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**ARTICLES**

- |  |           |
|--|-----------|
| <b>History, status and use of equines in the West African Republic of Gambia</b><br>R. Trevor Wilson   | <b>57</b> |
| <b>Improving live body weight gain of local sheep through crossbreeding with high yielding exotic Dorper sheep under smallholder farmers</b><br>Weldeyesus Gebreyowhens, Mengistu Regesa and Awet Esifanos | <b>67</b> |

Review

# History, status and use of equines in the West African Republic of Gambia

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**Gambia is the smallest country on the African mainland and is one of the poorest. Agriculture contributes about 23.6% of the national Gross Domestic Product, mainly from crop production. Cattle are the most important livestock species and oxen originally provided most of the draught power. In the fifteenth and sixteenth centuries, horses were traded by the Portuguese with local inhabitants for slaves and then used by the latter as cavalry in local wars. In the nineteenth and early twentieth centuries, equines were of little importance. From the mid twentieth century, however, both horses and donkeys rapidly increased in numbers and became the main providers of animal traction for agricultural work and general transport. Trypanosomosis is the main disease but other diseases also constrain the output of equines. Management of the equine resource is poor in terms of nutrition, health and housing. Poor welfare is also a major problem but there are some attempts by a local charity to improve this through provision of basic services and training of farmers and veterinary personnel.**

**Key words:** War horses, animal traction, donkey, horse, trypanosomosis.

## INTRODUCTION

The Republic of Gambia, is located in West Africa between latitudes 13 and 14°N and longitudes 13 and 17°W. With a total area of 11,300 km<sup>2</sup>, it is the smallest country on the African mainland. The country comprises a narrow strip of land 25 to 50 km wide and 475 km long (CIA, 2016). Gambia River runs through the longitudinal length of the country before debouching into the Atlantic Ocean. The unusually small size and idiosyncratic shape of the country are due to territorial compromises arising from 19th-century Anglo-French rivalry in Western Africa. Following almost 200 years as a British colony, Gambia gained its independence in 1965. Some 11.5% of the country is water, the terrain is generally low lying and subject to flooding but with low hills away from the river.

The climate is tropical with a hot rainy season lasting from June to November and a cooler drier season extending from November to May. Other than a very short coast line, Gambia is entirely surrounded by Senegal (CIA, 2016).

The human population of Gambia in 2015 was about 1.9 million. The density of 190 people/km<sup>2</sup> means Gambia is one of the most densely populated countries in Africa. About 43% of people live in rural areas. The Gross Domestic Product of US\$ 851 million equates to less than US\$ 500/person/year, placing Gambia high in the ranks of the poorest countries in the world. The economy relies on tourism, agriculture (23.6% of GDP) and remittances. Groundnuts, rice and palm oil are the main crops, fish is

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harvested from the sea and livestock provide meat, some milk and power for agricultural and transport applications (UNSD, 2015).

## MATERIALS AND METHODS

This paper is based on extended periods of residence in Gambia by the author and on a review of literature.

### Use of horses in the fifteenth to nineteenth centuries

The Gambia River was first explored by Europeans in the mid fifteenth century. In 1456, the Portuguese exchanged items that were of little value in their eyes for gold at Cantor (modern Kontaur) some 250 miles upstream from the river mouth (Gomes, 1937). One African ruler farther to the east was reputed to have a pile of gold (presumably ore) so large that he tied his horse to it (Gomes, 1937). Towards the end of the fifteenth and during the sixteenth centuries, the Portuguese found it profitable to trade horses for gold as well as for slaves. Many of the Portuguese trade horses were bred in the Cape Verde Islands off the Coast of Africa (Elbl, 1991). The Wolof Empire between the Senegal and Gambia rivers as well as the Mali Empire to the east dominated the local area by the use of horse cavalry to carry out very quick raids on local villages in order to capture slaves for working on their plantations or for further trading. This necessitated a regular supply of horses to replace those that very soon died in the harsh environment and from the effects of trypanosomosis (Elbl, 1991; Law, 1980). An indication of the importance of horses can be gauged from their value in the 1450s when one animal was traded for 10 to 15 slaves and a ship carrying ten horses made a profit of 500 to 700% (da Cadamosto, 1937). In the second half of the fifteenth century the local Wolof people had some 8000 cavalry that was much more effective than previously by the adoption of stirrups, thus allowing more freedom to fling spears than was possible when riding bareback (Gomes, 1937). There was also a good supply of horses, generally bigger than Portuguese ones, from Arab sources trading salt and slaves across the Sahara (Law, 1980).

