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Retrospective Studies on Sheep Mass Mortality in Guduru Livestock Production and Improvement Center, Horro Guduru Wollega, Ethiopia

[1]Diriba Diba, [1]Firissa Woyesa, [2]Hassan Yusuf and [3]Wahid M. Ahmed

[1]Department of Animal Sciences, Faculty of Agriculture, Wollega University; Ethiopia
[2]Department of Plant Sciences (Global Food Security),
Faculty of Agriculture, Wollega University; Ethiopia
[3]Department of Animal Reproduction and A.I., Veterinary Research Division,
National Research Centre, Giza, Egypt

Abstract: A retrospective study was conducted at and around Guduru animal production and improvement center to assess about the causes contributed to mass mortality of sheep flock in the then Guduru ranch and to document baseline information on the deaths of sheep in the ranch. Purposive sampling technique was employed for selecting peasant associations surrounding the Center as well as staffs of the center. Semi-structured questionnaire and observation on grazing fields were used to collect data. For the interview method of data collection, three "Gandas", which means peasant associations, surrounding the center was purposively selected with cross-sectional approach. About 30 households were randomly taken from each 'Ganda" and interviewed. The housing system for the flock was from medium comfort to comfortable. The flock was maintained on native pasture or hay supplemented with concentrate diets. They were grazing on mixtures of different species of native pasture so that there was wider chance of getting nutritious plants for the flock and there was less likely to suspect the aspects of malnutrition. Ewes with newborn were the most affected classes (39.4%) of the flock followed by ewe plus lambs (30.3%) and ewes alone (15.2%) were the third most exposed group to death. There were different symptoms such as cough, emaciation, diarrhea, sudden death and sudden death without visible symptom. None of the factors such as poisonous plants, mismanagement, weather changes and air drifting killed the sheep. Ticks infestation in the ranch was potentially suspected as likely cause for mass mortality of the flock. Nonetheless, there was no clear result concerning causes of the mass mortality of the flock. Therefore, there was no any indication for sheep not to be reared in Guduru climatic condition provided the *Acari* treatment in the center was effective.

Key words: Ethiopia · Guduru · Mass Mortality · Sheep

INTRODUCTION

The Horro Guduru ranch but now Guduru Livestock production and improvement center, was initially established by Bureau of Agriculture of Oromia regional state to prevent genetic dilution of the Horro sheep breeds with other local breeds and thereby to preserve the Horro sheep breeds. This was because Horro sheep are the very important source of mutton meat in Ethiopia and hence to disseminate them to the local farmers. The death of about 2000 sheep in 2001 was institutionally recognized fact and formally reported to Oromia Bureau of Agriculture. Due to this the regional government shifted the program from sheep to cattle production ranch in 2002. Mass mortality of the flock had been the sole reason to stop propagation of Horro sheep breeds in the then ranch. While many scientific reports revealed that sheep can be adapted to wider ecological zones [1-3] and the climate of Guduru ranch was very moderate like other areas considered favorable for sheep production in the nearest districts, the death of such a large number of sheep in few seasons was a paradox and its consequence on the livestock economy of the region was highly considerable.

Corresponding Author: Diriba Diba, Department of Animal Sciences, Faculty of Agriculture, Wollega University; Ethiopia.

According to the concepts included in annual budget planning documents of Guduru Livestock Production and Improvement Center 2010, diversification of livestock sub-sectors is important to enhance income of the center. However, failure of the ranch to sustain sheep production was one of the drawbacks for the achievement of the above plan.

Even though sheep were owned by some farmers of the vicinity without any scientific justification to stop sheep production in the center, institutionally recognized problems shall be formally and institutionally solved through research based procedures. In this regards, Bedele and Sebeta veterinary laboratory staffs tried to identify the cases before fifteen years but didn't reveal any infectious evidences for the events until now. As there was no infectious evidence for the mass mortality of the flock and the weather in which the ranch located was still in a climatic variable considered normal for sheep production, it seems logical and more scientific that the cause for the mass mortality of the flock needed to be assessed. Hence this research was initiated to conduct retrospective studies mainly about the causes contributed to mass mortality of sheep flock in the then Guduru ranch and to document baseline information on the deaths of sheep in the ranch.

