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On-farm reproductive performance and adaptability evaluation of Dorper sheep crosses (DorperXAdilo) in different husbandry system, southern Ethiopia

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A flock monitoring study was conducted in Wolaita zone, Damot gale and Damote sore districts and Siltie zone, Mirab Azernet district with the objectives of evaluating the reproductive and productive performance of Dorper sheep and to determine the current production systems. Data was collected from November 2013 to April according to Kaufmann case histories format and were subjected to general linear models (GLM) procedure of SAS. The fixed factors considered were breed, districts, season, birth type and lambing year. Mean birth weight, weaning weight, weaning age, market age, market weight, litter size, age at first lambing and sexual maturity for Dorper sheep were 2.25±1.72 kg, 17.30±0.98 kg, 3.16±0.55 months, 12.66±1.39 months, 30.66±3.26 kg, 1.48±0.71, 11.81±1.37 months and 5±0.74 months, respectively. Location, season, birth type, parity, sex and blood group had significantly (P<0.05) affected weaning weight. Season had influence on weaning age. Pre-weaning mortality rate of Dorper sheep was 2.93% and lower in Wolaita than Siltie zone. In Siltie, rather than Wolaita zone Dorper sheep was housing in the separate house. Housing Dorper sheep in separate house was good practice, so sharing the practice for the others through training, experience share and field trip should be needed. Further study is needed to characterize meat quality and carcass yield percentages from locally available feeds of Dorper sheep in the area.

Key words: Adaptability, crosses, Dorper, husbandry, performance, Ethiopia.

INTRODUCTION

Ethiopia has around 26 million sheep (CSA, 2013) that may be grouped into about 14 traditional sheep populations (Gizaw et al., 2008). Most of the sheep population of the country is kept by smallholder farmers and sheep production in the country is traditional (EARO, 2001). Moreover, sheep production in Ethiopia has great potential to contributing more to the livelihoods of the people in low-input, smallholder farmers and pastoralists under traditional and extensive production systems (Kosgey and Okeyo, 2007).

However, comparing the presence of large and diverse sheep genetic resources similar to other tropical untries, the productivity of indigenous sheep is very low mainly due to low genetic potential for functional traits as

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compared to improved tropical and temperate breeds (Tsegaye et al., 2013). Due to these reasons tropical countries have been implementing crossbreed of indigenous animals with improved exotic genotypes to improve the genetic potential of indigenous animals. Within the aim of improving indigenous sheep productivity, in Ethiopia crossbreeding has been undertaken employing several exotic breed. However, efforts made so far did not bring significant change in developing countries in the tropics.

Dorper, improved exotic sheep breed well perform and thrive in all agro ecological climate. Recently, the Dorper was imported from South Africa to evaluate the breed as a potential performance to Areka Agricultural Research Center took place in Autumn of 2008, with first round 3 rams and second round 38 rams were imported (AARC, 2012). Dorper sheep breed until now not been evaluated under Ethiopia production systems in above discussed districts. Therefore, the objectives of the research were: to evaluate the reproductive and productive performance of Dorper sheep under farmer's management conditions in different agro ecological zones.

MATERIALS AND METHODS

Description of the study area and study breeds

Siltie zone is one of the 14 zones of the Southern nation nationality and people's regional government. It is located at 173 km from Addis Ababa the capital city of Ethiopia and 177 km from the regional town Hawassa. It has eight woreda, of which Mirab Azernet was purposively selected based on Dorper sheep distribution. The Woreda is located in 2889 masl, 7.43 to 7.66°N latitude and 37.86 to 37.90°E longitudes. It has two different agro-climatic conditions, Dega and Woina-dega and consisting 37 and 63%, respectively. The annual average minimum and maximum temperature range from 14 to 17°C, respectively and the average annual rainfall ranges from 1200 mm (Melesse et al., 2013). There are three distinct seasons; big rainy season (June, July, August and September); dry season (January, February and March); small rainy season (October, November and December) (MAWAO, 2013; NMA, 2012).

Wolaita zone located at 330 km to the south-west of Addis Ababa and 160 km from Hawassa, the regional capital city. Its altitude ranges from 1200 to 2950 masl. It has twelve woreda, of which, two woreda (Damot Gale and Damot Sore) were purposively selected based on Dorper sheep distribution. Damot Gale and Damot Sore woredas are located in between 6°51" and 7°35" North Longitude; and 37°46" and 38°1", respectively. Agro ecology of the areas is 62% highland (Dega), 38% midland (Weina Dega) and 58% highland (Dega), 42% midland (Weina Dega), respectively. The average temperature varies from minimum 13.6°C to maximum 25.1 and 14°C to maximum 21°C, respectively. The annual average rainfall in Damot Gale and Damot Sore is 1175 and 1200 mm, respectively. In a bimodal pattern with three distinct seasons; dry (November to February), small rains from March to June and big rains from July to October in both districts (NMA, 2012, WZFED, 2013). For the study crossed Dorper sheep breed (DorperX Adilo, dominant indigenous breed in the area).

