

Comparison of Meat Goats of South African Origin

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Preface

As Boer goat magazine readers and others know, Boer goats first showed up in the U.S. in 1994 as frozen embryos from Landcorp, an arm of the New Zealand Ministry of Agriculture. Similar in-shipments occurred to Olds College in Alberta, Canada in 1993. Thereafter, the live kids born were used by Landcorp to promote the breed in the US market as well as Canada. Embryo prices ranged \$250-500 and up while conception and survival rates varied from 20-50%, only occasionally higher. Initial prices for 4 month-old kids ranged \$20,000 upward, but such inflated prices were not sustainable, and many latecomers to this betting game lost heavily in 1995 and 1996. Thereafter, prices stabilized at lower levels.

Though Landcorp gathered certain performance data on their foundation herd progeny, such figures were not shared with buyers. Readers should also understand that the original parents of Boer embryos exported to New Zealand (and later to Australia) were never performance tested. South African embryo sources were selected as donors using only phenotypic traits acceptable to the South African Boer goat association (as demonstrated in local Show Rings and described in Breed Standards). Accordingly, the donor dams/sires were chosen on the basis of their looks, not on their performance potential. Savannah embryos came in later (1999) to Canada and, as implanted recipients to the U.S. a year later; they too did not come from performance-tested donors. Insofar as I know, no Kalahari Red goats ever came to U.S. or Canada, but I am told that some did go to Australia.

Introduction

Current owners of Boer and Savannah goats and associated observers of these breeds, here and in Canada, seem imperfectly informed about these animals as to expected reproductive and performance traits, as well as to their typical carcass characteristics and also about their utility as paternal and maternal breeds. Their greatest usage in the U.S. and Canada has been in crossbreeding programs to realize hybrid vigor and to increase numbers of goats and to improve carcass characteristics when crossed with Spanish, Kiko, and dairy goats. In accordance with genetic theory, crossing Boers on Savannahs (or the reciprocal cross: Savannahs on Boers) will not engender as much hybrid vigor as either of them used on Spanish or Kiko goats. This is because the Boer and Savannahs breeds *are more closely related genetically to each other* (see more below).

In South Africa, the national base herd of about 6.6 million head is composed of ‘skilder’ goats (speckled red-on-white or black-on-white) as well as spotted goats descended from feral goats migrating southward from north African goats (about 2500 BC; these are thought to have been descended from India and Mid East goats several thousands years ago).

I have extracted for your edification information from a lengthy article in the Animal Genetic Resources International journal entitled, “South African developed meat type goats: A forgotten animal genetic resource?” by A. Pieters et al, 2009, 44:33-43. It is the best comparative piece on these breeds I have ever seen. I can email the intact article to you at no charge, should you want it for your files or to copy for inquirers. Herein begins my interpretation of the article that starts with a summary.

SUMMARY of the article: there are mainly three locally developed meat type goat breeds in South Africa, namely the South African Boer goat, the Savanna and the Kalahari Red. In order to maintain the characteristics of these breeds and to ensure that their unique

traits are not lost through continuous selection and crossbreeding, it has become important to revisit current breed standards and to introduce genetic characterization to obtain genetic diversity parameters. Both the Boer goat and Savanna breeds have established breeder associations while a breeders club was founded for the Kalahari Red goats.

These associations have set breed standards and the breeds' morphometric traits (FP: defined visible, measurable, phenotypic characteristics) have recently been described. The differences in morphometric traits among the breeds are *fairly insignificant*. Preliminary data on genetic diversity report heterozygosity values (indicating statistically real differences) above 50% for each of the three breeds, and they can be distinguished as separate breeds based on genotyping results with eighteen ISAG recommended microsatellite markers. There is, however, a need for a genetic characterization of both meat type and remaining indigenous goats to ensure sufficient diversity within the breeds for long-term conservation of the unique genetic resources.