MATERIALS AND METHODS

Study Site: Guduru Animal Production and Improvement Center is found in Horro Guduru Wollega zone, western Ethiopia and located between 09°29' North latitude 37° 26' East longitudes. Its average elevation is about 2, 296 m.a.s.l. with a uni-modal rainfall ranging between 1200 mm-1800 mm [4]. The rainy season occurs from April to mid-October where maximum rain is received in months of June, July and August. Maximum temperature of 23-27°C are reached from January to March and minimum temperature of 7-15°C were normal from October to November [5].

A purposive sampling technique was employed for selecting peasant associations surrounding Guduru Animal Production and Improvement Center as well as staffs of the center. The tools used for this study included semi-structured questionnaire and observation on grazing fields for visual assessment. This research was conducted mainly through interviews, focus group discussions and observations. For the interview method of data collection, three "Gandas", which means peasant associations, surrounding the center was purposively selected with cross-sectional approach. About 30 households were randomly taken from each 'Ganda" and interviewed. From these individuals volunteer based approach and their experience in sheep rearing was used to select some individuals for focus group discussion. Official records on those animals' death were searched from the center as supportive evidence.

Statistical Analysis: Data collected was summarized, described and used for the statistical analysis. Statistical procedure for social sciences (SPSS) software was used for the analysis of data. Mean comparison was made using LSD or chi-square test based on number of variables to be described and the data were tested at 1 and 5% significance levels.

RESULTS AND DISCUSSION

General Information about Respondents: Details of respondents' characteristics such as age, marital status and family size and education statuses are indicated in Tables 1. The average age of respondents was 42 years. This showed that they had enough experience in sheep farming. The mean family size was eight in number and there was no labor shortage for sheep production in the area. Almost majority of them had married and almost all of them (95%) were literate so that this was good opportunity to use them as respondents in this study.

Management Status as Implication of the Flock Health: The housing, feed types and flock feeding systems as implications for flock health status of the ranch is presened in Table 2. About 73.27% of the respondents from the ranch had confirmed that the housing system for the flock was from medium comfort to comfortable that it was made from concrete blocks and floors. Medium comfort and comfortable in the study context was meant by the status of housing which has no negative health implications. Only 27.3% of the respondents had claimed that the housing system of those flocks was not comfortable. From this result, someone can understand that the status of the housing system for the sheep flock in Guduru ranch exclude its contribution to mass mortality of the flock.

It was also noticed from the majority of respondents (94.5%) that the flock was maintained on native pasture or hay supplemented with concentrate diets. In cases where the flock was supplemented with concentrate diets, be the protein or energy concentrates were less likely to suspect malnutrition. The semi-intensive dominated husbandry practices of the flock had also created better opportunity to exploit resources available in the field and resting in indoor environments. From the housing, feed types and

Table 1: Respondents' or household characteristics

No	Effects	Range	Mean
1	• Age (years)	26-58	42
2	• Family size (number)	2-15	8
3	Marital status	Frequency	%
	• Single	8	8.4
	• Married	82	91.6
4	Education		
	• Illiterate	4	4.4
	• ≤ 6 grade	23	25.6
	• 7-10 grade	45	50
	• 11-12 grade	9	10
	• ≥ 12 grade	9	10
	• Total	90	100

Table 2: Housing, feed types and flock feeding systems in the Ranch

Housing	Freq	%	Feed type	Freq.	%	Feeding systems	Freq.	%
Comfortable	11	12.1	G only	5	5.55	In home only	3	3.33
Medium	55	61.1	C + H	33	36.7	SI	68	75.8
Not comfortable	24	26.7	G+C+H	52	57.8	extensive	19	21.2
Total	90	100	Total	90	100	Total	90	100

Con= concentrate diets; C= concentrate, G= Grazing, H= hay, SI= Semi-intensive

feeding systems sides of the flock management in the ranch, there could not be room for the flock to be exposed to mass mortality except when the flock consumes poor quality roughage only. The death of all sheep group consumed barley straw was higher than those fed on green native pasture hay under feedlot systems [6]. However, the sheep in the then ranch were not totally restricted to feedlot systems but they were sometimes roaming in the field for grazing. In this case they had chances for selectively grazing on more edible parts of herbs in the field. Hence it was less probable that feeds and feeding approaches contribute to their death.

