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Variations in village chicken management packages in two agro-ecological zones of Tanzania

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This study was conducted in two regions namely, Mbeya in southern highlands (Cool) and Singida in central (semi-arid) Tanzania. Currently, the African Chicken Genetic Gain (ACGG) project is testing tropically high producing adapted breeds in these areas. The objective of this study was to assess status of chicken management practices following the introduction of improved strains. In addition, five attitudinal statements describing different management elements were used to measure farmer's perception on the effect of the use of improved management intervention on production performance of their chicken. A total of 156 households representing 44% (352) of the intervened households were interviewed using semi-structured questionnaire at 48 weeks following introduction of the improved breeds. Data for management practices (housing, feeding and healthcare practices) were assessed using scoring method. For every management aspect, management index was calculated as the proportion of the total score obtained by individual farmer to that of the possible maximum score. The overall result of the present study indicates that most farmers fall under medium status (0.41-0.6) of chicken production practices. Farmers from southern highland zone had better management indices with respect to housing and feeding than those from the central zone. Despite the medium level of management, majority of the respondents in both ecological zones (74.4%) had positive attitude towards influence of management practices on chicken performance. For the improved strains to perform optimally under rural environment, a holistic approach focusing on management elements should be emphasized.

Key words: Management practices, improved breed, rural chicken production.

INTRODUCTION

In recent years, rural poultry genetic improvement programs in tropical countries has often been directed towards adoption of improved chicken breeds that are better in terms of productivity, adaptability and disease resistance (Wondmeneh et al., 2014; Reta et al., 2012; Habte et al., 2013). Basically, such improved breed were developed following low productivity of local chicken and considerable reduced livability of exotic and or cross breeds under extensive management system. Rural poultry genetic improvement program with almost similar

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is underway in Tanzania. The African Chicken Genetic Gain (ACGG) project is currently testing selected improved breeds for their production and livability potential under rural smallholder conditions in various ecological zones of Tanzania. The main objective of this project among many others, is to improve the livelihood of poor rural farmers, women in particular through introduction of more productive and agro-ecologically adaptable chicken strains. However, experience from previous studies has shown that single intervention to end users had low impact (Wondmeneh et al., 2014; Reta et al., 2012), thus, suggesting that multiple interventions through combined inputs and breed have great likelihood of attaining better impact and sustainability of the interventions. Nevertheless, even where interventions were made, some farmers who are expected to be the end users do not effectively utilize them while expecting better performance (Lyimo, 2013). As a result, majority of farmers often hardly realize full production potential of their flock and thus may lead to negative perception towards the potential of the improved strains. Furthermore, existing studies that investigate the adoption of new agricultural technology in developing countries have failed to consider how farmers' subjective perceptions and subsequent preference of technology affect their adoption decisions (Adesina and Baidu-Forson, 1995).

This study was therefore undertaken to characterize poultry management practices of the beneficiary households, to assess farmers perception towards improved management practices and identify constrains faced by farmers in the intervened areas of southern highlands and central zones of Tanzanian. The results are expected to help the project and other developmental agencies to identify critical entry points that need immediate attention and to select the most appropriate innovation for village chicken production improvement.

MATERIALS AND METHODS

Description of the study area, experimental layout and design

This study was conducted among the intervened villages of southern highlands (Mbeya region) and central zones (Singida region) of Tanzania. Singida region receives rainfall of between 500 and 800 mm per annum. Rainy season commences in November to April whereas, the dry season covers months of May to October. The temperature range is between 15 and 30°C. Mbeya region on the other hand, is located in the south western corner of the Southern Highlands of Tanzania. The region stretches from low altitude of 475 to 2981 masl in the highlands. Average temperature ranges from 16 to 25°C. The region enjoys abundant and reliable rainfall varying from 650 to 2600 mm. The rains normally commence in October to May.

Sampling and sample size

The study involved two intervened districts in each ecological zone. Two out of the four villages from each district were selected for detailed household management study. Quantitatively, a total of 156 out of 176 targeted beneficiary households in the eight selected villages (22 households per village) were successfully interviewed. The household selected represented 44% of the total intervened household (352) in the study zones which had previously received pre-vaccinated, 42 days old chicks of either the two improved breeds namely; Sasso and Kuroiler. The chicks were vaccinated against Mareks and Newcastle at the hatchery, followed by Infectious Bronchitis (IB) at 0, 7 10, 16 and 21 days. Newcastle vaccine was repeated at 10 and 21 days using Lasota vaccine. At 6 weeks, the chicks were again vaccinated for fowl pox before being distributed to farmers. Selected households were those with experience of at least 2 years in keeping chicken and had less than 50 local chickens before the new strains were introduced as per ACGG protocol.

