens for breeding and production purposes. Specifically, the result indicated that 98.2% the respondents ranked the plumage colors and ordered them in their preferences were red (1^{st}), Gebsima (Sigemo) (2^{nd}), Anbesima (3^{rd}) and others.

Furthermore, the respondents gave due attention to mothering ability characteristics of hens while broody hens were selected for incubation purposes. It was indicated that most of village chicken owners mainly selected breeding females based on previous hatching history (62.2%) followed by both good hatching history and protector from predators (30.9%) and good feeder and protector from predators (3.4%) (Table1).

In the same way, 97.4% of the respondents preferred to retain chickens with double comb types (rose and pea) while 0.5% of them favored to maintain chickens with single comb types for breeding and production purposes in the study area. This result was in line with the findings of (Bogale, 2008.) who reported that 94.4 % of village chicken producers practiced chicken selection based on different selection criteria like sex, plumage color, egg production and growth in Fogera district.

This result also corroborated the findings of (Al-Qamashoui et al., 2014). who reported that egg production (1^{st}), body size and growth rate (2^{nd}), Feather (plumage) color (3^{rd}), body conformation (4^{th}) and egg size (5^{th}) were the major traits used as selection criteria for selecting breeding chickens in a given flock in six major agro-ecological zones of Oman.

Breeding Objectives and Trait

Preferences

The pooled analysis of ranking indices of breeding objectives in indigenous chickens from both the survey and Focus group discussion has showed variability

Table 2: Culling practices, chicken culling criteria and utilization ways of culled chicken

Parameters	Agro- ecological zones					
	Highland n (%)	Midland n (%)	Lowland n (%)	Total n (%)	X2-test	p-value
Chicken culling practice for improvement					0.0(ns)	1.00
yes	94(100)	131(100)	160(100)	385(100)		
no	-	-	-	-		
Chicken culling criteria					**5.059(ns)**	**0.50**
Poor productivity	58(61.7)	47(35.9)	77(48.1)	182(47.3)		
Old age	-	-	6(3.8)	6(1.6)		
Sickness	-	3(2.3)	1(0.6)	4(1)		
Lack of broodiness	2(2.1)	6(4.6)	-	8(2.1)		
Poor productivity & old age	1(1.1)	12(9.2)	10(6.2)	23(6)		
Poor productivity & sickness	9(9.6)	43(32.8)	36(22.5)	88(22.9)		
Poor productivity & lack of broodiness	-	6(4.6)	-	6(1.6)		
Poor productivity, old age & sickness	24(25.5)	14(10.7)	30(18.8)	68(17.7)		
what age of the bird do you decide to cull it					**8.14(*)**	**0.017**
>3 year	18(19.1)	11(8.4)	21(13.1)	50(13)		
>4 year	7(7.4)	15(11.5)	28(17.5)	50(13)		
>5 year	-	-	4(2.5)	4(1)		
Birds not culled based on their age	69(73.4)	105(80.1)	107(66.9)	281(73)		
Utilization ways of culled chicken					28.589(*)	0.00
Consumption (slaughter)	55(58.5)	108(82.4)	87(54.4)	250(64.9)		
sell	10(10.6)	10(7.6)	20(12.5)	40(10.4)		
Consumption and sell	29(30.9)	13(9.9)	53(33.1)	95(24.7)		

* ($p<0.05$) and ns ($p>0.05$) and n=number of respondents interviewed per agro-ecology

across agro-ecological zones (Table 3). The keeping of chickens for sales seems the first priority that demonstrates the change from traditional (subsistence) to market oriented production system of chickens in the villages. This could be attributed to high market channel in the local community fueled by high cash crop production such as sesame and cotton, and cross border market opportunities to the Sudan in the west and to Eretria in the North. Moreover, this may be due to the increase in the population density of the area as many peoples and investors from different corners of Ethiopia as well as from Sudan are always flowing to this area to engage in different investment areas. Furthermore, some investors from Eritrea, Nigeria and Senegal are also living and engaging in different investment areas of the study area because the area is the investment zone of Tigray region.