Grazing Pasture and Water Resources for the Flock: The majority of the respondents (97%) i.e. except few (3%) have common understanding that the flock was grazing on mixtures of different species of native pasture than monoculture plants (Table 3). Such grazing species diversity indicated that there was wider chance of getting nutritious plants for the flock. Accordingly, about 69.8% of the respondents disclosed that the grazing pasture of the flock composed of at least three different species presumably with different nutritive values. This gives the flock the opportunity to select species of their choices during grazing. In addition, the flock has supplementary diets as indicated in Table 1. Hence, there was no ground to expect nutrient deficiency as factor contributing to deaths of the flock in the ranch.

Besides grazing resources for the flock, the sources of drinking water was studied to see whether there could be potential sources of infection or not. Accordingly, the chance of accessing tap water, by the flock, was low in that only 9.1% of the respondents confirmed this. The majority of respondents (86.7%) explained that these sheep flock were using Natural River and pond as sources of drinking water. However, the laboratory result (Table 7) did not show any indication of endoparasitic case or water born disease reports.

Flock Exposure and the Nature of the Deaths: The different classes of sheep in the flock studied were not equally susceptible to the diseases. There was variation between the flock on exposure to the sickness. Different researchers had also confirmed such variations due to age and sex variation of animals of the same breed [7]. Ewes with newborn were the most affected classes (39.4%) of the flock followed by ewes with lambs (30.3%) and ewes alone or dry ewes (15.2%) were the third most exposed group to death. Lambs alone or weaned lambs, rams alone, pregnant ewes and rams were the least exposed group.

There were about seven different symptoms, according to respondents report, were observed on the flock. These include, cough with emaciation, cough with diarrhea, diarrhea only, emaciation only, cough only, diarrhea with sudden death and sudden death without visible symptom. From these all, the sheep with cough plus emaciation were populous (48.5%) followed by those with cough and diarrhea (30.3%) symptoms.

The nature of the death of most of the flock was acute with some gradual (39.4%) and chronic (emaciated) and acute (27.3%) i.e. dies overnight. About 21.2% of the flock

Table 3: Composition of their grazing pasture and sources of drinking water

Composition of grazing pasture	Freq.	%	Drinking water	Freq.	%
Natural Grasses	3	3.33	NR	8	8.89
PS+Balami	5	5.54	Pond	10	11.1
CD+PS	19	21.1	TW+NR	8	8.89
HR+Balami+PS	25	27.8	NR + pond	61	67.8
Clv+PS+CD+AS	33	36.7	No response	3	3.33
Balami+PS+HR	5	5.54			
Total	90	100		90	100

AS = Acacia spps, Balami = local name of a grass with two spike as head, CD = *Cynodon dactylon*, Clv = clover, HR = *Hyperhenia ruffa*, No =no response, NR natural river, PS = *Pennisetum schempri*, TW= tap water, No= no response.

Table 4: Susceptible flock categories, sign of the disease and nature of the deaths of the flock

Categories	Freq.	%	Sign of diseases	Freq.	%	Nature of the death/disease	Freq.	%
Lamb only	3	3.03	Em.	3	3.03	Gradual	5	6.06
New born only	3	3.03	Cough	3	3.03	Acute	19	21.2
Ewes only	14	15.2	Diarrhea	5	6.06	Chronic	3	3.03
Ram only	3	3.03	Sud	3	3.03	Grad + Acute	35	39.4
Pregnant only	3	3.03	C+ D	27	30.3	Acute+ Chr	25	27.3
Ewe + Lamb	27	30.3	Sud + D	3	3.03	No	3	3.03
Ewe + Newborn	35	39.4	Em +C	44	48.5	-	-	-
Ewe + Ram	3	3.03	No	3	3.03	-	-	-
Total	90	100		90	100		90	100

C= cough, D= diarrhea, Em= emaciation, Chr = chronic , Grad = Gradual, No =No Response, Sud= sudden death

died in acute situation. Only 6.1% of the flock passed in gradual process. This acute nature of the disease may be the main reason for loss of thousands of the sheep within short time. Had the nature of the disease been gradual, there could be chance of treating the flock to save them. In general since different types of diseases could have same symptoms [8] and different classes of sheep could have different susceptibility rates, in this particular study, it was difficult to exactly identify the disease most contributed to the mortality of the flock based on the recorded symptoms.

