

Improving Management as a Means for Improving Livestock Productivity and Reproductive Performances

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Abstract

A study were conducted in Ganta Afeshum woreda, Eastern Zone of Tigray from March 2014 to April 2015 with an aim of improving livestock productivity and reproductive performance through improving livestock management practices of the producers. To achieve this, model farmers taken from the target sites were made to take an intensive training on livestock management and the impact of the training on productive and reproductive performances of the selected cows as well as chickens of the farmer's research groups were then followed while the farmer's research group try to implement the training they took at house hold level. Two types of data's (pre and post) training related to livestock productive and reproductive performance were collected during this study using Questionnaire and direct observation methods. Pre-training assessment of the reproductive and productive performance of the FRG's dairy cow and chickens shows an average milk yield (in Litter) of 1.06 ± 0.425 and 2.73 ± 0.82 ; AFC (in year) of 3.39 ± 0.66 and 3.12 ± 0.46 ; CI (in year) of 1.79 ± 0.5 and 1.46 ± 0.47 and CR (in Number) of 1.93 ± 0.18 and 1.98 ± 0.57 for local and cross breed dairy cows respectively and AFL (in month) of 7.3 ± 0.42 and 6.9 ± 0.24 , Number of eggs/hen/clutch of 11.5 ± 2 and 16.97 ± 4.19 and hatchability (in %) of 59.96 ± 2.26 and 55.81 ± 2.94 respectively in the local and cross breed chickens. Post training assessment of the FRG's Dairy cows on two parameter i.e. Average milk yield and conception rate shows a significant change in which 1.63 ± 0.61 and 3.38 ± 1.26 average milk yield and 1.58 ± 0.32 , 1.75 ± 0.37 average conception rate ($P < 0.05$) were recorded for both the local and cross breed cows respectively. On the other hand, the AFL, NE/H/C as well as Hatchability percentage of the local and cross breed chickens, were found 6.1 ± 0.38 and 5.18 ± 0.3 ; 15.9 ± 3.38 and 19.55 ± 4.49 ; 76.21 ± 0.53 and 73.7 ± 0.57 respectively indicating the fact that it is possible to improve the productivity and reproductive performance of our indigenous livestock even with the available resources provided that ample job is done to improve the understanding of the producers.

Keywords: Ganta Afeshum, Dairy Cows, Chickens, Management, Productive and Reproductive Performance

INTRODUCTION

Animal production has been considered as the main component of agricultural development in most parts of sub-Saharan Africa. Like in many developing countries of the region, domestic animals play a crucial role in Ethiopia. They provide food in the form of meat and milk, and non-food items such as draft power, manure and transport services as inputs into food crop production, and fuel for cooking. Livestock are also a source of cash income through sales of the above items, animal hides and skins. Furthermore, they act as a store of wealth and determine social status within the community. Ethiopia is known for its high livestock population, being the first in Africa and tenth in the world (Gebrecherkos *et al.*, 2012). The recent livestock population estimates that the country has about 52.1 million heads of cattle, 24.2 million sheep, 22.6 million goats and 44.9 million poultry (MOA, 2013). The population of these animals in Tigray region is 4,201,501 cattle, 4, 506, 64 shoats (sheep and goat) and 155,434 chickens of which wereda Ganta Afeshum have the proportion of 51, 514 cattle, 60, 040 sheep, 30, 050 goats and 67, 769 chickens respectively (Gebrecherkos *et al.*, 2012).

Despite the large number of livestock in the region the sector is characterized by low productivity and, hence, income derived from this sector of agriculture could not impart significant role in the development of the region's economy (Mukasa-Mugerwa, 1998; Elsa *et al.*, 2012). The low productivity is attributed to high disease incidence and parasite burden, low genetic potential of indigenous breeds, inadequate management, poor nutrition and reproductive performance (Elsa *et al.*, 2012). From the different livestock production constraints existing in the country in particular in the region, poor management and high diseases incidence are considered among the leading problems (Gebremedhin, 2007). A disease often results from a combination of two or more causes: first, the indirect or predisposing factor which may lower the animal's resistance and the second cause is the direct or determining factors which produce the actual disease. Predisposing causes of disease are referred to frequently as "stress" factors. Stress factors include chilling, poor ventilation, overcrowding, inadequate feeding and watering space, etc and the direct causes of disease include bacteria, viruses, parasites, fungi, nutritional deficiencies, chemical poisons, and unknown causes (<http://osufacts.okstate.edu>).

