Sheep & Goat Research Journal
Volume 26, 2011 – December

Effects of Season of Kidding on Doe Performance in Commercial Boer Cross Does[1,2]

K. M. Andries[3,4]

[1] *This article is part of Project KYX-60-05-14R, "Evaluation of doe and kid production and economic differences between fall and spring kidding season in meat goats*

[2] *The author would like to acknowledge the assistance of the staff at the Kentucky State University Research and Demonstration Farm, director of the Land Grant Program, and Associate Research Director*

[3] *Kentucky State University, Frankfort Kentucky, 40601*

[4] *Present address: 400 E. Main St, 225 Extension Building, Frankfort KY, 40601, e-mail: kenneth.andries@kysu.edu*

Summary

Little information is available on the impact of season of kidding on doe performance in goats. However, many producers in the southeastern United States kid in the late fall and winter because of seasonal market trends. Weather conditions during this time tend to require higher labor and nutritional supplementation. Because of this, a study was designed to evaluate doe performance by comparing total birth, 60 d and 90 d kid weight, doe efficiency ratio, conception rate, and kid survival to weaning in two alternative kidding seasons. One hundred and twenty commercial, meat-type does were randomly assigned to either a fall (October - December) or spring (March - May) kidding season. Data collected included birth weight, birth type, sex, 60 d weight, and 90 d weight on the kids. Doe weight and body condition score were taken at weaning (90 d), and the efficiency ratio was calculated by dividing the total weight of kids at 90 d by the doe weight taken at weaning. Kidding season had an effect ($P < .01$) on doe weight at weaning, total weight at 90 d, and conception rate. Season of birth did not affect total birth weight ($P = .21$) or total 60 d weight ($P = .38$). Doe weight and total 90 d weight were higher for fall than spring kidding; however, conception rate was higher for spring kidding does. This research indicates that kidding season has an influence on total weaning weight per doe. However, differences in conception rate may decrease profitability of fall and early winter kidding herds.

Key Words: Meat Goat, Season of Birth, Doe Efficiency Ratio

Introduction

Analysis of meat-goat, auction-market prices, have shown seasonal price differences with higher prices being seen in the spring when supply is generally low and several ethnic holidays increase demand. Many producers are breeding to target the market peaks around these ethnic holidays (Coffey, 2002). To do this, many producers have started breeding for fall and winter kids. However, little information is available on differences in conception rates, twinning rates, and doe productivity related to different seasons of birth in goats. Wilson and Light (1986) did find a seasonal effect on number born, total weaning weight, and survival in kids and lambs in Mali. Other research with cattle and sheep has also shown differences in weaning weight and breeding success for different calving and lambing seasons (McCarter et al. 1991; Gaertner et al. 1992; Lewis et al. 1996; and Casas et al, 2004). From this information, it would be reasonable to believe that goat producers may be impacting productivity by changing to a fall kidding season. Because of the work in other species and the limited information in goats, this project was designed to determine the effect of fall and spring kidding season on 1) doe performance; 2) conception rate; and 3) kidding rate in a group of commercial, Boercross, meat goats.

Materials and Methods

A total of 120 commercial, meat-type does were available each year for the three years of this project. The does were part of the herd at the Kentucky State University Research and Demonstration Farm (KySU), Frankfort, Kentucky; Latitude: 38.12, Longitude: 84.88, elevation: 228.14 m All does were bred to registered Boer bucks to produce kids in either the fall (October – December) or spring (March – May). Breed and age records were not available on the doe herd at the start of the project.

Due to differences in nutritional demands, does were managed separately from kidding to weaning and from four weeks before to two weeks after breeding. A flushing period was started four weeks before the start of the breeding season, and goats were not placed back into a single group until two weeks after the end of breeding. At kidding time does were separated starting four weeks before the start of the kidding season so they could be supplemented to meet their nutritional needs. The same supplement program was used and amounts were based on nutritional needs and forage quality.

