On-farm reproductive performance of local ewes and their crosses with Awassi in the cool highlands of eastern Amhara region

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Abstract

The objective of this study was to evaluate reproductive performance of local ewes and their crosses with Awassi under farmers' management. The study was implemented in three villages (South Wollo, Menz and Chacha) in the cool highlands of the Amhara region, Ethiopia. Crossbred rams (75% Awassi x 75% Menz) were borrowed to a group of farmers and they agreed with signature to use a ram in rotation both within and among groups of farmers. Age at first lambing in Chacha (490.43 days) and Wollo (470.89 days) was significantly lower than in Menz (592.43 days) while the first two were not different ($p>0.05$) from each other. Local genotypes had significantly lower age at first lambing than Awassi x Local crossbred in all locations. Lambing interval was affected ($p<0.05$) by location and genotype of the ewe. The shortest lambing interval was found in Wollo followed by Chacha and Menz. Local breeds had shorter ($p<0.05$) lambing interval than Awassi crossbreds in all locations. Whereas, in south Wollo Corriedale x Local crossbred ewes had similar lambing interval with Local breeds. Ewe postpartum weight was significantly ($p<0.05$) affected by location, genotype and their interaction. The largest ewe postpartum weight was in Wollo (28.46 kg) followed by Chacha (27.12 kg) and Menz (23.87 kg). Number of lambs born per ewe was affected ($p<0.05$) by location and genotype. Wollo ewes had the highest number of lambs born per ewe (1.58) followed by Chacha (1.49) and Menz (1.39). Local ewes were able to produce higher number of lambs per year than Awassi x Local crossbred ewes. Number of lambs born per ewe per year of Corriedale x Local crossbred ewes in South Wollo was 1.66 which was similar ($p>0.05$) with Local ewes whereas higher ($p<0.05$) than AwassixLocal crossbred ewes. The variation in reproductive performance among locations and farmers indicated the importance of delineating crossbreeding areas depending on the exiting environmental situation and farmers' capacity. Developing appropriate exotic blood level for each area and devising alternative crossbreeding system that enables use of Local and Corriedale x Local crossbred ewes as dam line should also be taken into consideration.

Key words: Awassi, crossbred, ewe, local, reproductive.

Introduction

Short fat tailed sheep breeds (Menz, Wollo, Tikur and Farta) predominantly found in the cool highlands of eastern Amhara region has contributed about 20% and 60% of the total

sheep population in the country and in the Amhara region, respectively (Solomon, 2008). The breeds are well adaptive to the environment and research result indicated that they are able to give three lambing in two years (Abebe, 1999; Tesfaye, 2008; Tesfaye, 2008). However, these sheep breeds have slow growth rate than other breeds with mature body weight of about 25 kg and very low twinning rate (Solomon, 2008); as a result, it is difficult to achieve fast return from them. Crossbreeding based on improved sire breed having better productivity is the most rapid way of improving productivity of local flocks.

Among many exotic breeds of sheep, Awassi sheep breed is an important genetic resource that plays a significant role in sheep industry as an improver breed in more than 30 countries besides the countries of its origin (Galal *et al.,* 2008). The Awassi sheep is a predominant dual-purpose, fat-tailed sheep breed of the Middle East. This sheep is well adapted to the harsh condition especially those related to scarcity of feed availability and high environmental temperatures. Similarly, Corriedale is another improved exotic sheep breed which was developed in New Zealand and Australia during the late 1800s' from crossing Lincoln Leicester rams with Merino females. The Corriedale is a dual-purpose sheep and was introduced to Ethiopia to improve meat and wool of local sheep breeds. A crossbreeding project using high grade Awassi and Corriedale sire is currently underway in the highlands of Ethiopia in three different locations to improve meat and wool production of native sheep breeds. Production performance is reflected by a combined effect of reproductive efficiency, growth rate and quality of the final product. Increasing the number of lambs marketed per ewe and per year is a major way to improve the efficiency of meat production in sheep. Evaluating the performance, particularly related to reproduction of crossbred animals at each stage of the project is essential. So far reproductive performances of crossbreds under farmers' situation are not evaluated. Thus, this paper is aimed at evaluating the reproductive performance of indigenous and crossbred ewes in different locations under farmers' management.

Materials and methods

Community-based sheep crossbreeding activity has been started and being implemented since 1998 in three villages, Chiro (Sowth Wollo) and, Sinamba and Chacha (North Shewa) administrative zone. The sites were selected based on their potential for sheep production and high dependency of farmers on sheep production. In this crossbreeding scheme, high grade exotic crossbred (3/4 Awassi x 1/4 Menz and ≥3/4 Corriedale x ≤1/4 Menz) rams were used to cross the indigenous sheep breeds of village flocks. The Awassi crossbred rams were distributed in all sites while Corriedale crossbred rams were distributed only to the Chirro site. The crossbred rams were borrowed to a group of farmers in selected villages. A group of farmers agreed with signature to use a ram in rotation both within and among groups. Farmers were responsible for the use and care of a ram given to them. An enumerator was recruited and trained for data collection and to facilitate ram utilization. A research team from the research center visited the area in three months interval to monitor and evaluate the progress. Unwanted ram lambs (local and crossbred having lower blood level than the distributed rams) were castrated or disposed before breeding age in order to control indiscriminate mating, while crossbred ewe lambs were maintained and backcrossed with the improved ram. Data on pedigree, birth, growth, reproduction and off take were collected regularly. All sheep were de-wormed twice a year against internal parasites. Vaccination was also carried out for common diseases based on the recommendations.