Diseases have numerous influences on productivity and fertility of herds. The effect of livestock diseases could be expressed in terms of losses due to mortality and morbidity, loss of weight, slow down growth, poor fertility performance and decrease physical power. Livestock diseases are the major cause of economic losses to the peasant farmer and pastoralists in Ethiopia amounting to hundreds of millions of birr annually. Because livestock are the chief source of cash income to small holders, up to 88% in the high land livestock-

cropping system, diseases are an important cause of reduced productivity of meat and milk as well as draft, hides and dung fuel (Muktar *et al.*, 1994).

In tropical high land areas including Tigray livestock health problems is high due to environmental factors like high temperature and humidity, topography structure of sloppy area exposed to flood so easy to infect soil born diseases and stress factors. The second major factor for the high prevalence and incidence of diseases in these areas is related with weak animal health services and poor management practices (Assegid, 2000). This finding goes in line with the study conducted at Ganta Afeshum in 2013 which identifies livestock diseases and poor management practices exercised by the producers of the local community to be the major problems of livestock production in the area. Various types of diseases (infectious and non infectious) were detected in the study and among this nearly 46% of the health problems identified was related to parasitic infections. Detailed economic evaluations repeatedly show that the major losses due to parasites are on animal production (production loss related to loss of weight, slow down growth, poor fertility performance and decreased physical power), rather than on mortality. In many instances, these costs exceed the costs of losses due to the major “killer” diseases due to viruses and bacteria (peter.waller@sva.se ; Yemisrach *et al.*, 2012).

Though many of the diseases of livestock that are considered to be a cause of decreased productivity in the community are able to be controlled easily, the poor management practices (i.e. feeding, housing, watering, breeding, and health maintenance) currently followed by the peasants (breeders) together with the poor health service system in the area are aggravating the prevalence and effect of these problems. As a result the huge economic loss associated with livestock disease and decreased productivity is continuing. Putting this problem in to consideration, this research were there for carried out with the following objectives ahead

- To assess the livestock production system of the area
- To assess the productive and reproductive performance of the areas livestock
- To transfer knowledge on systems of livestock management to selected producers of the community
- To show the effect of improving management on livestock productivity and reproductive performance to the farmers

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in 3 selected peasant associations (PAs) locally called “tsabias of Ganta Afeshum, which is one of the 7 woredas of the eastern zone of Tigray (excluding Adigrat and Wukro towns) (Figure 1) from March 2014 - March 2015). The area is located at 115km North of Mekelle and 960 North of capital city of Ethiopia, Addis Ababa. The district share boundaries with Hawzen in the south, Enticho in the west, Gulomahda in the north, and Saesi Tsaedaemba in the East parts (Tyhra *et al.*, 2011) and is situated at an elevation of 2457 meters above sea level. It has three agro climatic zones: low lands, mid land and high land with a bimodal rain fall pattern, in which the long rain season starts from end of June to beginning of September and short rain season stays from January to March. The average annual rainfall of the area varies between 300 and 400 mm. Livestock are main components as main factors for the livelihood of the community to undertake agricultural activities and also as source of income. The livestock population of the woreda includes 51,514 cattle, 60,040 sheep, 30,050 goats, and 67,769 poultry (chickens) respectively (Azimachew, 2010).

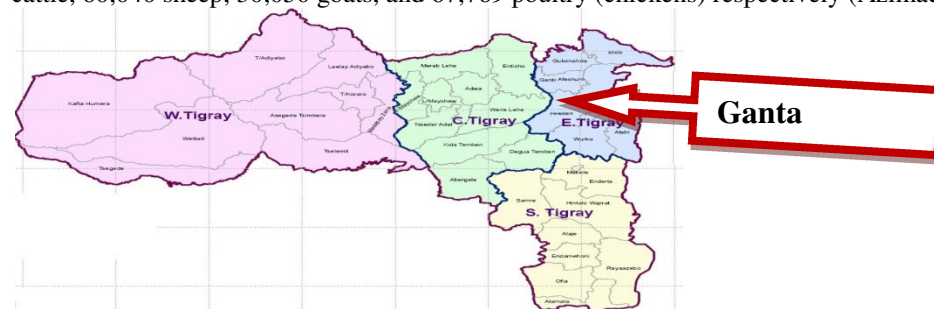


Fig1. Map of Tigray region showing the selected woreda (study site).