Does were randomly selected using a gate cut between the two breeding season treatment groups. There were no available records to determine age of the doe herd, mouthing of animals revealed very few animals under 2 years of age so age of dam was not standardized between groups. All goats remained in the assigned treatment group for the three years of this project. All does were exposed by natural service for a 60-day breeding season with target kidding dates of October 15 to December 15 for the fall kidding season, and March 15 to May 15 for the spring kidding season.

All bucks used were registered Boer bucks. Each buck was used in both seasons to reduce sire effects on growth. Bucks were randomly assigned to single-sire breeding pastures at the start of each breeding season. After 30 days sires were rotated to different single sire breeding pastures to reduce potential issues of fertility and libido on conception rates. Three bucks were used each year of the project and each buck produced kids in each season. Bucks were replaced as necessary due to injury or death through the study. A total of seven bucks were used in the project. At no point were all sires replaced at any single time, and one sire was used in each season through the entire project.

The does were maintained on tall fescue (*Lolium arundinaceum*) pastures during the year with a small amount of native warm-season grass available during the summer. In September, all does were placed on standing corn (*Zea mays*), when it reached the hard-dough stage of maturity, for six weeks shortly before fall kidding and breeding started. Does were fed a commercial pellet feed; produced by Bagdad Roller Milles, Bagdad, Ky., as needed to meet nutritional demands. The feed contained monensin to help control coccidia. Nutritional composition, provided by the manufacture, of the pellet is shown in Table 1. Hay-quality analysis were done each year, and the amount of supplement was adjusted to meet doe needs based on NRC recommendations. All other supplemental feeding was conducted based on forage availability and standard production practices. All does had access to free-choice minerals at all times. Fescue hay was provided, free choice, when necessary due to drought and for winter feeding.

Fall kidding does were flushed by supplementing with 0.34 kg of the pellet feed starting four weeks before breeding until two weeks after the end of the breeding season. The spring kidding does were not supplemented before the start of the breeding season, as they had access to the standing corn before the start of the breeding season. They received the same supplementation as the fall kidding does at the start of each breeding season until two weeks after the end of the breeding season.

Table 1. Nutritional composition of pellet feed.

Nutrient	Unit	AS Fed	Dry Matter
DM	%	89.78	100
Net Energy Main	mcal/lb	0.76	0.84
Net Energy Gain	mcal/lb	0.50	0.56
TDN	%	67.76	75.47
CP	%	15.02	16.73
Digestible Protein	%	12.19	13.58
NPN	%	0.82	0.92
ADF	%	19.32	21.52
NDF	%	36.55	40.72
Ca	%	0.99	1.10
P - Total	%	0.54	0.60
Vit A	kiu/lb	9.08	10.11
Vit E	iu/lb	8.59	9.57

Kids were weaned at an average age of 90 d. Kid weights were taken at birth, 60 d and 90 d. Both spring and fall born kids were creep fed, ad libitum, between 60 d and 90 d of age on the same pellet feed used to supplement the does.

Weights, eye-color score, and BCS were collected for the does at monthly weigh dates during the year except for two months during kidding. Birth and weaning weight for each kid born and raised by a doe were added together to create a doe performance record. This allowed for comparison of total weight per doe at birth, 60 days, and weaning to be evaluated. If a kid was bottle-fed, it was not included in the data set for the birth dam except for birth data. No kids were successfully grafted to another doe during the study.

Data were analyzed using Proc Mixed (SAS, Inc., Cary, N.C.). Season and project year were included as fixed effects. Age was included as a random effect for 60 d and 90 d total weight. Doe weight and BCS at weaning were used to compare doe size and condition. A doe efficiency ratio was calculated by dividing the total, actual, weaning weight by the weight of the doe at weaning. This value was used to compare efficiency of production between the two seasons.

Conception rate was calculated based on breeding and birth records. Birth weights were taken and identification numbers given to kids that were born dead or died shortly after birth to give the doe credit for the total weight carried to birth and for calculations of litter size at birth. Number of kids per doe at each weigh date was recorded and used to determine differences in survival between the two seasons of birth.