Mungo Park, who travelled extensively along the Gambia River at the end of the eighteenth and beginning of the nineteenth centuries, noted that he was accompanied by 200 horsemen from Kaarta in 1796 (Park, 1799). He noted that the Moors (from what is now Mauritania, 300 km north of Gambia) were very good horsemen. They rode without fear and their saddles with high pommels and cantles (Figure 1) provided a very secure seat. The greatest pride and one of the principal amusements of the Moors was to put their horses to a full gallop and then stop with a sudden jerk so as frequently to bring the animal down on his haunches. Important people never walked (except when going to pray) and always, even at night, kept two or three horses ready

saddled close to the tent. A very high value was placed on their horses as it was by superior fleetness that they were able to make predatory excursions to capture slaves. Horses were fed three or four times a day and generally with fresh milk in the evening (Park, 1799).

The Moorish cavalry were well mounted and very expert in skirmishing and attacking by surprise. Each soldier provided his own horse and accoutrements that comprised a large sabre, a double-barrelled gun, a small red leather bag for holding his balls and a powder bag. He was not paid and his remuneration arose from plunder. The horses were very beautiful and so highly esteemed that a native prince would pay from twelve to fourteen slaves for one horse (Park, 1799).

Donkeys were not only important to Park (1799) but also in the local economy. Park started his journey with one horse and two donkeys. Over several months donkeys were lost, stolen or confiscated and he generally had problems with them. On one occasion he bought a small but very hardy and spirited horse, which cost the value of £710s, and two asses for his interpreter and servant. Several references were made to the stubborn nature of the donkey. On one such, a very refractory donkey was subject to "a curious method to make him tractable". A forked stick had the forked part placed in the mouth, like the bit of a bridle, with the two wings tied together above the head leaving the lower part of the stick to strike against the ground should the ass attempt to put his head down. Consequent on this the ass walked quietly and gravely enough, taking care after some practice to hold his head sufficiently high to prevent stones or tree roots from striking the end of the stick, which experience had taught him would give a severe shock to his teeth. Getting horses across a stream was relatively simple. The ferryman held the steadiest by a rope, led it into the water and paddled the canoe out upon which the others, being pelted and kicked on all sides, unanimously plunged into the river and followed their mate. It was more difficult with asses as their disposition made them endure much pelting and shoving before they ventured into the water and often on reaching mid-stream, some would turn back in spite of every exertion to get them forwards. Local people usually travelled on foot, driving their asses before them. Caravans were taxed by local worthies according to the number of loaded asses in them. Donkey loads were very varied including local produce, salt and ivory. In the last case, the larger tusks were carried in nets, two on each side of the animal, whereas smaller ones were wrapped in skins and secured with ropes (Park, 1799).

## HORSES AND DONKEYS IN THE TWENTIETH AND TWENTY-FIRST CENTURIES

### Numbers

The 1909 livestock census carried out by the colonial



**Figure 1.** A Moorish saddle of the type described by Park in his "Travels" (Park, 1799).

authorities reported national populations of over 1,500 horses and 4,000 donkeys (Colonial Secretary, 1909). There do not appear to be any other data on numbers until 1961.

Cattle are important not only for meat production but also for providing draught power in support of crop operations: numbers increased from about 150000 in 1961 to 432000 in 2009 and then fell to 380000 in 2013. Goat numbers were 98000 in 1961, rose to 380000 in 2009 and then fell to 320000 in 2013. A total of 80000 were in the country in 1961, this number rising in a fluctuating manner to 251000 in 2010 and then falling to 150000 in 2013 (FAO, 2014). As Gambia is a Muslim country (it became formally an Islamic Republic in 2015) pigs are of lesser importance with only 3000 head in 1961, rising to 28000 in 2010 and then reducing to 7000 in 2013. There were 190000 domestic fowl in 1961 which through a generally steady increment rose to 1.3 million birds in 2013: ducks and Guinea fowl are very minor poultry species (FAO, 2014).

Donkey numbers increased steadily from 3000 in 1961 to 45000 in 1985, then levelled off until about 2008 when there was a surge in the population to 60000 in 2013.