Study Design and Procedure

A cohort study design was used to conduct the study. It was conducted in such a way that at first, the cohorts (farmers that were selected for this particular study (FRG)) were made to take thorough training on the improved systems of livestock management practices. The training was given focusing on livestock feeding (Nutrition), housing, watering, breeding, marketing and health maintenance areas. The training were given for 14 days (two weeks) aimed at increasing the awareness (understanding) of the farmers on modern livestock management practices and practicing these systems of livestock management by the FRG's and appreciate its difference from the traditional one that they had been using with respect to their livestock reproductive and productive performances.

Sample Size and Sampling Procedure

In the present study, 3 peasant associations (Pas) namely, Maiweyni, Adekney, and Kita, were selected purposively based on transport accessibility, degree of livestock production practices and agro ecological differences. From each PAs, 40 household heads (FRG's) were selected in a purposive random manner for the cohort study and hence the sample size used for this study was 120. The sample size for the study was determined using the "Sample Size Rule of Thumb" of Rick (2006).

Size of population	Sampling percent
0-100	100%
100-1000	10%
1001-5000	5%
5001-10,000	3%
1,0000+	1%

Source: Rick (2006): *Research Design and Statistical Analysis for Christian Ministry, 4th ed.*

Method of Data Collection

Two types of data's (pre and post training) were collected in this study. Both types of data were collected by using questionnaire survey and direct observation.

Pre-training Data- in this case data's related to the traditional (current) system of livestock management by the FRG and hence productivity and reproductive performance of these animal groups were collected through direct interview of the selected house heads and also direct observation of the investigators at house level.

Post- training data's- following provision of a thorough training on improved livestock management for the FRG and data's related to reproductive and productive performance were once again collected in a similar way using the questionnaire survey and direct observational methods to evaluate the impact of the training on the livestock productivity.

Data Analysis

The data obtained in this study were analyzed using Simple descriptive statics as well as SPSS 16.0 0 (SPSS, 2007) software for the (ANOVA) and t-test.

RESULT AND DISCUSSION

Demographic Features of the Farmers Research Groups (FRG's)

Majority of the FRG's included in the study were male (86%) and the rest female (14 %). The maximum and minimum ages were 64 and 25 years respectively. Regarding educational status, 73% of the FRG's' were illiterate.

Livestock Management Practices

Farming System and Farm Size- the farmers involved in the study revealed that the livestock production system is of mixed type in which both crop and livestock production are being practiced side by side. A relatively larger land as compared with grazing land were allocated for the production of crops in the area but the yield obtained from crops like wheat, barley, Teff, maize, pea and bean is not enough to secure the feed demand of the households and as a result livestock production serves as a means of additional income. The total cropping land per house hold in the study "Tabias" namely Maiweyni, Adekney and Keta in hectar were 0.78, 0.63 and 0.48 respectively (table 1). There was no private grazing land in the study woreda .

Table 5. Land Holding Per hectar (Mean \pm SD) and Land Use Pattern in the Study Tabias

Variables	Land use	Adekney	Maiweyni	Keta
Own-land	Cropping	0.45 \pm 0.33	0.56 \pm 0.43	0.33 \pm 0.22
	Grazing	-	-	-
Rented land	Cropping	0.18 \pm 0.33	0.22 \pm 0.30	0.15 \pm 0.25
	Grazing	-	-	-
Total land		0.63	0.78	0.48

Livestock Feed Resources and Feeding Practice- All most all of the FRG's 95% (N=114), indicated that crop residues from wheat, Maize, barley, bean, and peas were the primary feed utilized in the area followed by hay and natural pasture respectively. In addition to these, non conventional feeds such as "atela" as well as concentrate feeds were used by some of the farmers in sporadic manner (table 2).