INTRODUCTION: These three locally developed breeds have been subjected to artificial selection for improved production and growth (FP: via owner experiences and by Show activities, but not by controlled performance-testing programs). Although this has led (slowly) to improved performance in the breeds, the critical question arises if corollary specific genetic characteristics could be compromised by continuous selection for improvement of growth and meat characteristics. Often these breeds and our indigenous types are marketed as having special adaptive characteristics; however, local types often survive tick born diseases better than the developed types.

According to some authors, true indigenous goat breeds in South Africa have been virtually crossbred to extinction due to the development of the meat type goats such as the Boer goat. Some researchers and farmers believe that the pure 'unimproved'

indigenous goats possess important economic traits (including viability, good mothering ability, disease resistance and resistance against ticks) that should not be disregarded (discarded).

Recently a strategy for the conservation and utilization of South African genetic animal resources, including goat genetic resources, has been formulated. This government policy aims at facilitating poverty alleviation through the strategic management of genetic resources, thereby improving the livelihood of farmers and rural communities. The characterization and evaluation of genetic resources is one of the proposed ways in which this goal could be attained.

In order to maintain the characteristics of these locally developed breeds and to ensure that their unique traits are not lost through continuous selection and crossbreeding, it has become important to revisit current breed standards and introduce genetic characterization to obtain (identify) genetic diversity parameters. The objective of this paper was therefore to review the potential of locally developed meat type goats as a genetic resource with reference to their phenotypic and genetic characteristics. Goats are well adapted to the drier western region of South Africa and to northern regions where bush encroachment is a problem ((Figure 1). It is also in these areas where the Boer, Kalahari Red and Savanna goats are primarily farmed in commercial systems for meat production.

Figure 1. Distribution of the meat type goat breeds.



Boer goat breed standards specify a red head and white body, and the Boer goat replaced many unimproved local strains of varying color via strict selection for a white body and red head. They are large, long-legged goats with short, soft hair and long ears. These goats have a sturdy head with compressed nose and strong horns that have a gradual backward curve. They have fleshy, well-developed broad briskets, well-sprung ribs, broad backs and muscular legs with well-fleshed buttocks and thighs. Mature Boer goat bucks weigh between 110 and 135 kg (242 and 297 lb) and mature does weight between 90 and 100 kg (198 and 220 lbs). Boer does are known for their good mothering ability and can kid every seven to eight months. (FP: other South African scientists published data questioning this observation, noting that the

occurrence of poor mothering ability was in fact evident in various flocks). They have an exceptional ability to resist and survive diseases such as blue tongue, prussic acid poisoning, and, to a lesser extent, enterotoxaemia.

The Kalahari Red is believed to have originated from two lines: a line of red headed Boer goat and another of 'unimproved' local goats in South Africa. They have a distinct red color and are often used in crossbreeding to produce goats with a uniform solid, red color. They are fully pigmented and are able to endure heat and intense sunlight, as their dark coats and long ears provide good heat resistance. They have good mothering ability and they can kid three times in two years.

The white Savanna goat, sometimes known as the white Boer goat, was developed from indigenous goat of Southern Africa during the past few decades. The breed standards allow limited red, blue, and black hairs. (FP: in the U.S. and Canada, imported Savannas show black horns, hooves, and nose. There can be black or brown hair and skin around the eyes, ears, anus, and udder and, with ageing, some (but not all) will demonstrate red and/or gray roan hair colors). During the winter, they develop extra fluffy cashmere hair for protection. Their heads are fairly long and slightly curved with big, oval shaped ears. The forequarter is well muscled and of medium width, with a reasonably long neck for easy browsing. Does have excellent mothering traits and about 22% of their offspring are born as twins and triplets under adverse extensive conditions (12" or less annual rainfall). The Savanna and Kalahari Red goats have been recognized in South Africa as official breeds since 1993 and 1990, respectively.

MORPHOMETRIC TRAITS: morphometric data was collected from goats with an average age of 12 months in a recent study in 2007. The measurements taken are reported in Table 1 below. Goats were sampled from a number of stud herds in order to be representative of the different breeds and linear traits. Specific

linear traits were measured for a total of 42 Boer goats, 47 Kalahari Reds, and 49 Savanna goats. The goats were also classified according to qualitative traits including beard (absence or presence), incidence of horns (horned or polled), and coat color.