Horses numbered 1000 in 1961, rose to 17000 in 1996 then levelled through to 2003 before, as for donkeys, undergoing a massive upsurge to 41000 in 2008 followed by an unexplained decline to 20000 in 2013 (Figure 2) (FAO, 2014).<sup>1</sup>

In 1987 some 23% of 'dabada' reported having horses with 52% having donkeys. Average horse numbers per owning 'dabada' ranged from 1.0 to 1.8 in different parts of the country whereas the number of donkeys ranged from 1.4 to 2.2 (Sowe et al, 1988).<sup>2</sup> Sex ratios (male:female) were about 1.0:1.0 for horses and 1.0:1.1 for donkeys. Foaling rates for each species are about 25% per year. Heavy mortality in both species indicates that increases in numbers are from imports from Senegal as, based on vital parameters, the national population is not self-sustaining (Sowe et al., 1988).

<sup>1</sup> It should be noted that the 1961 numbers for both donkeys and horses are the same as provided by the Colonial Secretary in 1909. In general (and not only for The Gambia) FAO data on livestock numbers can appear bizarre.

<sup>2</sup> A 'dabada' is defined as the farm production unit in which two or more individuals (within the same compound) cultivate farms outside the communal farm for their own individual needs.



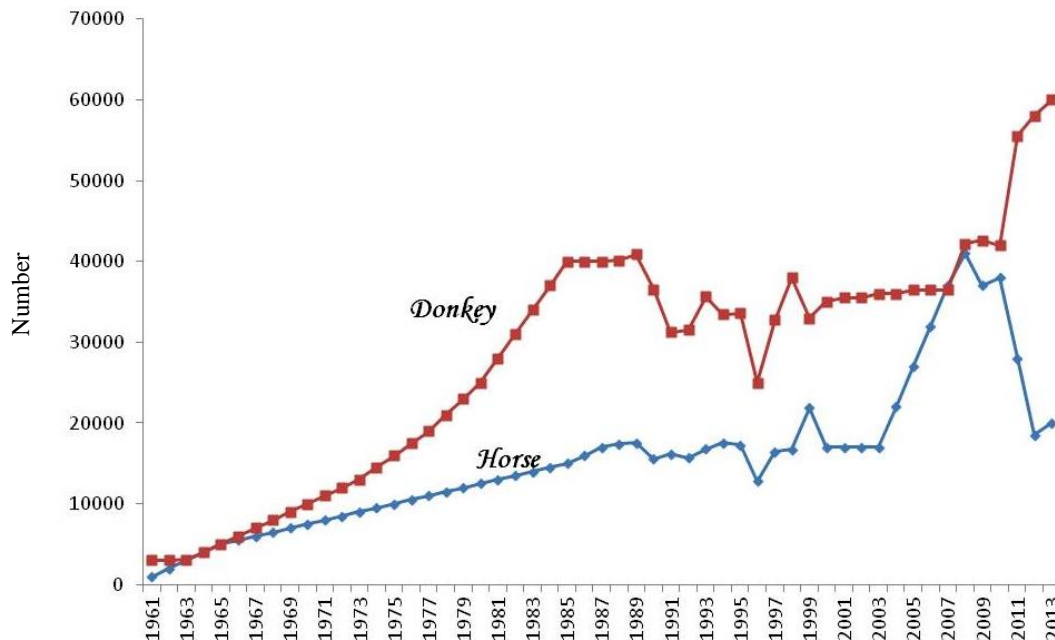


Figure 2. Horse and donkey number in the Gambia, 1961-2013 (FAO, 2014).

### Draught and transport

Draught animal power is critical to increased productivity of land and labour and therefore to sustainable agricultural production in the low input systems of Gambia. Equines, donkeys and horses combined, constitute 74% of the draught animal population in Gambia with the remaining 26% being oxen. There is a growing trend of horses and donkeys being increasingly used in areas to the south of their traditional area of use. This will lead to major changes in the subhumid zones mixed crop-livestock production systems (ITC, n.d.).

Gambia began promoting animal traction in the 1950s in order to increase crop production by small-scale farmers. By the mid 1980s, some 63% of farming units used some form of animal traction. Farmers often had difficulty in purchasing a pair of oxen, however, and the number used for draught has remained largely static over many years. Until the beginning of the 1990s, the use of donkeys for animal traction increased rapidly because of the low cost, the availability of light implements developed in Senegal and the advantage of using a single donkey to perform many of the necessary farm operations (Sowe et al., 1988; Sumberg and Gilbert, 1988).