Does were culled for failure to kid, failure to wean a kid, physical injuries, and structural defects. Replacement does were added to each kidding group each year as needed. Doe kids produced in the fall and spring seasons were selected based on being born twin or triplet and for growth to weaning. These does were exposed at a year of age to kid at an average of 1.5 years. This resulted in spring-born doe kids being added to the fall-breeding herd and the fall-born doe kids being added to the spring-kidding herd. This was done to provide a greater time for maturity and to reduce some of the impact of age of dam at first kidding. Because age records were not available on the breeding herd at the start of this project, age of dam was not included in the analysis.

Results and Discussion

Number of Kids Produced

Data from this study indicated there were no significant differences for season of birth on litter size and kids per doe at 60 d or 90 d ($P = 0.21$, $P = 0.38$, and $P = 0.48$ respectively). However, there was a significant difference ($P < .0001$) due to season on conception rate with spring does having a higher conception rate than fall-kidding does (Table 2). This resulted in a significant ($P < .0001$) difference in kidding rate (kids born per doe bred) between the two seasons. There were a similar number of kids lost between birth and weaning for both kidding seasons so the number of kids per doe bred at 60 d and 90 d (Table 2) were also significantly different ($P = 0.0024$ and $P = 0.0043$ respectively).

The difference in conception rate is believed to be due to the seasonal nature of small-ruminate-estrous cycles, resulting in greater fertility during shorter day length. This is supported by research with sheep. Carter et al. (1971) reported a slight genotype-environment interaction for conception rate in ewes. Lewis et al. (1996) and Notter and Copenhaver (1980) reported that ewes had higher litter sizes when exposed during "normal" breeding seasons in an accelerated breeding program.

Season of kidding did not effect survival to weaning ($P = 0.6584$). Researchers from other countries (Hussin et.al, 1995; Ndlovu and Simela, 1996; Wilson and Light, 1986) reported differences in survival rate for kids due to season. This may be due to differences in management practices, nutrition, and seasonal weather between the United States and these countries. Perez-Razo (1998) found that kids born in October to Januray had higher survival rates than those born from April to July in Dairy breeds. Earlier reports in the United States (Shelton and Willingham, 2002) indicated that cold weather reduced lamb survival to weaning. Cold weather is more common during the spring kidding season in Kentucky than fall kidding season.

Kid Weight per doe

Total kid weight per doe did not differ between seasons for birth or 60 d weight ($P = 0.21$ and $P = 0.38$, respectively). However, we did find a significant difference ($P = .014$) for 90 d weight in this study (Table 2). The fall-kidding does produced more total-kid weight at 90 d than the spring-kidding does.

Table 2. Least square means and SE within kidding season for production traits .

Trait	N	Spring[a]	Fall[a]
Conception rate, %	360	87.8 ± 3.12[y]	71.0 ± 2.91[z]
# kids born/doe exposed	360	1.73 ± 0.073[y]	1.34 ± 0.068[z]
Litter Size/doe kidding	283	1.98 ± 0.050	1.88 ± 0.052
Total birth wt/doe kidding, kg	276	7.06 ± 0.42	10.07 ± 0.408
# kids at 60 d/doe exposed	360	1.30 ± 0.066[y]	1.02 ± 0.062[z]
# kids /litter at 60 d	283	1.49 ± 0.058	1.44 ± 0.060
Total 60 d wt/doe kidding, kg	256	24.26 ± 0.911	24.16 ± 0.921
Survival to 90 days, %	279	81.9 ± 2.66	81.6 ± 2.77
# kids at 90 d/doe exposed	360	1.28 ± 0.066[y]	1.02 ± 0.062[z]
# kids / litter at 90 d	283	1.47 ± 0.058	1.44 ± 0.060
Total 90 d wt/doe kidding, kg	255	30.52 ± 1.15[y]	32.61 ± 1.16[z]
Doe wt at weaning, kg	256	55.5 ± 4.41[y]	66.6 ± 4.62[z]
Efficiency, %	252	73.5 ± 3.08[y]	61.5 ± 3.16[z]
BCS (1 – 5 scale)	255	1.5 ± 0.09	1.5 ± 0.09

[a] Means are expressed in the value of the variable ± Standard Error
[y,z] Means in the same row with different superscripts differ significantly ($P < .05$)