Table 2. Major Animal Feed Resources Available in the Area

Feed resource	N	%
➤ Crop residue	114	95
➤ Hay	78	65
➤ Natural pasture	35	29.1
➤ Concentrate	20	16.67
➤ Non-conventional (<i>atella</i>)	10	8.33
➤ Provision of salt (mineral supplementation)	6	5.0

*N= Number of FRGs, %= percent of respondents

Water Source and Watering Frequencies- The major sources of water mentioned by the farmers were river (64%) followed by temporary wells, stream, natural ponds (36%). The amount of these water sources decline in the dry season and hence the distances to watering points varies with seasons. Majority of the FRG's (74 %) trek their animals 1 to 5 km in search of water during the dry season, but during the wet season distance for (85%) of respondents is reduced to < 1 km.

Table 3. Seasonal Watering Frequency and Availability of Water According to FRG's response

Watering frequency	Season			
	DS		WS	
	N	%	N	%
➤ Freely	14	13.33	5	5.5
➤ Once a day	106	88.33	57	63.3
➤ Once in two days	--	--	28	31.1
➤ Once in three days	-	-	10	8.33

*N= number of FRG's, DS= dry season, WS= wet season and %= percent of respondents.

Livestock Housing- Good housing can determine productivity by reducing stress, disease hazards and making management easier. In this regard in the study area livestock housing was found to be similar from one Tabia (district) to the other. The finding revealed that, most of the farmers (70%) of the study group responded that they housed their livestock (small ruminants, cattle and poultry) separately from theirs but all animal groups (females, males and young animals) were kept in the same house regardless of the species, age, and health status.

Breeding Practice- There was no significant practice of controlled mating by the FRG's and hence the breeding practices were dominated by natural mating (88.33 %, N= 106) in which the male animals run with females throughout the year (Table4).

Table 4. Castration and Breeding Practice of the FRG's

Variables	N	%
Castration practice		
➤ Yes	54	45
➤ No	66	55
Breeding		
➤ Controlled	14	11.67
➤ Uncontrolled	106	88.33

*N= Number of FRG's, %= percent of respondents

Health Care System of the FRG's (Treatment and Prevention) - Farmers were asked for the kind of measures they take to maintain their livestock health as productivity can't be achieved without proper health maintenance, and in this regard they were asked for their practice of vaccination, deworming and treatment; accordingly the response of the farmers on each activity was given summarized in the following table (table 5).

Table 5. Livestock Health Care System of the FRG's

Activities practiced	When performed	Number of Respondents (N=120)	Percentage (%)
Quarantine	During signs of illness	11	9.2
	During introduction of a new animal	-	-
	None (not practiced)	109	90.8
Vaccination	Annually	35	29.1
	Semi-annually	11	9.16
	Quarterly	-	-
	None	15	12.5
	When there is disease out break	59	49.58
Deworming	Annually	16	12.5
	Semiannually	5	4.17
	Quarterly	1	0.8
	When there is infestation	99	82.5
	None	-	-
Treatment During occurrence of disease	Always	8	6.7
	Most of the time	28	23.3
	Some times	74	61.7
	Rarely	7	5.8
	None	3	2.5

Pre-training Productive and Reproductive Performance of FRG's Dairy Cows and Chickens

FRG's Dairy Cows Productive and Reproductive Performance

Table6. Productive and Reproductive Performance of Dairy cows According to FRG's Response

Parameter	Variable (cows genotype)	PAs (Peasant Associations)			P-Value
		Maiweyni (Mean + S.D)	Adekiney (Mean + S.D)	Ketagedeba (Mean + S.D)	
MY (In Litter)	Local	1.1±0.41 ^x	0.8 ±0.325 ^y	1.3 ± 0.54 ^x	0.016
	Cross	3.5 ±1.5 ^y	2.2 ±0.6 ^x	2.5 ±0.36 ^x	0.045
AFC (In Year)	Local	3.02 ± 0.54	3.6± 0.68	3.56 ±0.76	0.065
	Cross	3.1 ± 0.67	3.3 ±0.36	2.97±0.36	0.802
CI (year)	Local	1.45 ±0.52	2.01±0.37	1.93 ± 0.61	0.09
	Cross	1.53± 0.5	1.54 ±0.26	1.33 ±0.67	0.907
CR(number)	Local	1.9 ±0.17	2.1 ±0.24	1.8 ±0.13	0.523
	Cross	1.87± 0.45	2.03 ± 0.73	2.06 ±0.55	0.76

Within each row, values followed by the same superscript letter, do not differ from each other significantly (P> 0.05)