In a 1990 sample of 2411 'dabada' on the North Bank of the river, some 71.4% used animal traction with 41.2% of these using cattle, 55.4% donkeys and 32.3% horses. Cattle were invariably used in pairs whereas equines were usually used singly. Only 9% of 'dabada' employing cattle for draught used cows whereas 32% used female donkeys and 29% used female horses (Sowe and Reed,

1993). In neighbouring Senegal, equines are preferred to cattle for draught work not only because only one animal is used but also because they work at a faster speed (Dugué and Dongmo, 2004) and it seems likely that this is also the Gambian philosophy.

Both species are used in crop operations including land preparation with a tiller (Figure 3), planting whereby a seedbox is attached to a tiller (Figure 4), weeding and carting the crop and its by-products from field to farm. Donkeys need a second person, usually a child or a woman, to lead them whereas horses are controlled by one person using a long rein. Harness comprises a breast band of local, usually inappropriate manufacture and material, and rope traces from the breastband to the implement.

In addition to field and farm work both species of equine are widely used in general rural and urban transport operations. In this role, they usually pull a 2-wheel cart (Figures 5 and 6) and carry a variety of goods and also act as taxis in the transport of people. Once again the harness is less than satisfactory although it does include a breeching strap which is unusual in the African context. Less commonly both species are used as pack animals (Personal observation). A new and albeit limited use of horses is to provide rides for tourists on the beaches south of the capital of Banjul (Figure 7). The saddle and bridle in this context are of the standard English type.

Gastrointestinal and external parasites are a major constraint to the performance of equines. In one study in a sample of 173 donkeys it was found that 83.2% of the animals were hosts to internal parasites. Principal among



**Figure 3.** Donkey drawn cultivator opening up land near Touba, The Gambia, late July 2014 (note simple harnessing and need for an assistant operator).



**Figure 4.** Horse drawn cultivator with seeding attachment for dual operation, near Touba, Gambia, late July 2014.



**Figure 5.** Donkey carts waiting for trade at Birikama market, mid August 2014.



**Figure 6.** A horse being exercised ready for tourist rides on the beach at Kololi, south of the capital, mid July 2014.



**Figure 7.** A horse cart at Soma in the suburbs of the Gambian capital, July 2014.

these were strongyles (81.5% infection), *Parascaris* species (9.2%), *Strongyloides* species (4.0%), and *Oxyuris* species (0.6%) (Mattioli et al., 1993). Cases of rectal prolapse caused by massive infections of horse bot fly (*Gasterophilus* species) larvae have been recorded (GHDT, 2014). Other species of Oestridae and Tabanidae are also a nuisance due to blood sucking and general disturbance.

Tsetse fly is the vector of trypanosomiasis. In the past the presence of tsetse was the major inhibitor of the equine population in Gambia (Mattioli et al., 1993). Habitat destruction (clearing for cultivation and wood cutting for fuel) coupled to many years of low rainfall have rendered the environment less suitable for tsetse and resulted in a reduced trypanosome challenge for equines (Mattioli et al., 1993). The use of prophylactics and curative treatments for trypanosome infections, although expensive, has also assisted the increase in equine populations in the country. In one study of 173 donkeys, 9.2% were diagnosed positive for trypanosome infections: *T. congolense* was the most prevalent parasite, followed by *T. brucei* and then *T. vivax* (Mattioli et al., 1993). In a more recent study using different techniques for parasite detection, 91% of 183 horses and 58 donkeys were found to be infected. For individual species 31% were infected with *T. congolense*, 87% with *T. vivax* and 18% with *T. brucei* with multiple species present in 43% of cases (Pinchbeck et al., 2008). The three species of trypanosome were also found in another study comprising 11 horses and 67 donkeys in which it

was also shown that, when exposed to a similar tsetse challenge donkeys are significantly less infected than horses (Faye et al., 2001). A retrospective study of 2113 horse and 172 donkey consultation records at a clinic for the period 1995 to 2002 at Sololo in the centre of the country was undertaken. "Trypanosome infection" accounted for 61% of all cases. Trypanosome infections were recorded in 63% of horses compared to 43% in donkeys. In both species infections were mainly due to *T. congolense* (64%) and *T. vivax* (32%). No differences were seen in the occurrence of infections in male or female donkeys but more female (67.8%) than male (60.7%) horses were infected. There were no differences in age infections in donkeys but more older (63.2% >1 year) than younger horses (54.5% <1 year) were infected. In both species, infection rates decreased during the rainy season of June-September. The results, based on farmer questioning, also showed they had a fairly accurate knowledge of the diseases affecting their equines (Dhollander et al., 2006).