Potentially Suspected Causes of Death of the Flock: Since there was no clear result upon diagnosis of the dead body of the flock, the researchers were forced to suspect different cases as indicated in Table 5. The suspected cases include existence of poisonous plants in the ranch, change of weather or climate during death of the flock and housing air drift. From these about 69.7% of the respondents did not give idea on the existence of poisonous plants and 30.3% of them had confirmed that there were no poisonous plant in the ranch that could kill the flock. From this, we can perceive that poisonous plant may not be the cause for mass mortality of the flock.

The majority (78.8%) of respondents disclosed that there was no sudden change of weather during death of the flock while few of them (12.1%) have such opinions. Still some respondents (9.1%) have reservation about the weather situation during the death events. Based on these results (Table 5) it can be generalized that the probability that the change of weather in the ranch could be cause for the death of the flock was less likely. On the other hand air drifting in the house of the flock had been witnessed by most of (87.9%) the respondents. However, such massive loss of sheep can never die due to air drifting for two reasons. Firstly since the exposed sheep protects the rest in the group, others could be safe. Secondly, sheep are less sensitive to air drifting in the house since their skin was relatively covered with fur compared to dairy cows [9].

Participatory Aspects of the Establishment of the Ranch: Table 6 shows the official and societal aspects in decision making about the establishment of the ranch. Based on the fact that the community have to have the sense of belongingness, there needs participatory decision making about the establishment of the farm. However, most of respondents (42.4%) did not involve or participate on the ranch establishment decision while (36.4%) did not respond and only 21.2% involved. Such exclusive or dominating decisions of officials usually end up with conflicts. This was clearly indicated (Table 5) in that about 60.4% of observations had shown the existence of conflict between the society and the ranch (institution). The cause for the conflict, as some of the respondents orally interviewed, was mainly two fold. The first and foremost issue was that the land has stayed idle (with no visible development works) for over thirty years.

Table 5: Existence of poisonous plants in the ranch, change weather during death and house air drift of the flock

Poisonous plants?	Freq.	%	Change of weather?	Freq.	%	Housing air drift?	Freq.	%
No	27	30	Yes	11	12.1	Yes	79	87.9
No response	63	70	No	71	78.8	No	11	12.1
Total	90	100	No response	8	9.09	Total	90	100
			Total	90	100			

Table 6: Official and social facets concerning establishment of the ranch

Community involved in establishment?	Freq.	%	Conflict b/n Farmers & the ranch?	Freq.	%	Why conflict?	Freq.	%
No	38	42.4	Yes	55	60.6	For the land	57	63.6
Yes	19	21.2	No	35	39.4	No response	33	36.4
no response	33	36.4	no response	-	-	Total	90	100
Total	90	100	Total	90	100			

B/n= between

Table 7: Diagnostic evidences about deaths of the flock and prehistory of rearing sheep in the vicinity of the ranch

Infectious case lab. report?	Freq.	%	Postmortem organ defect?	Freq.	%	Sheep reared in the vicinity?	Freq.	%
Yes	33	36.4	Liver	11	12.1	Yes	87	96.97
No	41	45.5	Lung	8	9.09	No	3	3.03
No response	16	18.2	No Sign	14	15.2	-	-	-
-	-	-	Li+Lu	11	12.1	-	-	-
-	-	-	Li+Lu+Ki	5	6.08	-	-	-
-	-	-	Lack of Lab.	3	3.03	-	-	-
-	-	-	Ticks	25	27.8	-	-	-
-	-	-	NR	13	14.6	-	-	-
Total	66	100		90	100		90	100

Ki = Kidney, Li = liver, Lu = lung, NR = no response

Elders of the society told this in their own language as “Lafti Hagabuu Taa’ee” or “Lafti Maseenee”, the land stayed barren or stayed without worthwhile institution or product. The second source of conflict was that some few farmers (<0.01%) did not understand the objectives of establishing the then ranch as well as the current Animal Research Center and they needed their land back to use as private farm land. The majority (63.6%) of respondents have shown that the reason for the conflict (Table 6) was on grazing land between the borders of the ranch and the surrounding society. Conflict happened when animals of farmers enter the ranch for grazing and then when they were charged with some amount of money. Even though there was no clue indicating that the mortality of the flock was related to societal conflict. The degree to which institutions can survive and succeed in achieving their objectives will depend crucially on how well they interface with existing institutions and the manner in which this interface evolves over time in response to the needs and expectations of local communities [10].