GENETIC CHARACTERIZATION: A genetic characterization of these local meat type breeds has been undertaken by the University of Pretoria with blood samples collected from goats in the same areas described above. For the genetic characterization, Additional flocks were included for the genetic characterization to ensure that, insofar as possible, unrelated samples were taken. These Boer goats (62) were from three areas, while the 60 Kalahari Red were from six different flocks; the 56 additional Savanna samples were from two different flocks in the Northern Cape. Laboratory tests (eighteen microsatellite markers in the blood) were used to distinguish between breeds, and a factorial correspondence analysis was performed to document the relationship among the breeds. (FP: Such technology is way above my pay-grade, but is used worldwide). In any case, *the results indicated that these three breeds were genetically separate breed entities*. However, the data indicated that the Boer and Savanna breeds were more closely related to each other than either one to the Kalahari Reds.

DISCUSSION: Breed standards consist of primarily phenotypic descriptions, color, and culling defects, but attention is also given to type traits related to *function efficiency*. Except for the color variation between the three breeds, *the standards are quite similar*. Breeders aim to select for a well-adapted, functionally efficient meat type breed. (FP: U.S. breeders have developed various color schemes for spotted purebred Boer goats not readily apparent in the original imported stock, and some Savanna breeders seem overly concerned with adherence to this or that hair or skin color at this or that anatomical site. None of the traits have improved, or detracted from, productivity traits; accordingly, they are irrelevant to breed improvement, if not to imperfectly informed owners).

Morphometric measurements indicate a larger within breed variation (minimum and maximum) than between the breeds. Statistical differences were observed between the Savanna and the other two breeds for depth and length but not for height. The *only* trait where significant differences were observed among all three breeds was for head width, where the Boer goat had the broadest head and the Savanna the narrowest with Kalahari Red being intermediate. (FP: recent research at LSU found no positive statistical relationship between width between the horns and any linear or carcass measurements; this finding is contrary to much Show ring commentary).

RESULTS: Of the goats measured, 13% of Boer goats, 23% of the Kalahari Red and 25% of Savanna goats were bearded. Seventy five percent of all the Boer goats had white bodies with red heads, while the remaining 25% had either speckled heads or one or more red spots on the body. The Kalahari Red goats were primarily red coated with a white or black spot appearing on the body of 15% of the population. Savanna goats were all white. See table 1 for morphometric measurements; the superscript notations of a, b, c, identify statistically real differences between the three breeds. Breeds with the same superscript do not differ from each other. (End of article extraction).

Concluding remarks by FP: Note that detailed analysis of Table 1 shows that Savannas differ statistically from Kalahari Reds in several traits, but they statistically differ from Boers in very few traits. Accordingly, as predicted by the blood analyses, these two breeds are more closely related, both genetically and phenotypically to each other than they are to the Kalahari breed. This relationship is the basis for the comment in my 'introductory' section about reduced hybrid vigor in Boer X Savanna crosses due to genetic closeness of the breeds.

In current producer practice, both Boer and Savanna bucks are widely used on Kiko, Spanish, and Myotonic females to good

effect. Indeed, Boer X Spanish and Boer X Kiko are the most prevalent crossbred goats in our industry and outnumber purebred animals in either breed. However, Savanna X Spanish crosses are increasingly available and auction receipts show the use of Savanna bucks to improve weight and grade of slaughter kids by 30%+ as compared to straight Spanish. Insofar as I know, Savanna X Kiko crosses have not yet been publicly compared or tested at auction.

Texas' largest producer (6,300 does) is now using Savanna bucks on 3/8 Boer X 5/8 Spanish does on high desert rangeland (1doe/7 acres). My colleague, meat scientist Ken McMillin, and I will be evaluating the half Savanna X 3/16 Boer x 5/16 Spanish kids on the rail this fall. We will also be evaluating half Savannah/half Spanish kids, and we will invite Kiko breeders to participate in carcass evaluations of pure Kikos and various Kiko crossbreds. All results will be widely shared soonest.