Data collection

Data on poultry management practices from beneficiary households were assessed when the allocated strains had reached 48 weeks of age. Basically, the management aspects assessed were those hypothesized to have direct positive effect on chicken productivity, that is, improved housing, general bio-security status, supplementation level, disease control measures and perception of farmers towards the impact of management practices on overall chicken productivity. Farmers were interviewed using pretested questionnaire and on-site observation to assess the extent of use of the recommended poultry management practices. Farmer's levels of awareness on the effect of management practice on chicken performance were also assessed. Furthermore, constrains that farmer's faces during the study period were also inquired. From the list of the challenges captured, only the first five challenges that had highest frequency were considered.

Determination of management practices level of the respondents

Diseases and health care control measures

The following healthcare elements were used to assess participating households: (i) vaccination against Newcastle diseases; (ii) vaccination against fowl pox; (iii) provision of prophylactic measures; (iv) poultry house disinfection; (v) separation of sick birds from healthy ones and (vi) treating of sick birds. For every healthcare element studied, a score of 1 or 0 was assigned to users or non-users, respectively. Thus, with respect to all healthcare elements studied, the minimum and maximum theoretical score individual farmer could score was 0 and 6 marks, respectively.

Supplementation level

The following elements of feeding were studied: (i) amount supplemented per bird per day; (ii) quality of supplements and (iii) frequency of supplementation. With regards to amount of feed supplemented per bird per day, individual farmer were further ranked into five levels (i) nil; (ii) poor (20 g and below); (iii) inadequate (between 20 to 30 g); (iv) adequate (anything above 40 g) and (v) *ad libitum* feeding.

Regarding the quality of supplementing material, individual farmers were further ranked into five levels considering that the complete diet has to contain ingredients having carbohydrates, fat, protein, minerals or vitamins as follows: The levels were (i) nil/kitchen left overs; (ii) supplemented grains and or their by-products only; (iii) supplemented grains plus oils seeds cakes or

legumes; (iv) supplemented number (i) and (ii) above plus commercial feed ingredients; (v) commercial diet. Lastly, individual farmers were further ranked into five levels with regards to regularity of feeding, that is, (i) occasional feeding; (ii) at least once in a week; (iii) 2 to 3 times in a week; (iv) once per day and (v) 2 to 3 times a day. For all feeding elements studied, Likert scales of 0 to 5 points were allocated to the respective levels according to Parveen (2008) and Elkashef et al. (2016). Finally, the overall score per respondent with regards to supplementation practice was obtained by summing up the score obtained from all the three feeding practices. Thus, with reference to the sub-elements of feeding, the lowest and highest possible score individual farmer could score was 0 and 15 points, respectively.

Poultry housing condition

The following elements of improved poultry housing were used to assess housing structure of participating households: (i) ventilation status and orientation; (ii) spacing requirement of chicken; (iii) floor status; (vi) roof status (spillage); (v) presence of feeder and drinkers; (vi) presence and quality of litter/bedding material; (vii) general hygiene status. The housing structure in this context was not necessarily built using expensive materials to be ranked high but rather to meets the basic requirements regardless of construction materials used. From the developed scale, poultry housing elements were ranked with four levels, that is, (i) poor; (ii) moderate; (iii) good and (iv) very good. A Likert scale of 0 to 4 points was assigned to the respective levels as per Parveen (2008) and Elkashef et al. (2016). Similarly, the overall score per respondent with regards to housing practice was obtained by summing points obtained from each poultry housing element. Thus, with respect to the seven studied housing elements, the minimum and maximum possible score individual farmer could score was 0 and 28 points, respectively.

Determination of famer's perception towards poultry management intervention

Likert scale was used to measure farmer's perception on the effect of the use of improved management intervention on production performance of their chicken. A total of five attitudinal statements describing different management elements were used. After data transformation, a Likert scale was categorized into negative, neutral and positive into which a score of 1, 2 and 3 points were allocated into respective categories. The total score for individual respondent was obtained by summing up the score obtained from all five attitudinal statements. Thus, the highest, middle and lowest possible points were 15, 10 and 3 points, respectively. In this regard, farmers who scored 1 to 9 points were considered to have negative attitude while those who scored 11 to 15 stood for positive attitude. Farmers that scored 10 were considered to have neutral attitude.