Data on reproductive performances collected from a total of 71 farmers (26 in Chiro, 18 in Chacha and 27 in Sinamba) were used in this analysis. Data were collected from 1998 to 2004. During the crossbreeding process, crossbred having different blood levels were produced. For the analysis of the reproduction data, genotype of the sheep was categorized as Local, Awassi x Local and Corriedale x Local crossbred. Crossbred ewes having 37.5% and above exotic blood level were considered as crossbred and those ewes having less than 37.5% exotic blood level were excluded from the analysis as they were few in number. Data on reproductive performance were analyzed using GLM procedure of SAS version 9.1 (SAS, 2003). In the analysis, genotype and location were fitted as class variables and the

reproductive performances as dependant variable. Within location analysis was also implemented for all locations by fitting genotype as class variable. When significant, means were separated using adjusted Tukey-Karmar test.

Results and discussion

Age at first lambing, lambing interval, ewe postpartum weight and number of lambs born per ewe per year by location, genotype and by genotype within location are presented in Table 1. Age at first lambing was significantly ($p<0.05$) affected by location, genotype and the interaction of the two. Age at first lambing in Chacha (490.43 days) and Wollo (470.89 days) was significantly lower than in Menz (592.43 days) while the first two were not different ($p>0.05$) from each other. Local genotypes had significantly ($p<0.05$) lower age at first lambing than Awassi x Local crossbred in all locations. In South Wollo, age at first lambing of Corriedale x Local crossbred ewes was found in between Local and Awassi x Local crossbred ewes with no clear separation of means. They were not different ($p>0.05$) from both Local and Awassi x Local crossbred ewes.

Lambing interval was affected ($p<0.05$) by location and genotype of the ewes. The shortest lambing interval was found in ewes of Wollo followed by Chacha and Menz. Local breeds had shorter ($p<0.05$) lambing interval than Awassi crossbreds in all locations. Whereas, in south Wollo Corriedale x Local crossbred ewes had similar lambing interval with Local breeds.

Ewe postpartum weight was significantly ($p<0.05$) affected by location, genotype and their interaction. The largest ewe postpartum weight was in Wollo (28.46 kg) followed by Chacha (27.12 kg) and Menz (23.87 kg). Ewe weight at postpartum for Locals and Awassi x Local crossbreds was 24.5 and 27.8 kg, respectively. Generally, Awassi x Local crossbred ewes had higher weight at postpartum than locals.

Within location comparison also indicated that Awassi x Local crossbreds had higher ewe postpartum weight than their local contemporaries in all locations. In South Wollo, post

partum weight of Corriedale x Local crossbred ewe was found in between local and Awassi x Local crossbred ewes.

Number of lambs born per ewe was affected ($p<0.05$) by location and genotype. Wollo ewes had the highest number of lambs born per ewe (1.58) followed by Chacha (1.49) and Menz (1.39). When considering the genotype, Local ewes produced higher number of lambs per year (1.57) than Awassi x Local (1.34) crossbred ewes. Number of lambs born per ewe per year of Corriedale x Local crossbred ewes in South Wollo was 1.66 which was similar ($p>0.05$) with Local ewes, whereas higher ($p<0.05$) than Awassi x Local crossbred ewes. Again the number of lambs born per ewe for Awassi x Local ewes in South Wollo was similar ($P>0.05$) with Local ewes in Chacha and Menz. In all locations, age at first lambing, lambing interval, ewe postpartum weight and number of lambs born per ewe per year varied from farmer to farmer (result not presented here). We also observed that farmers in South Wollo gave more attention for their sheep.

Discussion

Age at first lambing for local breeds in all location and Corriedale x Local and Awassi x Local crossbreds in South Wollo were in the range of 446.2 to 528.6 days. This generally seemed to be similar with that reported in tropical traditional systems which are between 446 and 572 days (Galina *et al.,* 1996) and improved breeding conditions between 431 days and 572 days (Armbruster *et al.,* 1991). Lambing interval found in this study for local, Awassi x Local and Corriedale x Local crossbred ewes ranged from 228 to 252 days is fairly comparable with that of Mexican Black belly and Pelibuey breeds which are 230 and 254 days, respectively (Galina *et al.,* 1996) and Menz sheep breed 253 days (Mukasa-Mugerwa *et al.,* 1994).

Table 1. Least square means (SE) of the effect of location and genotype of the reproductive performance in three locations under farmers' management.

