

## Preliminary assessment of Boer and Kiko does as maternal lines for kid performance under humid, subtropical conditions

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### Abstract

Thirty Boer and 27 Kiko does were exposed to Spanish bucks and evaluated for doe reproduction, pre-weaning kid growth, and production efficiency in the humid, subtropical south-eastern United States. Does of each breed were represented by at least seven seed stock farms and eight sires. Twenty-five Boer and 23 Kiko does gave birth to at least one live kid. Body weights at parturition were heavier for Boer than Kiko dams. Litter size and litter weight were similar at birth for Boer ( $1.92 \pm 0.12$  kids,  $6.05 \pm 0.31$  kg) and Kiko dams ( $1.82 \pm 0.12$  kids,  $5.90 \pm 0.33$  kg). Birth weights were similar between 46 Boer and 42 Kiko F<sub>1</sub> kids. Birth weights were heavier for single than for twin kids; twin kids were heavier at birth than triplet kids. Bucks were heavier than does at birth. At least one kid was reared to weaning by 20 Boer and 21 Kiko dams. Body weights at weaning were similar for dam breeds. Litter size, litter weight, and litter weight to doe weight ratio were significantly greater for Kiko ( $1.85 \pm 0.09$  kids,  $31.73 \pm 1.52$  kg,  $78.1 \pm 4\%$ ) compared with Boer dams ( $1.58 \pm 0.09$  kids,  $26.48 \pm 1.51$  kg,  $63.9 \pm 4\%$ ) at weaning. Pre-weaning growth rates and weaning weights were greater for 38 Kiko compared with 32 Boer F<sub>1</sub> kids and were greater for bucks than for does. Kiko F<sub>1</sub> kids had significantly lower attrition rates (9.5%) and Kiko does had significantly fewer episodes of lameness ( $1.60 \pm 0.33$  episodes/doe) compared with Boer (34.8%,  $3.31 \pm 0.31$  episodes/doe). Kiko dams tended to wean a higher kid crop percentage and weaned higher litter weights per doe exposed compared with Boer dams. Significant variation existed between Boer and Kiko as maternal breeds for performance, efficiency, and fitness under these research conditions.

**Keywords:** Meat goats, breeds, reproduction, pre-weaning growth, fitness, doe productivity

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### Introduction

In the United States, goat production is characterized as a non-traditional, alternative agricultural enterprise. The meat goat is an emerging class of livestock offering U.S. farmers a new option for on-farm income. Major determinants of profitability in a meat goat enterprise are reproductive and maternal abilities of the doe herd. Genetic composition of does may affect the performance of progeny. The improved Boer goat from South Africa (Casey & Van Niekerk, 1988; Campbell, 2003) is a breed developed for meat production that evolved from selection pressures placed on common goats of the region by farmers. Exportation of Boer goats to the U.S. in the mid-1990s helped to stimulate interest in meat goat production. No goat breeds in the U.S. had been developed specifically for meat production; milk, fibre, and brush control were the primary reasons of raising goat with meat being a by-product. The Kiko from New Zealand (Batten, 1987) is another goat breed exported to the U.S. in the mid-1990s that was developed for meat production. The Kiko breed developed from the systematic breeding of selected New Zealand feral does with dairy bucks, further crossbreeding and interbreeding at the F<sub>2</sub> and F<sub>3</sub> generations, and breed establishment at the fourth generation (Batten, 1987). Exportations of Boer and Kiko goats have created an opportunity for goat producers internationally to introduce the germplasm of new meat breeds into their breeding programs.