Nearly all Gambian equines are reportedly seropositive to African Horse Sickness Virus (AHSV) (Mattioli et al., 1992; Oura et al., 2012). In a light trap study, species of *Culicoides* known or suspected as vectors of African horse sickness virus (AHSV) and bluetongue virus (BTV) comprised 83% of female captures with 65% being *C. imicola* or *C. miombo*. It is suggested that virus challenge from *Culicoides* vectors may be a factor in the health of Gambian horses and donkeys (Rawlings et al., 1998).

Several other diseases have been reported in Gambian



**Figure 8.** The welcome board of the Gambia Horse and Donkey Association at Touba village in the south of Gambia.

equines and there are undoubtedly others waiting to be recorded. Equine Infectious Anaemia (EIA), caused by a virus and transmitted mechanically by biting flies has been demonstrated in the serum of horses and donkeys in Gambia (Mattioli et al., 1992). Epizootic lymphangitis, a fungal disease due to *Histoplasma farciminosum*, is reported regularly from the country's veterinary clinics. An outbreak of strangles (*Streptococcus equi*) occurred in January 2014 in the donkey population of Sambel Kunda and surrounding villages which spread to the donkey herd of the Gambia Horse and Donkey Trust (GHDT, 2014). *Pythium insidiosum*, an oomycete pathogenic in mammals occurs mainly in tropical and subtropical areas and particularly in horses, dogs and humans (Gaastra et al., 2010). One case was recorded in a horse in Gambia in February 2013 (GHDT, 2014). Babesiosis, known in horses and donkeys as Equine Piroplasmiasis (EP), is usually caused by *Babesia caballi* or *Theileria equi* (formerly *Babesia equi*) or occasionally by both. It was searched for in a special study but no evidence of either species was found (Mellhuish, 2011).

### Welfare

In one of the poorest countries in the world and with many people chronically hungry it is no surprise that animal welfare is not a primary concern. Coupled to this are the relatively recent introduction of equines as work

animals and the lack of knowledge of owners about their charges. Symptoms of disease are not recognized, physical deformities are ignored and animals are often chronically malnourished. Concurrent to these "passive" problems are "active" ones of physical cruelty to animals including beating with sticks and clubs and attacks by their owners with sharp weapons.

The Gambian Horse and Donkey Trust (GHDT), established in 2002, is a charity working with owners to pioneer good husbandry and healthcare (Figure 8). It provides harness and equipment, undertakes farriery, performs dentistry and provides veterinary treatment at low cost. It also provides theoretical and practical training courses to owners and users in an attempt to educate them to be more conscient of animal needs and to provide better care for them. GHDT also supports training courses for government animal health assistants at the local veterinary school. There is no doubt that the trust has had a positive impact on the welfare of equines in the area in which it works. It should be understood, however, that it has limited funding and few personnel and its physical area of outreach is limited. There remains much to be done for the welfare of Gambia's equines.

### DISCUSSION

Equines, particularly donkeys, have increased in

popularity since the 1950s. It has been concluded (Starkey, 1986) that "during the period 1965 to 1985, donkeys changed from being of minor importance to their present status as the dominant draft animal in Gambia". The extent and rapidity of this change is illustrated as in a broad but detailed study of Gambian agriculture in 1972 to 1975 emphasis was placed on ox cultivation but there was only passing reference to equines (Dunsmore et al., 1976).

A number of widespread beliefs continue to exist about equines in Gambia. This "perceived wisdom" can be summarized as: in the past the use of equines was limited by trypanosomosis; horses and donkeys were relatively inexpensive and were not expected to survive over long periods, and low reproductive rates were the norm. The tsetse challenge undoubtedly declined in the second half of the twentieth century and continues to do so but it is believed that large numbers of equines are still imported from neighbouring countries and account in large part for the maintenance and increase of the Gambian resident populations. The predominance of males, older ages and physical condition of imported animals contributes to the poor reproductive performance and high mortality of the country's horses and donkeys. Management factors, however, are of equal or greater importance than the foregoing, including nutrition, work time, housing and health care.