Data analysis

All descriptive data collected were coded and analysed for each variable investigated using SPSS version 20.0 (SPSS, 2016).With regards to management data, the total score for individual farmer were used to calculate management index (MI) with respect to the three intervention categories. In all cases, management index was calculated as the proportion of the total score obtained by individual farmer to that of the total scores, that is:

$$\text{Management index (MI)} = \frac{\text{Respondent total score}}{\text{Sum of the total score for a given technology}}$$

Based on computed management index values, participating households were categorized into four management levels: (i) low level (MI 0 to 0.40); (ii) medium level (MI 0.41 to 0.6); (ii) high level (MI 0.61 to 0.80); (iii) very high level (MI 0.81 and above). Cross tabulation analysis was thereafter used to compare management levels to particular technology elements between the two ecological zones. Descriptive statistics such as frequency distribution, percentages and mean were used for categorization of description of the variables. T-test and Chi-square were used to identify whether the differences between zones means were statistically different. Furthermore, multiple linear regression analysis was used to measure association between management indices of the respondents as dependent variable against respondent's socio-demographic and related factors as independent variables.

RESULTS

Respondent's characteristics

Table 1 shows that female constituted majority of the respondents (82.3%). The mean age of the respondents in both zones was 37 years with the mean chicken farming experience of 17 years. Only 20.5% of the respondents had secondary educational level and beyond. The remaining proportions (78.5%) had primary education or were semi illiterate. Southern highland zone had more households rearing their chicken under partial confinement (84.6%) while the predominant system (76.9%) for the central zone was free range.

Management level categories of the respondents

Management level categories of the respondents for the three management aspects are presented in Table 2. Southern highland zone had about 50% of the households who had fairly good housing for their chicken with better feeding (56.4%). Overall, 41% of the households had better management followed by 35.5% who scored medium.

In the central zone, most of the visited households kept their chicken in poor housing structure (48%) and only 16% scored higher. Similarly, feeding was poor for almost two third of the households. Overall, 56.4% of the household fell under medium level of management. With regards to healthcare, there was almost equal distribution of respondents in the three categories.

Management index score between zones

Management index score for the two zones are presented in Figure 1. There was significant difference in management level indices with respect to housing ($P>0.05$) and feeding practices ($P>0.05$) for the two zones in favour of southern highland zone. Healthcare practices were almost similar in the two zones. Overall, management index further revealed significant difference between the two zones.

Table 1. Socio-demographic information of the respondent (N=156), for the two agro-ecological zones.

Variables		Agro-ecological zones		Overall means
		Southern Highland zone	Central zone	
Gender	female	60(76.9)	70(89.1)	130(82.3)
	Male	18(23.1)	8(11.4)	26(17.7)
Education level	Secondary education and above	18(23.1)	14(17.9)	32(20.5)
	Primary education and below	60(76.9)	64(82.1)	124(78.5)
Management system	Partial confinement	60(76.9)	12(15.4)	72(46.2)
	Free range	12(15.4)	66(84.6)	78(50.0)
Age of farmer (years)		35.96	37.98	36.9
Chicken farming experience (years)		15.36	18.64	17.0

Numbers outside and inside parenthesis represents respondent number and percentage respectively.

Table 2. Proportion of household within agro ecology by management level categories.

Recommended practice	Agro-ecological zone							
	Southern highland zone				Central zone			
	Poor	Medium	High	Very high	Poor	Medium	High	Very high
Housing structure	18(23.1)	22(28.2)	38(48.7)	0(0.0)	38(48.7)	32(41.0)	8(10.3)	0(0.0)
Feed and feeding	26(33.3)	44(56.4)	8(10.3)	0(0.0)	52(66.6)	26(33.3)	0(0.00)	0(0.0)
Healthcare	12(15.3)	30(38.5)	32(41.0)	4(5.1)	30(38.5)	16(20.5)	28(35.9)	2(2.6)
Overall	18(23.1)	28(35.5)	32(41.0)	0(0.0)	30(38.5)	44(56.4)	4(5.10)	0(0.0)

Poor = 0.0 to 0.41, Medium = 0.41 to 0.6, high = 0.61 to 0.8, = very high = 0.81 to 1. numbers outside and inside parenthesis represents respondent number and percentage, respectively.