Effect	N	LI (days)	N	AFL (days)	N	EPPWT	N	NLBEY
Location		*		*		*		*
Chacha	984	258.01(2.80)[a]	139	490.43(7.96)[a]	2194	27.12(0.13)[a]	906	1.49(0.02)[a]
Wollo	739	242.33(2.61)[b]	61	470.89(12.16)[a]	1682	28.46(0.22)[b]	667	1.58(0.02)[b]
Menz	1259	274.09(2.80)[c]	177	592.43(7.76)[b]	2329	23.87(0.16)[c]	1243	1.39(0.16)[c]
Genotype		*		*		*		*
Local	2716	243.26(1.09)	265	479.20(6.16)	5504	24.50(0.05)	2567	1.57(0.01)
Awassi	145	285.64(4.55)	112	556.64(9.09)	443	27.80(0.18)	137	1.34(0.03)
CV (%)		21.88		17.31		14.86		19.83
				Within location comparison				
Chacha		*		*		*		*
Local	904	242.69(1.80)	91	456.86(8.79)	1961	25.92(0.08)	833	1.57(0.01)
Awassi	80	290.49(6.04)	48	656.31(15.19)	233	28.32(0.22)	73	1.31(0.27)
CV (%)		21.91		17.48		13.06		20.09
Menz		*		*		*		*
Local	1223	259.12(1.16)	133	528.55(8.74)	2194	21.53(0.07)	1207	1.47(0.30)
Awassi	36	304.83(9.39)	44	724.95(14.44)	135	24.95(0.27)	36	1.24(0.27)
CV (%)		21.64		17.99		14.68		20.44
Wollo		*		*		*		*
Local	589	228.32(2.12)[a]	41	446.22(14.12)[a]	1349	26.00(0.13)[a]	527	1.66(0.01)[a]
Corriedale	121	229.73(4.67)[a]	32	491.47(15.98)[a,b]	258	29.82(0.30)[b]	112	1.65(0.03)[a]
Awassi	29	252.03(9.53)[b]	30	518.10(16.10)[b]	75	31.73(0.56)[c]	28	1.51(0.06)[b]
CV (%)		22.37		14.61		18.09		18.24

N = number of observation, LI = Lambing interval, AFL = age at first lambing, EPPWT = ewe post partum weight, NLBEY = number of lambs born per ewe per year; * = significant at p = 0.05, means with different subscript within a column are statistically different ($p<0.05$).

Number of lambs born per ewe per year found in this study for Awassi x Local crossbred ewe in Menz and Chacha area was lower than the value reported for Mexican Black belly and Pelibuey breeds (1.37 and 1.55, respectively) (Galina *et al.,* 1996). However Local breeds in Menz and Chacha and Awassi x Local in South Wollo gave comparable results; Local and Corriedale x Local sheep genotypes in South Wollo gave higher result from the above report.

Generally, reproductive performance is affected by both genetic and environmental factors. In this study, Local breed had better age at first lambing, lambing interval and number of lambs born per ewe per year than Awassi x Local crossbred ewes in all locations. However in South Wollo, Corriedale crossbreds showed comparable performance with Local ewes. Regarding location, ewes in South Wollo showed better performance than ewes in Menz and Chacha. For example, lambing interval for Awassi x Local crossbred ewes in South Wollo (252 days) was comparable with Local breed in Chacha and Menz 243 and 259 days, respectively. This performance could allow three lambing in two years which is a character of productive ewes in terms of lambing interval. This pointed out that in better environment and management Awassi x Local crossbred ewes could also perform comparable to Local breeds in terms of reproductive performance. Better performance in South Wollo might be due to the combined effect of Local genotype, better environment and good farmers' management. Genetic potential for early puberty reported for Awassi ewe lambs in Baghdad (424 days) has suggested the breed's good potential for reproduction (Younis et. al., 1978). In contrast to this, in unimproved Awassi flocks, the ewes lamb for the first time at the age of two years or more (Epstein, 1982). This wide range of variability in reproduction performance indicated the higher effect of management on this trait which is also reported by many authors (Kremer *et al.,* 2009; Mokhtari *et al.,* 2010). Furthermore, low heritability for reproductive traits had been reported in many literatures (Mokhtari *et al.,* 2010; Selvaggi *et al.,* 2010) indicating that more focus should be given on improving the environment like ewe nutrition before mating, during late pregnancy and early lactation for the improvement of reproductive performance. Inbreeding depression is higher for traits of low heritability than the highly heritable traits.

Thus, the use of limited number of crossbred rams in this project might also contribute for the lower reproductive performance of crossbred ewes. However the effect of inbreeding in reproductive performance needs further investigation.

Conclusions

Local breed had better age at first lambing, shorter lambing interval and higher number of lambs born per ewe per year than Awassi x Local crossbred ewes in all locations. However, in South Wollo, Corriedale crossbreds showed comparable performance with Local ewes. Regarding location, ewes in South Wollo showed better performance than ewes in Menz. This study revealed that in better environment and management, Awassi x Local crossbred ewes could also perform as comparable as Local breeds in terms of reproductive performance. The variation in reproductive performance among locations and farmers observed in this study indicated that the importance of delineating crossbreeding areas and developing appropriate exotic blood level for each area. Furthermore, devising alternative crossbreeding system which allows the use of pure Local and Corriedale x Local crossbred genotypes as dam line is imperative for the success of the crossbreeding program.

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