The establishment of Welkait National Sugar Factory in Mezega area of Maygeba wereda may also be a factor for population density increment which consequently increases poultry products' demand in the area. The breeding objectives in the village chicken production are meant to address multiple objectives through designing and implementing community- based and environmentally friendly holistic and sustainable genetic improvement strategies.

The rank of breeding objectives across agro-ecologies was variable (Table 3). In highland agro-ecology, farmers mainly reared chickens primarily for sales for income (1^{st}), Ceremony (2^{nd}) and home consumption (3^{rd}) while chickens mainly reared for ceremony (1^{st}), home consumption and ceremony (2^{nd}) and sales for income (3^{rd}) in the midland agro-ecology (Table 3). On the other hand, chickens primarily reared for sales for income (1^{st}), ceremony and sales for income (2^{nd}) and home consumption and ceremony (3^{rd}) in the lowland agro-ecology (Table 3). Likewise, this result was equivalent with the findings of (Fisseha et al., 2010) revealed that sale for income (51%), hatching (breeding) (45%), and home consumption (44%), ceremony (36.4%) and egg production (40.7%) were the rearing purposes of chickens in Bure district. In the same way, (Addisu. et al., 2014)recently reported that home consumption (30.4%), replacement (23.18%) and market reasons (18.1%) were the first, second and third main rearing purposes of chickens in North Wollo Zone of Amhara regional state. In Northern Gondar, home consumption and income (82%), home consumption and replacement (46%) and sources of income (37%) were identified as main poultry production objectives of local chicken owners (Wondu et al. 2013). Similarly, (Solomon et al. 2013) reported cash income (98.6%), household consumption (95.2%), extra farm activity (82.8%), job opportunity (60%), use of chicken for cultural/religious ceremonies (39.3%) and to use them as gift (20%) were the main purposes of chicken production in Metekel Zone of Northwest Ethiopia. Moreover, (Petrus, N. P .2011) reported that home consumption (46.1%), custom (42.3%), income

Table 3: Ranking of breeding objectives in three agro-ecological zones of Western Tigray

Highland Agro-ecology												
Objectives	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**R11**	**Index**
Sales for income	48	14	20	12	0	0	0	0	0	0	0	0.1522
Ceremony	26	36	10	22	0	0	0	0	0	0	0	0.1470
Home consumption	12	20	22	30	10	0	0	0	0	0	0	0.1354
Hatching/breeding	8	15	18	16	28	9	0	0	0	0	0	0.1254
Home consumption and ceremony	0	9	14	8	20	30	8	5	0	0	0	0.1064
Home consumption and sales for income	0	0	4	2	10	22	40	12	4	0	0	0.0829
Ceremony and sale for income	0	0	3	1	6	12	20	42	10	0	0	0.0721
Breeding and home consumption	0	0	2	1	6	10	12	20	40	3	0	0.0635
Ceremony and breeding	0	0	1	1	5	8	10	10	20	36	3	0.0524
Breeding and sales for income	0	0	0	1	8	1	4	3	12	30	36	0.0377
Breeding ,home consumption ,sales for income and ceremony	0	0	0	0	1	2	0	2	6	25	59	0.0248
Midland agro-ecology												
Ceremony	46	40	38	7	0	0	0	0	0	0	0	0.1512
Home consumption and ceremony	40	34	37	20	0	0	0	0	0	0	0	0.1476
Sales for income	36	42	32	21	0	0	0	0	0	0	0	0.1475
Hatching/breeding/	9	6	10	35	40	20	11	0	0	0	0	0.1141
Ceremony and sales for income	0	3	4	20	30	32	20	12	10	0	0	0.0934
Breeding and home consumption	0	2	5	10	20	36	18	14	12	14	0	0.0801
Home consumption	0	2	2	10	12	32	16	8	26	14	9	0.0720
Ceremony and breeding	0	2	3	6	10	5	25	43	20	9	8	0.0670
Home consumption and sales for income	0	0	0	2	8	4	19	22	28	42	6	0.0525
Breeding and sales for income	0	0	0	0	6	1	12	18	20	30	44	0.0399
Breeding ,home consumption ,sales for income and ceremony	0	0	0	0	5	1	10	14	15	22	64	0.0348
Lowland agro-ecology												
Objectives	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	Index
Sales for income	80	47	20	13	0	0	0	0	0	0	0	0.1547
Ceremony and sales for income	50	30	27	23	18	12	0	0	0	0	0	0.1397
Home consumption and ceremony	20	45	27	26	14	10	9	9	0	0	0	0.1288
Home consumption and sales for income	10	32	29	20	16	12	15	20	6	0	0	0.1144
Hatching /breeding	0	6	18	21	50	10	16	22	8	9	0	0.0956
Ceremony	0	0	14	18	26	35	18	15	20	12	2	0.0850
Ceremony and breeding	0	0	10	18	30	29	20	16	21	10	6	0.0825
Breeding and home consumption	0	0	8	**7**	6	24	36	42	20	12	5	0.0711
Home consumption	0	0	5	6	0	16	34	36	54	6	3	0.0644
Breeding and sales for income	0	0	2	5	0	10	12	0	18	80	33	0.0402
Breeding ,home consumption ,sales for income and ceremony	0	0	0	3	0	2	0	0	13	31	111	0.0235
Western zone of Tigray												
Sales for income	164	103	72	46	0	0	0	0	0	0	0	0.1513
Ceremony	72	76	62	47	26	35	18	15	20	12	2	0.1223
Home consumption	12	22	29	46	22	48	50	44	80	20	12	0.0857
Hatching/breeding	17	27	46	72	118	39	27	22	8	9	0	0.1089
Home consumption and ceremony	60	88	78	54	34	40	17	14	0	0	0	0.1294
Home consumption and sales for income	10	32	33	24	34	38	74	54	38	42	6	0.0855
Ceremony and sale for income	50	33	34	44	54	56	40	54	20	0	0	0.1072
Breeding and home consumption	0	2	15	18	32	70	66	76	72	29	5	0.0729
Ceremony and breeding	0	2	14	25	45	42	55	69	61	55	17	0.0697
Breeding and sales for income	0	0	2	6	14	12	28	21	53	140	109	0.0396
Breeding ,home consumption ,sales for income and ceremony	0	0	0	3	6	5	10	16	34	78	234	0.0276