The advantages of equines over oxen as work animals are multiple. They, and especially horses, work at a greater speed, can be used singly and work longer spells than oxen. In addition to the management factors to which allusion has already been made, equine performance could be greatly improved by provision of better harness. A clear example would be the replacement of the breastband with a collar. With the former the animal "pulls" its attachment as it works through its forelimbs only whereas with a collar the horse or donkey can use its hindlimbs to apply its force as it "pushes" the implement. Horses with collars can apply 50% more power to a task in a given time period than those with breastbands (Riddle, 2008). A major disadvantage of equines in comparison with oxen is that when retired from work they cannot be eaten (in the Gambian context) as cattle can (Sowe and Reed, 1993).

## CONFLICT OF INTERESTS

The author has no financial or personal relationships that could inappropriately influence or bias this paper.

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*Full Length Research Paper*

# Improving live body weight gain of local sheep through crossbreeding with high yielding exotic Dorper sheep under smallholder farmers

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The study was conducted in Hawzen and Hintalowagerat districts of Tigray region Northern Ethiopia with the objective of enhancing meat production performance of the local sheep through cross breeding with high yielding exotic Dorper sheep under smallholder farmers. Pure male Dorper mated with local sheep produced first and second generation with 50 and 25% blood level of Dorper, respectively. Farmer's research groups were established in both locations. The average live body weight of the 50% crossbred male and female sheep was 45 and 38 kg, respectively at adult age. The average live body weight of the adult male and female local sheep (highland) was 25 and 20 kg, respectively. On farm crossbreeding of Dorper (male) sheep with local sheep (female) improved body weight by 55% (male) and 53% (female) at yearly age. Smallholder farmers perceived that Dorper crossbred sheep are appropriate for meat production improvement. It is concluded that regardless of the black body color and the appearance short thin tail of the crossbred, Dorper sheep breed is the appropriate technology for enhancing meat production performance of the local sheep.

**Key words:** Crossbreeding, Dorper sheep, meat production, local sheep.

## INTRODUCTION

Sheep production dominates in almost all of the highland agroecology of Ethiopia. Indigenous sheep populations are adaptive to local environment and varied topographical features. It becomes an important economic activity under small hold farmer for household food security in all part of Ethiopia. Most of the indigenous sheep are reared under traditional production system for subsistence production as means of obtaining

meat, manure and cash (Hassen et al., 2004). They are a source of risk mitigation during crop failures, of property security and of monetary saving and investment in addition to many of other socio-economic and cultural functions (Tibbo, 2006). The regional government of Tigray is endowed with huge number of 1.4 million sheep This number is proportionate in zones from highest to lowest as western, Southern, Central, Eastern and

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Northwestern Zones of Tigray, respectively. The indigenous sheep have poor production performance under small holder farmer. Dorper is a superior meat type sheep breed in South Africa developed through the long time effort of crossbreeding of Black-headed Persian and the Dorset Horn in 1930 (Gavojdian et al., 2013). To improve the productivity of indigenous sheep, crossbreeding with high yielding exotic Dorper sheep breed is valuable for market oriented meat production and for enhancing the benefits obtained from the local sheep (Helen et al., 2015). The Ethiopian Sheep and goat productivity Improvement Program (ESGPIP), a USAID support project, was implemented in different parts of Ethiopia with the objective of improving the productivity of the local sheep of Ethiopia. The objective of this paper is therefore to present the performance crossbreeding of Dorper sheep with local sheep.

## Objectives

1. To enhance meat production performance of the local sheep through cross breeding with Dorper exotic sheep breed
2. To upgrading local sheep breeds through cross breeding with high yielding exotic breeds

## MATERIALS AND METHODS

### History of imported Dorper sheep

The pure breed of Dorper male sheep were introduced from Werer (Afar), Haremeye University and Fafan (Somali) found in Ethiopia. The introduced Doper sheep were used for crossbreeding with highland sheep under smallholder farmer. Collection of the genetic material from other sites of our country that have already introduced the breed was used as alternative option using and IRISH-Aid funded operational research for food security project.

### Description of the study area

The regional government of Tigray is found Northern Ethiopia and is located between 36 and 40° East longitude. Its north-south extent spans 12.5 to 15° north. It is bordered by Eritrea in the north, Sudan to the west, Amhara to the southwest and Afar in the east. The study was conducted Eastern zone of the region (Hawzen and Hintalowajerat districts) under mixed crop livestock production system is the dominant agricultural production system in the highland agroecology of Ethiopia (Institute of Biodiversity Conservation, 2004). Agricultural is the backbone for household food security of the smallholder farmers in the study area. Wheat and Barley are the major crops grown widely under rain fed conditions. Maize is the cash crop grown at both rain fed and irrigation conditions. In both districts, sheep are among the livestock species kept by smallholder farmers.