Relationships between management indices and some characteristics of the respondents

Out of the five elements used to characterize the respondents, only two: awareness level and management system adopted (P>0.05) positively affected the overall chicken management indices of participating households (Table 3). The result further shows that sex of the farmer, educational level and poultry keeping experience had no influence on level of management.

Farmer's perception of the interventions

The results for farmer's perception on the importance of poultry management practices on overall productivity are presented in Table 4. There was no significant difference in farmer's perception between agro-ecological zones. Majority of the respondents in both zones (74.4%) had positive attitude towards effects of management interventions on overall flock , while 10.3 and 15.4% had neutral and negative perception, respectively.

Constraints encountered by farmers during the study period

The predominant constrains as perceived by farmers are presented in Table 5. Low price of eggs, high feed cost, diseases, predation and retained eggs in that order, were the first five frequently mentioned constraints.

DISCUSSION

High percentage of women in the current study (82.3%) validated the findings that poultry keeping activity in rural areas is fully in the domain of women (Muchadeyi et al., 2007; Ali, 2012). This observation was expected since more women were recruited in the project using chicken keeping as potential opportunity for their empowerment. Nevertheless, gender of person, educational level and age did not significantly influence overall management level. The difference in management systems observed in the two zones may thus be explained by other socio-economic factors including the relative size of land available for livestock and crop production. The intervened villages in Southern highland are located in peri-urban areas where land is limited but with better access to inputs and markets, while, the villages in Central zone were spatially populated with ample scavenging area but with limitations in market access. The observation conforms to ILRI (1995) report that intensity of production in smallholder agricultural is likely to be higher in areas with small area of land since under

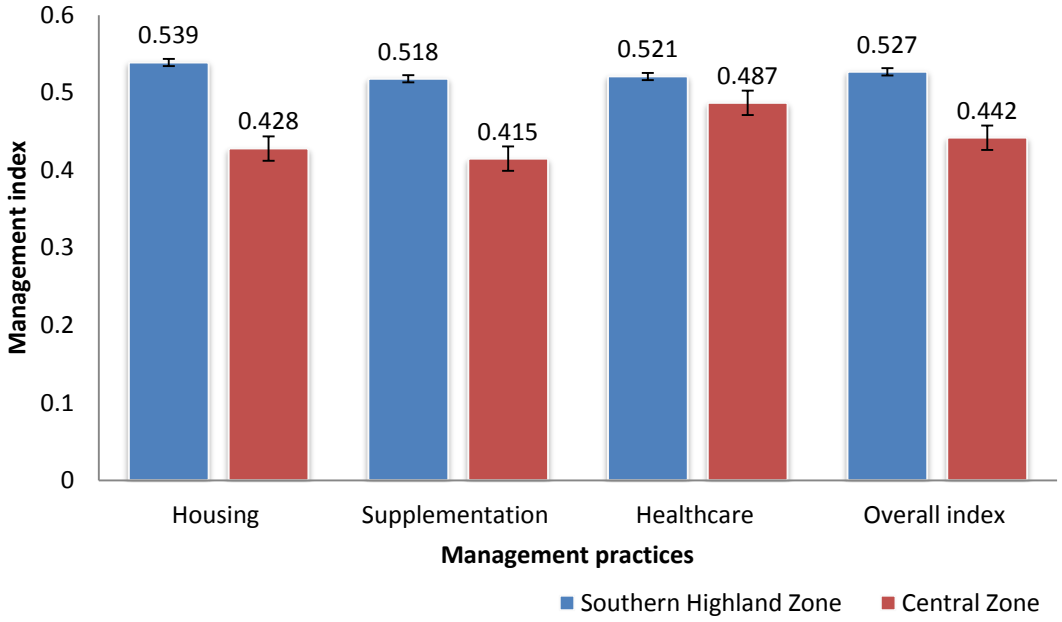

Figure 1. Management index score for the three management aspects by zone.

Table 3. Influence of socio-demographic and related factor on overall management index.