* R1, R2, R3---R11=Rank 1, 2, 3, 4----11 respectively. Index=sum of (11 for Rank1 +10 for Rank2 +…+1for Rank 11) given for each trait divided by the sum of (11for Rank1 +10 for Rank2 +…+1for Rank 11) for all traits under consideration.

(9.6%) and Sacrifices (1.9%) were the main chicken breeding purposes of keeping indigenous chickens in four regions (Oshana,Omusati,Ohangwena and Kavango) of Northern Namibia. (Nassim et al., 2011) also reported that meat production (96.2%, 100% and 90.9%), tradition (88.5%, 73.3% and 72.7%), food security (73.1%, 86.7% and 54.6%) and egg production (19.2%, 40% and 9.1%) were the main objectives of keeping the Ri chicken breed in the Ky-son,Luong-son and Gia-Lam districts of North Vietnam respectively. In a study conducted in Uganda, home consumption (36%), cash (33%), ceremonies (16%) and gifts (13%) were found to be the main purpose of keeping indigenous chickens and indigenous eggs were mainly used for hatching chicks (45%), eaten at home (33%), sale for cash (20%) and 2% are used other purposes (Ssewannyana et al., 2008).

The diversity in breeding objectives in different agro-ecologies shows the need to plan a breeding strategy that suits the market demand and farmers preferences. However, setting a breeding program to address multiple objectives may complicate the method of evaluation and infrastructure which in turn necessitated the need to focus on two or three priority breeding objectives.

The analysis of ranking indices of the trait preferences of chicken producers from both respondents and focus group discussion indicated no variability across agro-ecological zones even if production environments are heterogeneous (Table 4). This confirmed that farmers across agro-ecologies have nearly used homogeneous attributes in selecting best breeding chickens from their flock for achieving their production objectives. Generally, plumage color (1^{st}), egg yield /clutch (2^{nd}) and comb type (3^{rd}) were the most preferred traits used for selection of breeding chickens in all agro-ecological zones of the study area (Table 4). Plumage color was the first most preferred traits in choosing breeding chickens in all agro-ecological zones. Red, gebsima and anbesima colored chickens in that order are most preferred to chickens with other plumage colors while black and white colored chickens are the least favoured for breeding and consumption (Table 4).