### Introduction of Dorper sheep and animal management

Three male Dorper sheep (two at D/chidan water shade housed in

Farmers Training Center (FTC), one in Hintalo Wajerat Farmers Research Group (FRG) were introduced. These animals were managed under traditional management system of the local sheep and their adaptability was evaluated together with the participated farmers. The local female sheep were mated with pure male Dorper sheep and produced crossbred sheep.

### Mating procedure

Ram services system was used during grazing hours. Pure Dorper (male) mated with pure local sheep (female) produced crossbred male and female lambs (Figure 1). The rams gave mating service to the local sheep of the Framers Research Group established around the Farmers Training Center in Gebrekidan and Amdeweyane water shads.

### Data collection

Live body weight was collected at birth date, weaning date, and yearly for both crossbreds and local sheep using spring balance with accuracy to the nearest of 0.5 kg.

### Data analysis

Descriptive statistic was used to calculate mean of live body weight at birth date, weaning and yearly age. Figures and Tables were used to present quantitative data.

## RESULTS AND DISCUSSION

### Comparison on live body weight

The comparison of local and crossbred based on the live body weight is presented in Table 1. The average daily body weight gain for male crossbred at the age group of 0-4, 5-9, 10-12 and >12 months was  $162.5 \pm 12.5$ ,  $137.0 \pm 24.1$ ,  $88.9 \pm 0.0$  and  $83.3 \pm 0.0$  g, respectively. Whereas for the female crossbred, the average daily body weight gain at the age group of 0-4 months and >12 months was  $158.2 \pm 9.7$  and  $111.1 \pm 5.6$  gm. The average daily body weight gain for male local sheep at the age group of 5-9, 10-12 and >12 months was  $63.5 \pm 9.4$ ,  $47.2 \pm 0.0$  and  $33.6 \pm 19.7$ , respectively. Whereas for the female local sheep, the average daily body weight gain at the age group of 0-4 and >12 months was  $66.7 \pm 0.0$  and  $30.6 \pm 0.0$  g, respectively. The current study observed that the average body weight gain was higher for Dorper crossbred sheep under traditional management system. The male crossbred sheep reached marketable weight (27 kg at 5-9 months) as compared to the male local sheep (15 kg at 5-9 months). Dorper lambs can grow daily by 206 g/day post weaning supplemented with concentrated feeds (Cloetea et al., 2000). According to Byrne et al. (ND) Doper lambs have live body weight gain of 240 to 280 g/day tested at varied environmental conditions. The early weaning age (2 to 3 months) of the Doper lambs have a potential of enhancing post-weaning gains 180 to 200 g/day (Byrne et al., ND).



**Figure 1.** Cross breeding of pure dorper (male) and pure local (female) sheep.

**Table 1.** Live body weight and daily body weight gain of the local and crossbred sheep.

| Breed                  | Sex    | Age categories (months) | Number of observation | Live body weight | Average daily weight gain (g/day) |
|------------------------|--------|-------------------------|-----------------------|------------------|-----------------------------------|
|                        |        |                         |                       | Mean±SE          | Mean ±SE                          |
| Crossbred              | Male   | 0- 4                    | 2                     | 10 ± 1           | 162.5 ± 12.5                      |
|                        |        | 5-9                     | 3                     | 27 ± 2           | 137.0 ± 24.1                      |
|                        |        | 10-12                   | 1                     | 32 ± 0.0.        | 88.9 ± 0.0                        |
|                        |        | > 12                    | 5                     | 45 ± 0.0         | 83.3 ± 0.0                        |
| Local sheep (highland) | Female | 0- 4                    | 7                     | 13 ± 0.1         | 158.2 ± 9.7                       |
|                        |        | > 12                    | 2                     | 38 ± 0.0         | 111.1 ± 5.6                       |
| Local sheep (highland) | Male   | 5-9                     | 2                     | 15 ± 0.2         | 63.5 ± 9.4                        |
|                        |        | 10-12                   | 1                     | 17 ± 0.0         | 47.2 ± 0.0                        |
|                        |        | > 12                    | 2                     | 16 ± 6           | 33.6 ± 19.7                       |
| Local sheep (highland) | Female | 0- 4                    | 1                     | 3 ± 0.0          | 66.7 ± 0.                         |
|                        |        | > 12                    | 1                     | 22 ± 0.0         | 30.6 ± 0.0                        |
| <b>Total</b>           |        |                         |                       |                  | 27                                |