Distribution of improved breeds in the study areas

Improved breeds of sheep (Dorper) were introduced over the years in order to increase lamb production and to show carcass yield percentages within Adilo local sheep. As this result, Development agents (DAs) collect money from model farmers based on their interest.

Sampling technique

All farmers who received improved breed (Dorper) sheep were a sample frame. A total of 65 households (48 from Mirab Azernet district, Siltie zone, 9 from Damot Gale and 8 from Damot Sore district, Wolaita zone) were monitored and considered purposively for the household survey in the current study based on Dorper sheep breed distribution.

Breed management

Sheep in the study areas are kept in combination with other species of animals, usually with cattle and equines in Wolaita (Shigdaf et al., 2013). All the farmers construct house for their sheep.

Flock monitoring

Flocks of 65 households were monitored between November 2013 and April 2014. Prior to sampling, previous survey results and secondary data from the Office of Agriculture and Rural Development (OoARD) on overall agricultural production, socioeconomics and crop-livestock integrations were reviewed, and experts of animal husbandry consulted. Field visit was also made to gather pre- information and select the study Kebeles, villages and thereby the households.

For each Kebele, flock density one enumerator was recruited from the respective locality (5 for the whole study (2 enumerators for Wolaita zone and 3 enumerators for Silte zone). All the data collectors are diploma completed, unemployed and able to speak local language and Amharic. Training and demonstration was undertaken before commencement of the study. All animals were identified and numbered at the start of the study. Reproductive data (age at first lambing, lambing interval, and litter size), productive (birth weight and weaning weight) and mortality data were recorded (Appendix 1 and 2). Within 24 h of the new born; date of birth, birth weight, type of birth, sex of lamb and ewe/dam parity were taken. Weaning weight was recorded on 90^{th} day. Weights were taken by using balance scale.

Case histories

To grasp adequate information on the parameters like age at first lambing, lambing interval, lamb mortality, litter size, case histories of breeding females was taken according to Kaufmann (2005, Appendix 3). This is because the monitoring time was still short to record these events. The breeding females whose histories were recorded were those that gave birth at least once. Case histories were done giving priority for older females assuming that they were more informative. Twenty seven case histories were recorded on breeding ewes.

Data management and statistical analysis

Reproductive and growth data were subjected to GLM procedure of Statistical Analysis System SPSS. Statistical significance for quantitative data was done using F test. Fixed effects fitted in the model included the effects of location (2), sex (2), parity (1- >3), birth type (Single, twin, triple, multiple) and season of birth (dry,

Table 1. Distributed Dorper sheep breed in number, where it distributed and blood groups of the breed.

Parity	Blood group and sex						Delivered to	Year
	75%	Sex		50%	Sex			
		M	F		M	F		
1st	12	7	5	86	61	25	Azernet and wolaita	2010/2011
2nd				75	51	24	Wolaita	
3rd				8	3	5	Mirab Azernet	
4th				31	13	18	others	2011/2012

Male, male; F, female and others; distribution of Dorper sheep to other zones. Source: (AARC, 2012)

small rainy and big rainy season). The statistical model is explained as follows:

$$Y_{inlmjyo}=\mu + L_i + X_j + P_l + B_m + S_n + e_{ijlmnyo}$$

Y_{inlmjo} = Weights and weaning of the n^{th} lamb; μ = the overall mean; L_i = the fixed effect of the i^{th} location; X_j = the fixed effect of j^{th} sex; P_l = the fixed effect of l^{th} parity; Bm = the fixed effect of m^{th} type of birth; S_n= the fixed effect of n^{th} season; ei_{nlmjo}= the random error,

RESULTS

Reproductive performance of Dorper sheep

Birth weight, weaning weight, weaning age, market weight and market age were varied among the two zones. Weaning weight and market age mainly dependent on location, birth type, parity and blood group and observed differences were significant (P< 0. 05) level of significance. The least square means (kg) of birth weight, weaning weight, weaning age (month), market age (month) and weight(kg) of Dorper sheep lamb was 2.25, 17.30, 3.16, 12.66 and 30.66, respectively (Table 1). Weaning weight, market age and market weight were affected by birth type and blood group. Location had significance on weaning weight and market age, whereas season had significance on weaning weight and market weight. Weaning weight also affected by parity and sex of lamb.