Chickens with the order of red, gebsima and anbesima plumage colors have high market demand while black and white colored chickens are undesired on market across all agro-ecologies. All respondents in all agro-ecologies of the study area also perceive that the plumage color of chicks is inherited from the plumage color of breeding cock and hence farmers gave highest emphasis for plumage color of cocks during selection for breeding purpose. Due to this reason, farmers gave greatest emphasis for egg yield /clutch performances of breeding females (hens) during selection for breeding. Comb type was the third most preferred attribute for selection of breeding chickens in all agro-ecologies (Table 4).

Chickens with double comb (pea and rose) types are highly preferred to single combed chickens for breeding (Table 4) and the former has higher market demand while the latter has less preferred in the market. This result was somewhat parallel with the findings of (Addisu et al., 2013) in which number of egg production/clutch (37.91%) and plumage color (37.58%) were the major preferred traits in North Wollo zone, and plumage color (44.34%) was the primarily selected traits in the lowland while egg (46%) was selected as primarily trait in the highland. However, Comb type and plumage color were found to most preferred traits in Fogera district (Bogale, 2008.) and in Bure district of North West Ethiopia (Fisseha et al., 2010). (Nigussie, 2011) also reported that farmers mainly selected adaptive traits, meat and egg test as their preferred traits in different parts of Ethiopia. Moreover, growth rate, disease tolerance, egg yield, body size and fertility were the most important preferred traits of chicken producers in Jordan (Abdelqader et al. 2007). In Kenya, egg yield (1^{st}), mothering ability (2^{nd}) and body size (3^{rd}) were the most preferred traits by majority Kenyan chicken farmers (Okeno et al., 2010).

Identification of trait preferences of chicken producers under scavenging production system is one step ahead in developing successful and sustainable chicken breeding strategies (Shishay, 2015). Thus, designing and developing of sustainable breeding programs for genetic improvement of indigenous chickens should incorporate trait preferences of chicken owners and address the current and future market circumstances in order to enhance sustainable improved chicken productivity.

The pooled analysis of both ranking indices of the individual interview (Table 5) and Focus group discussion revealed that there were no differences in the desire traits to be improved through breeding. Overall, Egg laid/clutch (1^{st}), body weight (2^{nd}) and adaptations (3^{rd}) were the major preferred traits to be improved through breeding in the study area (Table 5). This result was comparable with the reports of (Addisu et al., 2013.) in which egg production /hen, meat yield and disease resistance were the farmers' preferred traits to be improved through breeding in North Wollo Zone. Moreover, (Abdelqader et al., 2007) also reported that hatchability, survivability, flock size, number of clutches, egg weight and egg mass of local chickens were the major traits improved significantly with improvement in management levels in the rural areas of northern district of Jordan.

CONCLUSIONAND RECOMMENDATION

Mating of chickens is usually natural even if both uncontrolled and controlled mating were practiced. Uncontrollable mating was the most predominantly practiced mating system which is mainly due to free scavenging production system. Almost all households

Table 4: Ranking of trait preference of chickens in three agro-ecological zones of Western Tigray