To evaluate the productive and reproductive performance of dairy cows in the study site an interview were made for the FRG's taking four parameters as indicators (table 6) and as indicated in the table there was a significant variation in the average milk yield of both local and cross breed dairy cows across the three peasant associations (P< 0.05), while in the other parameters (i.e. age at first calving, calving interval and conception rate) no significant variation was found (P>0.05). The reproductive and productive performances of the dairy cows of both genotype cows obtained in this study were lower than other similar study conducted in different corners of the country including by G/kidan *et al.*, (2012) in central zone of Tigray, by Nega, (2013) in central Ethiopia, and Niraj Kumar *et al.*, (2014) in and around Mekelle Town and this could be related with difference in the management system and genotype of the dairy.

FRG's Chicken Productive and Reproductive Performance

Table 7. Productive and Reproductive Performance of Chickens According to FRG's response

Parameter	Variable (chickens genotype)	Pas (Peasant Associations)			P-Value
		Maiweyni (Mean \pm S.D)	Adekiney (Mean \pm S.D)	Ketagedeba (Mean \pm S.D)	
AFL(month)	Local	7.8 \pm 0.5 ^x	6.1 \pm 0.37 ^y	8.0 \pm 0.4 ^x	0.017
	Cross	6.9 \pm 0.23 ^x	6.4 \pm 0.15 ^y	7.4 \pm 0.34 ^x	0.032
NE/H/C	Local	11.5 \pm 2.1	11 \pm 2.4	12 \pm 1.5	0.074
	Cross	15.4 \pm 3.2 ^y	18.02 \pm 4.06 ^x	17.5 \pm 5.32 ^x	0.016
H (in %)	Local	60.3 \pm 2.52	57.6 \pm 1.87	62 \pm 2.41	0.0576
	Cross	52.5 \pm 3.71	56.7 \pm 2.77	58.23 \pm 2.35	0.947

Within each row, values followed by the same superscript letter, do not differ from each other significantly (P> 0.05)

In a similar fashion, an assessment was done to evaluate the reproductive and productive performance of chickens in the study area (table 7) by taking three parameters namely: age at first laying, number of eggs per hen/clutch and hatchability. As indicated in the above table, there were significant variation between the three peasant associations (P<0.05) in the AFL in which chickens (both local and cross) in Adekiney reach more early than the other two tsabias. As to the number of eggs/ hen/clutch the variation was found significant between the study sites for the cross breed chickens (P<0.05) while it was insignificant for the local chickens. The average age at first laying of the chickens found during this study were close to the findings of Melkamu *et al.*, (2013) and Alem, (2014) conducted in Eastern Gojjam and Centarl zone of Tigray respectively. While the NE/H/C as well as Hatchability percentage of the chickens obtained in this study were found lower than the findings Ale metal (2013), in central tigray zone, Melkamu *et al.*, (2013) in Eastern Gojjam as well as Addisu *etal.*, (2013) in North Wollo zone of Amhara region. The comparatively low reproductive performance of the chickens in the study area could be associated with the inadequate management practices being followed by the local producers.

Post training FRG's livestock Reproductive Performance and Productivity

Dairy Cows Productive and Reproductive Performance

Table 8. Milk Yield (in litter) and Conception rate of Dairy Cows of the FRG following the practice of improved livestock management

Parameter	Variable (cows genotype)	PAs (Peasant Associations)			P-Value
		Maiweyni (Mean \pm S.D)	Adekiney (Mean \pm S.D)	Ketagedeba (Mean \pm S.D)	
MY (Litter)	Local	1.9 \pm 0.73 ^x	1.2 \pm 0.58 ^y	1.8 \pm 0.54 ^x	0.031
	Cross	4.3 \pm 2.03 ^x	2.34 \pm 0.75 ^y	3.5 \pm 1.02 ^x	0.018
CR(in number)	Local	1.45 \pm 0.24 ^x	1.76 \pm 0.32 ^y	1.54 \pm 0.41 ^x	0.043
	Cross	1.77 \pm 0.37	1.82 \pm 0.21	1.66 \pm 0.55	0.562

Within each row, values followed by the same superscript letter, do not differ from each other significantly (P> 0.05). NB: 5 local and two cross (Local X HF) dairy cows from each PA's all with second trimester were used for the milk yield assessment study and 6 local and 2 cross breed cows of the same trimester were used for the conception rate study.