Reproduction and maternal ability are important economic traits to consider when evaluating the strengths and weaknesses of a new breed. When assessing new breeds for genetic merit in meat animal production systems, the maternal side is often overlooked. Breed of dam genetics can influence the performance of any sire's progeny. Meat goat dam breeds likely differ for general production efficiency in a given production environment as documented in sheep (Bourfia & Touchberry, 1993; Bunge *et al.*, 1995; Dimsoski *et al.*, 1999). Maternal breed has not received much attention in the area of meat goat production. Breed of dam has been shown to affect body weight, growth from birth through the post-weaning period and

carcass traits for the progeny of Boer sires and dairy breed sires (Ruvuna *et al.*, 1992; Waldron *et al.*, 1996; Goonewardene *et al.*, 1998; Ward *et al.*, 1998). Percentage Boer does did not outperform Spanish does under range conditions (Ward *et al.*, 1998). Studies involving Kiko-influenced does have not been published to date in the scientific literature. The reported breed of dam effects on kid performance were largely based on absolute weights and not adjusted for dam weight to measure production efficiency. Reproductive and maternal merits should be considered when making breed of dam choices. The semi-arid origin of the Boer and humid origin of the Kiko are distinctions that may influence the merits of these breeds in a given environment. This project focused on reproductive and maternal abilities of Boer and Kiko does under the humid, subtropical climatic conditions of the southeastern United States.

## Materials and Methods

In the autumn, 30 Boer and 27 Kiko does were exposed to three Spanish bucks in single-sire breeding groups to begin evaluating meat goat breeds of doe for reproductive rates, pre-weaning kid growth, and production efficiency. Each breed of doe was represented by at least seven seedstock farms and eight sires. Does were nulliparous or primiparous purebreds under two years old with age and parity balanced across breeds. All goats were managed on the Tennessee State University research station in Nashville, Tennessee, USA (36°17'N, 86°81'W). Nashville is 183 m above sea level and receives an annual rainfall of 1222 mm. The 12-month rainfall during the study (September, 2002 to August, 2003) was 1552 mm.

Does were managed in pastures that provided tall fescue (*Festuca arundinacea*) for limited grazing supplemented with orchardgrass hay (*Dactylis glomerata*; 110 g CP/kg, 50% TDN, estimated as-fed) for *ad libitum* consumption and 682 g/d of a commercial concentrate (160 g CP/kg, 69% TDN, as-fed) medicated with monensin. Does kidded on pasture without intervention. The spring-born kids were not creep-fed and bucks were not castrated before weaning. Dams and kids were weighed at birth and at weaning (14 wk). Animal weights, litter size, production efficiencies and hoof care for lameness were statistically tested by analysis of variance. Kid crop percent was determined by litter size at weaning divided by number of does exposed. Individual doe health records were maintained, from which cases of lameness and subsequent hoof treatments were obtained. Kid attrition was analysed by chi-square. Kid attrition included pre-weaning kid mortality, excluding stillborns, and kids orphaned due to dam mortality.

## Results and Discussion

At kidding, 25 Boer and 23 Kiko does produced at least one live kid. Stillborns were not included in birthing datasets. Boer dams at kidding were heavier ( $P = 0.06$ ) than Kiko dams ( $48.49 \pm 1.25$  vs.  $45.04 \pm 1.32$  kg). Litter size and litter weight at birth did not differ ( $P > 0.5$ ) between Boer ( $1.92 \pm 0.12$  kids,  $6.05 \pm 0.31$  kg) and Kiko dams ( $1.82 \pm 0.12$  kids,  $5.90 \pm 0.33$  kg). Kid birth weights were similar ( $P = 0.43$ ) between 46 Boer and 42 Kiko F<sub>1</sub> kids ( $3.21 \pm 0.09$  vs.  $3.29 \pm 0.08$  kg). Each litter type differed ( $P < 0.001$ ) for kid birth weights (singles =  $3.84 \pm 0.14$ , twins =  $3.23 \pm 0.06$ , triplets =  $2.67 \pm 0.13$  kg). Bucks at birth were heavier ( $P < 0.01$ ) than does ( $3.40 \pm 0.08$  vs.  $3.10 \pm 0.09$  kg). Birth traits were generally similar for the dam breeds.