Traits	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	Index
Lowland agro-ecology												
Plumage color	137	0	10	0	0	13	0	0	0	0	0	0.1586
Comb type	0	95	0	37	23	0	1	0	0	4	0	0.1345
Egg laid/clutch	10	55	95	0	0	0	0	0	0	0	0	0.1435
Body weight /growth	13	10	42	95	0	0	0	0	0	0	0	0.1308
Reproduction/hatching	0	0	13	15	132	0	0	0	0	0	0	0.1099
mothering ability	0	0	0	0	5	132	13	0	0	10	0	0.0864
Adaptation	0	0	0	13	1	14	132	0	0	0	0	0.0810
Length of legs	0	0	0	0	0	0	4	155	1	0	0	0.0609
Shank color	0	0	0	0	0	0	10	5	145	0	0	0.0478
Smoothness of legs /shank/	0	0	0	0	0	0	0	0	14	146	0	0.0316
Head shape	0	0	0	0	0	0	0	0	0	0	160	0.0152
Midland agro-ecology												
Plumage color	106	0	22	0	0	3	0	0	0	0	0	0.1510
Comb type	0	96	0	2	25	0	8	0	0	0	0	0.1392
Egg laid/clutch	22	13	96	0	0	0	0	0	0	0	0	0.1445
Body weight /growth	3	22	10	96	0	0	0	0	0	0	0	0.1299
Reproduction/hatching	0	0	3	30	98	0	0	0	0	0	0	0.1114
mothering ability	0	0	0	0	0	128	0	0	3	0	0	0.0908
Adaptation	0	0	0	3	8	0	98	0	0	22	0	0.0718
Length of legs	0	0	0	0	0	0	3	128	0	0	0	0.0616
Shank color	0	0	0	0	0	0	22	3	106	0	0	0.0514
Smoothness of legs /shank/	0	0	0	0	0	0	0	0	22	109	0	0.0332
Head shape	0	0	0	0	0	0	0	0	0	0	131	0.0153
Highland agro-ecology												
Plumage color	84	0	5	0	0	5	0	0	0	0	0	0.1609
Comb type	0	68	0	12	10	0	4	0	0	0	0	0.1395
Egg laid/clutch	5	21	68	0	0	0	0	0	0	0	0	0.1412
Body weight /growth	5	5	16	68	0	0	0	0	0	0	0	0.1277
Reproduction/hatching	0	0	5	9	80	0	0	0	0	0	0	0.1082
mothering ability	0	0	0	0	0	84	5	0	5	0	0	0.0876
Adaptation	0	0	0	5	4	5	80	0	0	0	0	0.0818
Length of legs	0	0	0	0	0	0	0	94	0	0	0	0.0606
Shank color	0	0	0	0	0	0	5	0	89	0	0	0.0470
Smoothness of legs /shank/	0	0	0	0	0	0	0	0	0	84	10	0.0287
Head shape	0	0	0	0	0	0	0	0	0	10	84	0.0167
Western zone of Tigray												
Plumage color	327	0	37	0	0	21	0	0	0	0	0	0.1470
Comb type	0	259	0	51	58	0	13	0	0	4	0	0.1260
Egg laid/clutch	37	89	259	0	0	3	0	0	0	0	0	0.1321
Body weight /growth	21	37	68	259	0	0	0	0	0	0	0	0.1190
Reproduction/hatching	0	0	21	54	310	0	0	0	0	0	0	0.1011
mothering ability	0	0	0	0	5	344	18	0	8	10	0	0.0809
Adaptation	0	0	0	21	13	19	310	0	0	22	0	0.0713
Length of legs	0	0	0	0	0	0	7	377	1	0	0	0.0560
Shank color	0	0	0	0	0	0	37	8	340	0	0	0.0448
Smoothness of legs /shank/	0	0	0	0	0	0	0	0	36	339	10	0.0288
Head shape	0	0	0	0	0	0	0	0	0	10	375	0.0143

* R1, R2, R3---R11=Rank 1, 2, 3, 4----11 respectively. Index=sum of (11 for Rank1 +10 for Rank2 +…+1for Rank 11) given for each trait divided by the sum of (11for Rank1 +10 for Rank2 +…+1for Rank 11) for all traits under consideration.

Table 5: Ranking of trait of local chickens to be improved through breeding in three agro-ecological zones of Western Tigray