Table 1. Statistical description of body measurements recorded for 42 Boer goats, 47 Kalahari Red and 49 Savanna goats.

| Trait (in inches) | Breed | Body Minimum | Measurements Maximum | Least square mean ² | Standard error (±) |
|----------------------|--------------|-----------------|-------------------------|-----------------------------------|-----------------------|
| Height | Boer | 18.50 | 26.57 | 22.24a | 0.20 |
| | Kalahari Red | 19.41 | 23.70 | 21.30a | 0.20 |
| | Savanna | 18.82 | 24.37 | 21.93a | 0.20 |
| Length | Boer | 21.65 | 31.30 | 26.85ab | 0.31 |
| | Kalahari Red | 23.86 | 32.76 | 27.48a | 0.31 |
| | Savanna | 11.81 | 27.99 | 25.55b | 0.28 |
| Depth | Boer | 8.74 | 12.99 | 10.39ab | 0.12 |
| | Kalahari Red | 9.06 | 12.52 | 10.67a | 0.12 |
| | Savanna | 8.82 | 11.42 | 9.80a | 0.12 |
| | Boer | 30.71 | 44.09 | 35.55ab | 0.39 |

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|--------------------|--------------|-------|-------|---------|------|
| Heart girth | Kalahari Red | 25.83 | 44.88 | 37.52a | 0.39 |
| | Savanna | 28.58 | 39.45 | 34.06b | 0.39 |
| Hock length | Boer | 6.50 | 13.39 | 11.14a | 0.20 |
| | Kalahari Red | 5.98 | 14.21 | 10.91a | 0.20 |
| | Savanna | 7.13 | 11.46 | 9.25b | 0.20 |
| Head width | Boer | 1.89 | 4.13 | 3.03a | 0.08 |
| | Kalahari Red | 1.89 | 3.50 | 2.60b | 0.12 |
| | Savanna | 1.65 | 2.87 | 2.20c | 0.08 |
| Head length | Boer | 5.12 | 8.27 | 6.77a | 0.12 |
| | Kalahari Red | 3.86 | 8.50 | 6.18b | 0.08 |
| | Savanna | 5.16 | 7.87 | 6.22ab | 0.08 |
| Neck circumference | Boer | 13.07 | 22.44 | 19.02a | 1.57 |
| | Kalahari Red | 13.27 | 23.03 | 16.73ab | 1.50 |
| | Savanna | 11.97 | 25.75 | 14.84ab | 1.46 |
| Tail length | Boer | 2.36 | 6.69 | 4.80ab | 0.12 |
| | Kalahari Red | 4.09 | 7.56 | 5.20a | 0.12 |
| | Savanna | 3.78 | 7.48 | 5.24a | 0.12 |
| Pelvic width | Boer | 3.07 | 8.43 | 5.43a | 0.12 |
| | Kalahari Red | 3.54 | 5.31 | 4.37b | 0.12 |
| | Savanna | 3.31 | 6.97 | 4.49b | 0.12 |
| Pelvic length | Boer | 5.31 | 10.43 | 7.76a | 0.16 |
| | Kalahari Red | 6.30 | 9.76 | 8.07a | 0.12 |
| | Savanna | 6.57 | 10.79 | 7.52a | 0.12 |
| Ear length | Boer | 5.67 | 10.24 | 8.43a | 0.12 |
| | Kalahari Red | 5.51 | 7.28 | 7.56b | 0.08 |
| | Savanna | 6.42 | 8.94 | 7.68b | 0.08 |

¹adapted from Pieters et al. 2009. South African developed meat type goats: A forgotten animal genetic resource? *Animal Genetics Resource International* 44:33-43.

²Least square means for a variable with different letters differ ($P < 0.001$). (This level of probability (P) means that there is only 1 out of a thousand chances that these differences are not real).