Variables	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	Std. Error	Beta		
(Constants)	0.136	0.72		1.898	0.060
Sex of the farmer	0.005	0.026	0.014	0.204	0.838
Age of the farmer	-0.002	0.002	-0.115	-0.973	0.332
Level of education of the farmer	0.039	0.023	0.115	1.188	0.093
Management system of the farmer	0.092	0.020	0.341	4.698	0.000
Farming experience of rearing chicken	0.005	0.002	0.265	2.213	0.078
Awareness of the farmer	0.336	0.071	0.337	4.730	0.000

Multiple R = 0.565[a], R^2 = 0.319; Adjusted R^2 = 0.262; Std. Error of the estimate = 0.11706; F-statistics = 5.552, F significance = 0.000[b]; Dependent variable: Overall management index.

Table 4. Overall perception index categories of respondents in the two agro-ecological zones.

Categories	Agro-ecological zone		Total	χ2	df	P-value
	Southern highland zone	Central zone				
Negative	8(10.1)	16(20.5)	24(15.4)			
Neutral	6(7.70)	10(12.8)	16(10.3)	4.908[a]	2	0.086
Positive	64(82.0)	52(66.6)	116(74.4)			

Numbers outside and inside parenthesis represents respondent number and percentage respectively.

search circumstance, farmers will strive to maximize production. Cooler and abundant rain in Southern highland zone may imply intense agriculture activities as compared to semi-arid central zone which in a way could have instilled positive influence on entrepreneurship tendencies. The results conform to what was reported by Tsadik et al. (2015) in Ethiopia where higher adoption rate (48.3%) of poultry technologies was found in the

Table 5. List of challenges encountered by farmers in their order of importance.

Constrains	Responses		
	N	Percentage	Percentage cases
Low eggs prices	118	34.1	76.6
Feeding cost	100	28.9	64.9
Diseases	72	20.8	46.8
Predators	42	12.1	27.3
Retained eggs	14	4.0	9.1

highlands as compared to 33.3% in the lowland agro-ecologies. Despite the observation that educational level did not influence level of management significantly, UNESCO (2012) contended that education is a key socio-economic factor that can enhance the ability of farmers to adopt new agricultural innovations. Likewise, the observed mean age of household heads of approximate 37 years falls within the economic active age group which is comparable to the mean age of 36 years reported for rural poultry farmers in coastal region of Tanzania (Lyimo, 2013).

Availability of feeds and feeding practices are critical in ensuring that farmers optimise the genetic capacity of the flock. Moreover, the difference in management practices with respect to supplementation seems to be rather influenced by the agro-ecologies whereby availability of feeds throughout the year can dictate whether the farmer adopt semi-intensive or scavenging mode of production. For example, Alem (2014) and Habte et al. (2013) reported slightly better performance of both local and exotic breeds in mid-highland than in the lowland ecologies of Ethiopia due to availability of feeds and favourable environment. Likewise, proximity of households as was the case in Southern highland also meant that there was limitation in terms of scavenging feed resource, thus further explain why semi-intensive system was common in this zone. Despite the difference in feeding management, almost all farmers (96.2%) from both ecological zones provided one form or another of supplementary feeds. These results are in agreement with the findings of Lyimo (2013) in Tanzania, Tadesse et al. (2013) in Ethiopia and Elkashef et al. (2016) in India which showed that over 95% of chicken owners in respective study areas supplemented their birds.

Regarding quality of supplementing material, grains and their by-products (maize, sorghum, and rice) and sunflower seed cake appears to be the most important feed resource commonly used by farmers in the two zones. Nonetheless, availability of these feed resources was influenced by season and competition between human and livestock. Farmers reported increased use of supplement during harvesting period and much less during wet season. Previous study by Goromela et al. (2007) in central region of Tanzania observed similar pattern with seasonal availability of feed. Again, the need for cash under smallholder condition during the dry season compel the farmers to sell stock of crops that could have been used to smoothen supplementation of birds during lean periods. These findings suggest the necessity of developing a practical feed supplementation strategy and feed conservation techniques for rural farmers based on estimated scavenging feed resource in the study area.

Furthermore, commercial feed was not an important feed resource in both regions due to prohibitive costs and accessibility. Few farmers especially from southern highland zone used home-made formulations and in some cases, vitamins and bone meals were added. The findings are in agreement with the observation made by Lyimo (2013) and Goromela et al. (2007), in Tanzania, Tadesse et al. (2013) in Ethiopia and Ali (2012) in Sudan noted that commercial feeds and the use of premixes is rare in rural areas. Thus, depending on the season, birds are liable to under nutrition and may explain the often poor performance reported for both local and improved strains (Reta et al., 2012; Wondmeneh et al., 2016).