Lowland agro-ecology											
Traits	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**	**R7**	**R8**	**R9**	**R10**	**Index**
Egg laid /clutch	160	0	0	0	0	0	0	0	0	0	0.1818
Body weight /growth	0	132	28	0	0	0	0	0	0	0	0.1605
Adaptation	0	0	132	28	0	0	0	0	0	0	0.1423
Reproduction/hatching	0	28	0	132	0	0	0	0	0	0	0.1336
Plumage color	0	0	0	0	132	28	0	0	0	0	0.1059
mothering ability	0	0	0	0	28	132	0	0	0	0	0.0941
Comb type	0	0	0	0	0	0	132	0	0	28	0.0632
Smoothness of legs /shank/	0	0	0	0	0	0	28	132	0	0	0.0577
Length of legs	0	0	0	0	0	0	0	28	132	0	0.0395
Shank color	0	0	0	0	0	0	0	0	28	132	0.0214
Midland agro-ecology											
Egg laid /clutch	131	0	0	0	0	0	0	0	0	0	0.1818
Body weight /growth	0	107	24	0	0	0	0	0	0	0	0.1603
Adaptation	0	0	107	24	0	0	0	0	0	0	0.1421
Reproduction/hatching	0	24	0	107	0	0	0	0	0	0	0.1339
Plumage color	0	0	0	0	107	24	0	0	0	0	0.1058
mothering ability	0	0	0	0	24	107	0	0	0	0	0.0942
Comb type	0	0	0	0	0	0	107	0	0	24	0.0627
Smoothness of legs /shank/	0	0	0	0	0	0	24	107	0	0	0.0579
Length of legs	0	0	0	0	0	0	0	24	107	0	0.0397
Shank color	0	0	0	0	0	0	0	0	24	107	0.0215
Highland agro-ecology											
Egg laid /clutch	94	0	0	0	0	0	0	0	0	0	0.8118
Body weight /growth	0	75	19	0	0	0	0	0	0	0	0.1600
Adaptation	0	0	75	19	0	0	0	0	0	0	0.1418
Reproduction/hatching	0	19	0	75	0	0	0	0	0	0	0.1346
Plumage color	0	0	0	0	75	19	0	0	0	0	0.1054
mothering ability	0	0	0	0	19	75	0	0	0	0	0.0946
Comb type	0	0	0	0	0	0	75	0	0	19	0.0617
Smoothness of legs /shank/	0	0	0	0	0	0	19	75	0	0	0.0582
Length of legs	0	0	0	0	0	0	0	19	75	0	0.0400
Shank color	0	0	0	0	0	0	0	0	19	75	0.0219
Western zone of Tigray											
Egg laid /clutch	385	0	0	0	0	0	0	0	0	0	0.1818
Body weight /growth	0	314	71	0	0	0	0	0	0	0	0.1603
Adaptation	0	0	314	71	0	0	0	0	0	0	0.1421
Reproduction/hatching	0	71	0	314	0	0	0	0	0	0	0.1340
Plumage color	0	0	0	0	314	71	0	0	0	0	0.1057
mothering ability	0	0	0	0	71	314	0	0	0	0	0.0943
Comb type	0	0	0	0	0	0	314	0	0	71	0.0.0627
Smoothness of legs /shank/	0	0	0	0	0	0	71	314	0	0	0.0579
Length of legs	0	0	0	0	0	0	0	71	314	0	0.0397
Shank color	0	0	0	0	0	0	0	0	71	314	0.0215

* R1, R2, R3---R10=Rank 1, 2, 3, 4----10 respectively.
Index=sum of (10 for Rank1 +9 for Rank2 +…+1for Rank 10) given for each trait divided by the sum of (10 for Rank1 +9 for Rank2 +…+1for Rank 10) for all traits under consideration.

had breeding practices of improving productivity of their flocks either by improving indigenous chickens or importing exotics. Moreover, village chicken owners had also a practice of improving the productivity of their indigenous flocks either by crossbreeding (10.4%) or line breeding (86.2%). In the study area, all respondents practiced chicken selection for breeding and production based on plumage color (98.7%), body weight (100%), egg yield (100%), mothering ability (100%), comb type (97.9%) and sex (100%).

Sales for income (1st) and ceremony (2nd) were the first two prioritized breeding objectives of village chicken production in the study area inspite of slight breeding objectives differences existed among the agroecological zones. Plumage color (1st), egg laid/clutch (2nd) and comb type (3rd) were the major attributes used by chicken owners for selecting superior breeding individual chicken for achieving their

breeding objectives. Moreover, egg laid/clutch (1st), body weight (2nd) and adaptions (3rd) were the most preferred traits to be improved through breeding interventions.

Understanding of breeding practices and objectives and trait preferences of farmers under free scavenging productions are indispensable for development of holistic and sustainable genetic improvement and conservation programs. Agro-ecologically friendly and community based sustainable genetic improvement breeding programs should be designed and implemented with incorporation of breeding objectives, trait of preference and adaptive genetic merits of local chickens for conservation and sustainable utilization of the diverse indigenous chicken genetic resources.

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