The diagnostic evidences about deaths of the flock and prehistory of rearing sheep in the vicinity of the ranch is indicated in Table 7. There are majorities (63.7%) of respondents who did not get information on the laboratory report concerning the cause for mortality of the flock while some lower number (36.4%) of the society has accessed. According to the postmortem examination done at Bedele veterinary laboratory, as disclosed by discussants, about 39.4% of the causes of deaths were related to liver, lung and kidney problems while 42.4% of them have no idea about the diagnostic results. Concerning the previous history of sheep rearing in the area, the majority (97%) has confirmed that there were sheep reared in the near vicinity, in the same ecology, of the ranch. This may be an indication of the fact that the mortality of the flock could not be due to agro-ecology related problems of the area. The area where the ranch existed receives normal climatic variables (see study location above) which cannot negatively affect survival and production of sheep. In fact climate change induced heat stress is thus one of the complex factors making sheep management and husbandry challenging in many geographical locations in the world [11]. These researchers reviewed that within the sheep industry, reproductive wastage, which means early losses of embryos, is a major challenge throughout the varying breeding landscapes. This was not the case of the then Guduru ranch because at Guduru it was the loss of flock but not the loss of embryos. The second reason could be that the temperature (23-27°C) of Guduru where the ranch

located was not at a level that it can cause heat stress to sheep or other kinds of flock. In addition, Horro sheep were not wool types or breeds because wool is a natural indicator of short-term stress exposure within the sheep's natural environment [11].

On the other hand, most of the discussants (27.8%) disclosed the existence of ticks (*Acari*) in the ranch that most of the ventral part of sheep was bitten by these external parasites. Such ectoparasites were common in Ethiopian sheep farming systems [12]. Tick-bites in animals may result in the disease tick-borne fever (TBF), induced by the bacterium *Anaplasma phagocytophilum* [13]. TBF causes high fever and weakens the immune system. Different Researchers [14-16] stated that ticks have direct and indirect effects causing significant losses in the production of meat, milk, eggs, leathers and in many cases the death of the affected animals. It was noted that blood-sucking ticks can carry an astonishing range of pathogens from viruses to protozoans [17]. These included tick-born fever, tick pyaemia, anaplasma ovis infection, heart water, babesiosis, theileria, Louping ill and other tick borne encephalitides, Nairobi sheep disease (NSD) and Borna disease of sheep [18, 19]. Some of these diseases, for example, NSD caused high mortality rate in sheep [17]. From this, we can suspect that, the most potential causes of mass mortality in sheep at the then Guduru ranch might be tick-borne diseases.

Generally, since the sheep were not using hay (grazing only) and the concentrate feeds packed in sacks were stored in dry, cool and moisture free concrete building, there was no fungal development and no mycotic toxins suspected to cause the death. This was confirmed with the fact that all of them did not dye in two-three months. Few of them died within this range but most of them died in a year period of time.

CONCLUSION

The housing system for the flock was from medium comfort to comfortable. The flock was maintained on native pasture or hay supplemented with concentrate diets. They were grazing on mixtures of different species of native pasture so that there was wider chance of getting nutritious plants for the flock and there was less likely to suspect the aspects of malnutrition. Ewes with newborn were the most affected classes (39.4%) of the flock followed by ewe plus lambs (30.3%) and ewes alone (15.2%) were the third most exposed group to death. There were different symptoms such as cough, emaciation, diarrhea, sudden death and sudden death without visible symptom. None of the factors such as poisonous plants, mismanagement, weather changes and air drifting killed the sheep. Ticks infestation in the ranch was potentially suspected as likely cause for mass mortality of the flock. Nonetheless, there was no clear result concerning causes of the mass mortality of the flock. Therefore, there was no any indication for sheep not to be reared in Guduru climatic condition provided the *Acari* treatment in the center was effective.

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