Housing systems

Sheep are housed in different ways. The majority of the respondent in Mirab Azernet (95.8%), house their sheep in the separate house and housing sheep in main house was also reported by some farmers in the same woreda. However, the all respondents of Damot Gale and Damot Sore woreda (100%) house their sheep in the main house with families.

Adaptability of Dorper sheep

Survival rate

Based on the data obtained within six months from flock monitoring, the average pre weaning mortality of the Dorper sheep lamb was 2.93%. As the result indicated that the pre weaning mortality rate was highest in Siltie (2.20) and female (2.20) than in Wolaita (0.73) and male (0.73). Unlike other improved sheep breed, Dorper sheep breed has good adaptation under different climatic conditions. Thus farmers should be encouraged to use the breed for crossbreeding with the native or local breeds.

Fast growth

Moreover, fast growth of Dorper sheep as indicated 44.4, 37.5 and 29.2% in Damot Gale, Damot Sore and Mirab Azernet, respectively, followed by easy to manage, 33.3, 25.0 and 39.6% in Damot Gale, Damot Sore and Mirab Azernet made reasons to future expand of improved sheep breed.

Feeding habit

Discussion with key informants and flock holders in two zones showed that farmers appreciate the capability of Dorper to produce lamb, as meat better than Adilo sheep, with minimum input. The fact is that, Dorper sheep are able to consume diverse feed source and plant species that cannot be easily consumed by local sheep: Like Crop residues (straw of wheat, teff, barley), *chat* leftover and pods and broken seeds of haricot bean), was mentioned as the amazing desirable feature of Dorper sheep breed.

DISCUSSION

Age at first lambing

A total of 27 ewes were assessed for their life histories in the study area. Age at first lambing (AFL) varied by location and season, although observed differences were not significant (P>0. 05) level of significance (Table 2). Age at first mating is influenced by genetics. The current finding of least square means age at first lambing of

Table 2. Least square means and standard errors for age at first lambing, sexual maturity (in month) and litter size of ewe Dorper sheep.

Source of variation	N	Age at first lambing LSM(±SE)	Sexual maturity LSM (±SE)	Litter size LSM (±SE)
Overall	27	11. 81 ±1.37	5. 00±0.74	1.48±0.71
Location		NS	NS	NS
Siltie	18	11.77±0.51	5.16±0.27	1.50±0.26
Wolaita	9	11.89±0.70	4.66±0.38	1.44±0.36
Season		NS	NS	NS
Dry season	10	12.20±0.60	4.90±0.32	1.20±0.31
Small rainy season	5	11.60± 0.77	5.40±0.42	1.40±0.40
Big rainy season	12	11.58±0.00	4.91±0.29	1.75±0.54
Blood group		**	NS	NS
50% cross of Dorper	13	11.07±0.53[a]	4.84±0.28	4.88±0.27
25% cross of Dorper	14	12.50±0.65[b]	5.14±0.36	4.96±0.26

Means within each subclass with different superscript (a,b) letters differ significantly (P<0.05); NS, non significant.

Dorper sheep, 11.81 months was comparable with the previous reports of 12 months (Tsegaye et al., 2013) in Ethiopia and 11.5 months of ewe sheep of Dorper (Fourie et al., 2009). There is micro difference existed due to difference in production systems and climate.

Sexual maturity

Sexual maturity was recorded. The current finding of least square means sexual maturity of Dorper sheep, 5 months was comparable with the previous reports of Budai et al. (2013) and Cloete et al. (2000).

Birth and weaning weight

Location, season, sex, birth type, parity and blood group had no influence on birth weight and observed no differences were significant (P> 0. 05) level of significance. The mean birth weight obtained in this study, 2.25 kg was comparable with Berhanu and Aynalem (2009) of indigenous sheep. However, Gavojdian et al. (2013) reported 3 and 3.5 kg for crossed and pure Dorper sheep. This reflects that the variation of blood group and production systems. Births in the late dry and small rainy seasons could be disadvantageous due to poor quality and limited quantity feed, especially as little supplementary feeding is practiced in the studied areas. Mean weaning weight of Dorper sheep found in the present study, 17.30 kg was comparable to 18.2 kg for Dorper sheep (Cloete et al., 2000). The present result was lower than previous result of Daniel and Held (2005) reported weaning weight of 33. 4 kg under intensive production systems, this variation is due to difference in production system.