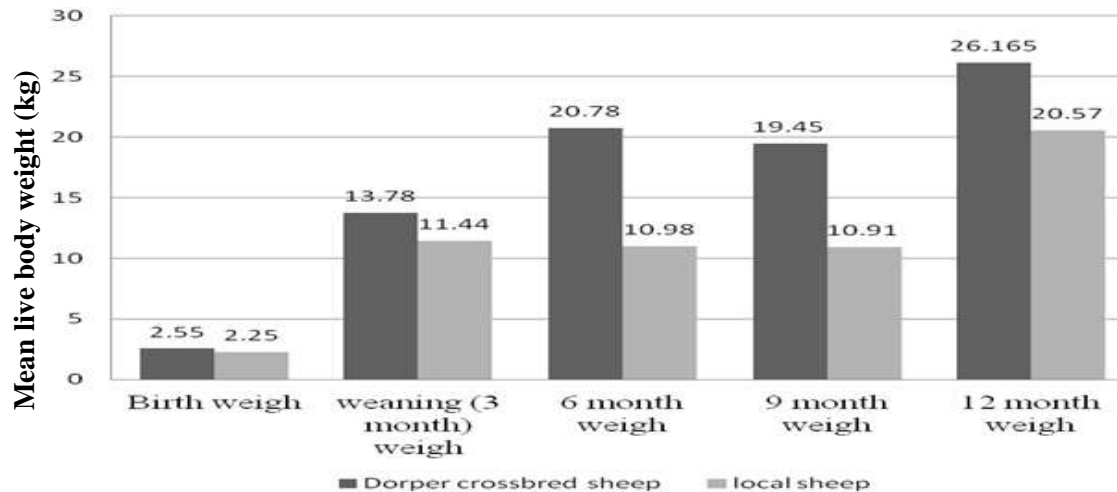
### Improvement on the meat production performance of the local sheep

Crossbreeding Dorper exotic sheep breed with the highland sheep improved the growth rate of the local sheep. The average live body weight for male and female crossbred sheep at adult age (>1.5 years) was 45 and 38 kg, respectively. The current study observed that crossbreeding with Dorper sheep improved the growth rate of the local sheep by 89 and 78% at 6 and 9 month age, respectively (Figure 2). This result of the current finding is in line to the previous of Lakew et al. (2014) who found that the crossbred ewes were found weighed more than the local sheep ewes at adult age ( $32.7 \pm 0.63$  vs.  $22.8 \pm 0.43$  kg).

The body weight performances of the Dorper crossbred have got premium result in improving the local sheep worldwide (Lakew et al., 2014). The current suggested that Dorper sheep is an appropriate technology for producing crossbred lambs with better growth rates under smallholder farmers (Figure 3).

### Smallholder farmer perception towards the Dorper crossbred sheep

Informal interview of the smallholder farmer indicated that the crossbred have non-selective feed behavior and excellent in meat production under farmer's management. Farmers of the watershed are highly



**Figure 2.** Comparison on the production performance of the crossbred and local sheep.



**Figure 3.** Male crossbred of pure Dorper (male) and pure local (female) sheep.

interested and demanding introduction of additional rams. Some of the beneficiaries have earned up to 2200 Birr from the sale of adult crossbreds.

### Conclusion

Doper sheep breed is the appropriate technology for enhancing meat production performance of the local sheep under smallholder farmers. It has the potential to

improve meat production performance of the local sheep by 53%. Introduction of male crossbred sheep of Dorper have better adaptability under smallholder farmers. Therefore, upgrading the local sheep through continuous back crossing with male crossbreds of the first generation has a potential to solve the problem of adaptability to the local environment. Strengthening the capacity of nucleus site sheep farm is necessary for sustainable dissemination of the improved crossbred meat breed to smallholder farmers. Introduction of improved feeding

technology like Urea Molasses Block and Urea molasses treated straw are better to be provided as a package while the improved breed is disseminated to farmers.

## CONFLICTS OF INTERESTS

The author has not declared any conflict of interests.

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