It was observed that most of the farmers provided some forms of housing for their chickens. However, there was a huge variation in the quality of housing structure across the zones; those from southern zones at least met the minimum standards as compared to those of central zone. Thus, the quality of houses and overall management could be influenced by the level of agriculture productivity which implies better income. Under such circumstance, farmer may perceive the development projects differently hence their willingness to invest. This observation conforms to what was reported by Dorji and Gyeltshen (2012), Tadesse (2013) and Elkashef et al. (2016). As such, most primitive poultry houses and inadequate feeders and drinkers were found in households practicing free range system, suggesting the influence of socio-economic background on level of technology adoption.

On biosecurity, it was anticipated that the levels of biosecurity under rural environment cannot match with prescribed standards for commercial poultry production. Given the training and support extended by the project, majority of farmers adopted ectoparasite control practices as well as vaccination for major diseases such as New castle, Fowl pox and infectious bronchitis. Vaccination

was done to both introduced and the local strains, following project interventions as part of the management packages. Lyimo (2013) in Tanzania and Khandait et al. (2011) in India found that de-worming was uncommon practice in rural setting of developing countries probably due to insufficient knowledge. Nevertheless, all farmers vaccinated their chicken against new castle disease and fowl pox. Newcastle disease (ND) has been ranked the greatest killer disease of free-ranging local chickens in Tanzania (Swai et al., 2007; Minga et al., 1989) and thus its control is very critical in any program seeking to improve rural poultry production. Other diseases which were commonly reported included Coccidiosis, fowl Coryza, fowl typhoid and vitamin A deficiency.

Despite the differences in management levels between the two ecological zones, the overall results indicated that most of the households were responsive in adopting recommended management practices. Lyimo (2013) in Tanzania, Tsadik et al. (2015) and Tadasee et al. (2013) in Ethiopia had similar observation in areas where there were external interventions. Such observations auger well with the fact that majority of farmers had positive perception on influence of best practices in management (74.4%). This could be attributed to the level of awareness created before introduction of the improved breed and extension support consistently provided by the project. Likewise, the project provided pre-vaccinated brooded chicks when they were 42 days. This reduced the higher incidences of chick mortality commonly observed in scavenging mode of production and likely to have raised the farmers' confidence. Minga et al. (1989) and Alexander et al. (2004) showed that vaccination against Newcastle alone can significantly reduce chicken mortalities in rural areas. Apparently, adoption of innovation is a process that can be influenced by the nature of the project and other externalities. For example, Tsadik et al. (2015) in Ethiopia observed that on introducing new technologies, initially, some farmers tended to have either negative or positive perception about the technology. Later on, it was observed that, most of the farmers developed positive perception following their participation and only a few still had negative or neutral perception. Wondmeneh et al. (2016) contends that purposive selection of participating households based on prior experience in chicken production had influence on the overall perception. In the current study, recruited farmers were also required to have at least chicken keeping experience of two years. Even though majority of respondent had positive attitude, the overall level of management observed in this study was at medium level index suggesting that other factors more than awareness level might have contributed to the status. For instance, majority of respondents who did not use the recommended management practices claimed to be aware of their importance although low financial status and a number of other constrains such as low egg prices, high cost of inputs, diseases and predations remained their major challenges. These constraints can therefore partly explain why farmers were reluctant to fully adopt the management practices, especially if they are not guaranteed with market. Wondmeneh et al. (2016) reported that as long as farmers are assured of getting profit, he/she is also likely to invest in technologies. In general, small family poultry producer have poor levels of knowledge on how to raise their birds profitably. And therefore, productivity and the rate of output/rate of input will likely be affected by various socio economic factors such as motives for keeping poultry, flock size and economic cost (of stock, feed and health maintenance). Given the level of management and farmers' perceptions on the contribution of management to overall productivity, the study seek to further establish to what extent the observed levels of management influence the actual birds' performance.

CONCLUSION AND RECOMMENDATIONS

On the basis of the important findings of the study, the following conclusions are drawn and presented.

1. Overall management level of farmers in the study areas were medium and influenced by agro-ecology and level of awareness created
2. Majority of the farmers had positive perception that improved management will have positive impact on overall performance of their birds.
3. In order to optimize productivity of introduced improved strains of chicken in rural areas, a holistic approach that addresses critical management elements is recommended.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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