As indicated in the above table a significant variation in milk yield of the dairy cows of both type breeds were found across the three peasant associations of the woreda and a better average mean milk yield of (1.9 \pm 0.73) in litter were found in "maiweyni" peasant association as compared to the other PAs. This might be associated with the better implementation of the training by the FRG's of the tsabia as compared to the other PAs FRG. Taking the conception rate, there was a difference in the performance of the local and cross breed cows in which a significant variation were found in the conception rate of the local breed dairy cows. As indicated in the above table, the conception rate of "Maiweyni" dairy cows were relatively higher than the other peasant association and this could also be associated with the better management practices by the PAs FRG as reproductive performance is highly related with nutrition and other management practices. But no significant variation was found in the conception rate of the three cross breed cows of the three PAs. Over all an encouraging result in the milk yield and conception rate of the dairy cows was found in all the three PAs as compared to the previous productive and reproductive performances of these animals indicating the fact that livestock productivity is highly dependent on appropriate management.

Chicken's Productive and Reproductive Performance

Table 9. Productive and Reproductive Performance of FRG's Chickens Post Training

Parameter	Variable (chickens genotype)	PAs (Peasant Associations)			P-Value
		Maiweyni (Mean \pm S.D)	Adekiney (Mean \pm S.D)	Ketagedeba (Mean \pm S.D)	
AFL(month)	Local	6.1 \pm 0.42	6.4 \pm 0.22	5.8 \pm 0.52	0.078
	Cross	5.7 \pm 0.35 ^x	4.2 \pm 0.33 ^y	5.66 \pm 0.23 ^x	0.013
NE/H/C	Local	13.7 \pm 3.06	16.56 \pm 3.04	17.45 \pm 4.05	0.69
	Cross	17.42 \pm 5.03	20.2 \pm 4.08	21.05 \pm 4.37	0.95
H (%)	Local	76.4 \pm 0.52	72.8 \pm 0.67	79.43 \pm 0.41	0.77
	Cross	72.5 \pm 0.62	76.7 \pm 0.53	71.9 \pm 0.56	0.83

Within each row, values followed by the same superscript letter, do not differ from each other significantly ($P > 0.05$)

The above table shows the reproductive and productive performance of the FRG' chickens after the selected producers took an intensive training on improved chicken management and tried to implement these management practices at house hold level. No significant variation in mean age of the local chickens at first laying between the different PAs of the study site were found but a significant variation were obtained in this regard on the cross breed chickens of the three PAs in which cross breed chickens of "Adekiney" reach the age of egg lay at earliest period (with in less than 5 month) than the other PAs chickens.

Considering Number of eggs/hen/clutch and Hatchability no significant difference were found among both chickens types of the different PAs. Even though no significant difference in these parameters among the PAs chickens were obtained, the average mean was by far better as compared to the previous management egg productivity of hens/clutch as well as Hatchability.

CONCLUSION

- This study revealed that the livestock management system of the area was mainly extensive where by animals are fed mainly on by-products of various food crops and additional green fodder and coarse grains could not be grown and utilized in the area due to the limited land availability.
- Available resources utilization (management) were found not judicious as majority of the animals in these areas were fed below standard and due to this the overall productive and reproductive performance of the areas livestock were consequently suboptimal
- A better productive and reproductive performance of dairy cows as well as chickens were observed in the study area when the farmers tend to practice the improved systems of management indicating the fact that, it is possible to improve the productive and reproductive performance of our indigenous livestock even with the available resources provided that ample job is done on the livestock producers to developed their awareness on livestock management.
- A significant difference in the reproductive and productive performance of dairy cows and chickens were observed across the three PA's

RECOMMENDATIONS

Based on the conclusions obtained from the present study the following recommendations are forwarded:

- The management system should be progressively changed if possible in to intensive and if not in to the semi intensive system i.e. the feeding, housing, watering, and health maintenance system of the livestock production should be given due attention and get improved if increased production and reproductive performance of the animals is expected in the area.
- utilization of the available feed resources should be optimized
- Improve the genetic potential of the indigenous breeds by hybridizing with the better performing exotic breed animal species
- The perception of the farmers towards believing in quantity rather than quality should be changed through gradual education of the livestock producers.

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