Pre-weaning growth rates and weaning weights were greater ( $P = 0.04$ ) for 38 Kiko F<sub>1</sub> kids ( $140.4 \pm 4.61$  g/d,  $16.81 \pm 0.51$  kg) compared with 32 Boer F<sub>1</sub> kids ( $126.5 \pm 5.97$  g/d,  $15.29 \pm 0.65$  kg). Bucks had higher ( $P < 0.01$ ) pre-weaning growth rate and weaning weights ( $145.2 \pm 4.3$  g/d,  $17.29 \pm 0.47$  kg) than does ( $121.7 \pm 6$  g/d,  $14.81 \pm 0.66$  kg). Kids orphaned before weaning were not included in the weaning kid dataset. Kid attrition rates before weaning were higher ( $P < 0.01$ ) for Boer than for Kiko (34.8 vs. 9.5%). These data indicate that pre-weaning performance of the Spanish-sired kids was enhanced by Kiko dams.

Twenty Boer and 21 Kiko dams reared at least one kid to weaning. Boer and Kiko dam body weights at weaning did not differ ( $P = 0.35$ ;  $42.42$  vs.  $40.75 \pm 1.25$  kg). Weaning litter size was smaller ( $P = 0.05$ ) and litter weaning weight was lower ( $P = 0.02$ ) for Boer ( $1.58 \pm 0.09$  kids,  $26.48 \pm 1.51$  kg) than for Kiko dams ( $1.85 \pm 0.09$  kids,  $31.73 \pm 1.52$  kg). The ratio of litter weight weaned to doe weight at weaning was greater ( $P = 0.01$ ) for Kiko compared with Boer dams (78.1 vs.  $63.9 \pm 4\%$ ). In terms of overall herd efficiency, Kiko does tended ( $P = 0.10$ ) to wean a higher kid crop percent and weaned a heavier ( $P = 0.07$ ) litter weight per doe exposed ( $125 \pm 19\%$ ,  $21.55 \pm 3.05$  kg) compared with Boer does ( $86 \pm 19\%$ ,  $14.77 \pm 2.96$  kg). During the 12-month period, Boer does had more ( $P < 0.001$ ) episodes of lameness requiring hoof care than Kiko does ( $3.31 \pm 0.31$  vs.  $1.60 \pm 0.33$  episodes/doe). Performance comparisons appeared to favour

the Kiko does under these research conditions.

Boer goats have been used extensively in the U.S. over the last 10 years for crossbreeding with the goal of enhancing growth and conformation of market kids. In the process, the Boer influence has become pronounced in U.S. commercial herds as Boer-cross does are retained as replacements. The substantial numbers of Boer-cross does in commercial herds and purebred Boer does raised in the seedstock and commercial operations necessitate an evaluation of this breed for maternal ability under U.S. production conditions. In simulation work of Blackburn (1995), the production environment determined if Spanish or Boer does were more productive and efficient as genetic x environment interactions existed. Unlike the Boer goat that evolved under semi-arid to arid conditions, the Kiko goat was developed in a humid environment. Environmental adaptations of the Kiko goat are speculated as contributing to its fitness and performance at this research location which is situated in the humid, subtropical climate zone of the south-eastern United States. Comparatively higher pre-weaning kid attrition rates and greater hoof care requirements of the Boer further suggest that the Boer may be less adapted to a humid environment. Poor environmental adaptation could negatively influence performance. The evaluation of various doe breeds for performance within unique environmental settings is warranted.

## Conclusions

This project was designed to evaluate Boer and Kiko does for economically important production traits under the humid, subtropical conditions of the south-eastern United States. The Kiko exhibited greater performance levels and efficiencies compared with the Boer for doe-kid performance. These initial results suggest that Kiko does would be a viable breed option to enhance doe-kid performance in commercial meat goat production systems of the humid subtropics. The reader is cautioned, however, that the current dataset is based on a rather small sample, thus is preliminary in character at this stage of the study. Nevertheless, results highlight the need to evaluate new breeds under unique environmental conditions for doe fitness, reproductive and maternal traits that are important to commercial meat goat production.

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