Market weight and age

Since Dorper sheep breed growth fast, it attains optimum market weight in short period of time in mid attitudes and semi intensive production systems. Majority of the farmer's sale their animals early before attaining optimum market weight was reported by Getahun (2008). The mean market weight and market age of current study of Dorper sheep breed was 30.68 kg and 12.66 months, respectively. The current finding of market weight was lower than the report of 36 for female crossed and 70 for male pure Dorper sheep (Fourie et al., 2009). Market weight and market age were affected by birth type and blood group. Parity and location also had significant on market age of lamb. Season had significant on market weight. In Siltie zone, Dorper lamb reached market age at 12.87 months, which was significantly higher (P<0.05) than those in Wolaita zone, 12.05 months.

Housing systems

Housing system for sheep depends on the management systems. In the Mrab Azernet district, the system of house used separate house for their sheep is different from that of Wolaita of Damot Gale and Damot Sore districts, used main house. Discussion with key informants and field observation in the area revealed that the materials used for housing also vary according to the economic status of the family. Dorper sheep are kept in house during night to protect them from predators, theft and abrupt climatic changes.

Adaptability of Dorper sheep

Dorper sheep are able to consume diverse feed source and (straw of wheat, teff, barley), *chat* leftover and pods and broken seeds of haricot bean), was mentioned as the amazing desirable feeding habit of Dorper sheep breed, uncommon on Adilo sheep and comparable with the study of (Ermias, 2014). As this result, the breed gain adaptation through feeding mechanisms. And pre weaning mortality of the breed was higher than the previous study of 13.5 of Adilo sheep (Belete, 2009). The difference is due to Dorper sheep breed consume all feed source unlike that of Adilo indigenous sheep breed.

CONCLUSIONS AND RECOMMENDATIONS

Dorper sheep crosses had better reproductive performance than indigenous sheep breed of Adilo especially in weaning weight and market weight even though it has similar sexual maturity and litter size. The high survival rate of the breed indicates high adaptation through the unique feeding habit in addition to less disease load. The study also pointed out the non genetic factors has significant effect, especially housing Dorper sheep in separate house was good practice.
In view of the above, the following recommendations were suggested;

1. Housing Dorper sheep in separate house was good practice, so sharing the practice for the others through training, experience share and field trip should be needed
2. In Siltie zone, there should be adequate supply of improved 50% cross of Dorper sheep breed with least cost to farmers because of in the area there was awareness on the breed.
3. Further study is needed to measure body weight, identifying economically important diseases, characterize meat quality and carcass yield percentages from locally available feeds of Dorper sheep in the area.

Conflict of Interest

The authors have not declared any conflict of interest.

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Appendixes

Appendix I: Flock monitoring format

Flock dynamics follow-up format									
Breed/class	**Inventory (Number)**	**Monitoring 1 Date**						**Monitoring 2 date**	**Monitoring 3 date**
		Birth			**Purchased (number)**	**Sold (number)**	**Died (number)**		
		Single	**twin**	**triple**					
Local									
Ewe									
pregnant									
suckling									
dry									
ram									
lambs									
<3month									
3-6month									
7-12mont									
Exotic									
Ewe									
pregnant									
suckling									
dry									
ram									
lambs									
<3month									
3-6mont									
7-12mont									
Crosses									
50/75%									
Ewe									
pregnant									
suckling									
dry									
ram									
lambs									
<3month									

Appendix I: Contd.

3-6mont														
7-12mont														

Appendix 2: Lamb weight

Lamb weight monitoring format

Farmer name: _____

Wereda:_____

Zone: _____

Ewe name	Breed	Parity	Lambing date	Birth Type	sex	Weight							
						date	kg	date	kg	date	kg	date	kg
Ewe #1													
Ewe #2													
Ewe #3													
Ewe #4													
Ewe #5													
Ewe #6													
Ewe #7													

Appendex 2. Lamb weight

Ewe #8

Ewe #9

Ewe #10

Type : single, twin, triple

Appendix 3. Life histories questionnaires for breeding females

1. Name of the owner
2. Name of the ewe
3. Does she have ID?
4. Tag No. of the ewe
5. When did you get? How (purchased, from research centers)?
6. Age of the ewe when acquired
7. Was she born in your flock or did you get from somewhere else?
8. How many lambs did this ewe deliver up to now? (The complete number, alive as well as dead ones) a) at the first_____
   b) At the second_____
   c) At the third _____
9. At what age did she give birth for the first time? (Age in months)
10. The month and year of first lambing, second, third_____
11. Does the animal have any problems like udder abnormalities, mastitis, poor milk let down of else? If yes, for which problem you could account for?
12. Does this animal have any abortions?
    a. If yes, how many and before which lamb did they occur?
    b. Where those early or late abortions?
13. Did this animal ever show difficulties to conceive? a. yes b. no
14. If yes, what do you think was the reason?
15. Is the ewe now pregnant and since how many months?