Other researchers have indicated a difference between growth rate in lambs and calves due to season of birth (Carter et al., 1971 and Notter et al., 1975). Delgadillo et al. (2007) reported that season of birth affected birth weight with October-born kids being heavier than those born in January and May. Marai et.al (2002) reported that in Nubian does in Egypt, total weight produced per doe lifetime was increased in does that kidded in November and December over those that kidded in February to March, but birth weight was higher for those kidding in February to March. Other research has indicated that creep feeding reduces or eliminates seasonal effects on weaning weight (Marlowe and Gaines, 1958 and Notter et al., 1975). The kids in this study were creep fed between 60 d and 90 d of age. This may have reduced the impact season of birth had on kid weight but failed to eliminate it totally due to the short duration of the creep- feeding practice. The other research was looking at individual performance that may account for some differences with this project. Further analysis is needed to determine if individual kid weights differed.

Doe Weight and Condition Scores

Doe weight at weaning (Table 2) was significantly different ($P < .0001$) between the two kidding groups. However, body condition score (Table 2) did not differ ($P = .36$). This indicated that the spring-kidding does were smaller in body size than the fall-kidding does. To confirm this, the doe weights at breeding were examined (data not shown). A similar difference was found at breeding with the fall-kidding group being heaver than spring though BCS was similar. The management practice of culling does that failed to breed for their assigned season may have removed more of the smaller does from the fall kidding herd resulting in this difference.

Doe Efficiency

Efficiency was calculated as the percent of doe-body-weight weaned. In general, larger animals have higher maintenance requirements. This results in a greater cost of maintenance for larger does. The fall-kidding does were heavier at weaning and weaned more pounds of kid per doe. This value will help determine if the amount of additional weight weaned is proportional to doe size.

Doe efficiency was significantly different ($P < .0001$) between spring and fall groups; however, the spring-kidding does had a higher efficiency ratio than the fall-kidding does (Table 2). This indicates that the fall-kidding does did not increase productivity proportional to their body size, making the spring-kidding herd more efficient.

Reports with cattle have shown that larger dams tend to wean larger offspring (Lemenager et al; 1980, Andries; 1992). However, Andries (1992) reported that this relationship was quadratic, indicating that larger cows may not be as efficient in productivity as smaller ones. Nichols and Whiteman (1966) saw only a small, non-significant correlation between yearling-ewe weight and total-lifetime-weight produced, again indicating that larger dams may not be as efficient.

Economics of Kidding Season

Price differences between months for goat kids can be very large. An analysis of price per kg for kid-slaughter goats reported by USDA-AMS over four years showed prices were highest for kid goats in February, March, April, and May ($0.49, per kg) and lowest in August, October, and November ($0.42, $0.41, and $0.42 per kg, respectively). This indicates that kids ready for market in the winter and spring bring higher prices than those ready in the fall and summer. If fall-born kids were marked at weaning in February ($0.49 per kg) and spring-born kids in June ($0.42 per kg), it would result in a $0.07 per kg price advantage for the fall-kidding group in this study. The gross income per doe was calculated by multiplying the total-weaning weight by the price per kg ($0.42 or $0.49, for spring- or fall-kidding respectively). This value was then analyzed to determine if there was a difference in gross income between fall- and spring-kidding herds.

When the data were analyzed for the whole herd, season was not significant ($P = 04351$) for gross income. This indicates that fall- and spring-kidding herds have the potential to generate similar incomes despite the difference in price and conception rates in the fall. When the data was analyzed specifically for does that produced kids and weaned kids season was significant ($P < 0.0001$ in both analysis) with fall kidding does generating greater gross incomes. Because does kidding in the spring are able to be placed on fresh forage and reduced supplementation, spring-kidding does may have a lower cost of production compared to fall-kidding does. More research is needed to determine exact differences in cost between the two kidding groups. This will allow for better determination of profitability of the different seasons of kidding.

Conclusions

The results of this study indicate that fall-kidding does weaned more total weight per doe that kidded but had a lower conception rate than spring-kidding does. However, number of kids born per doe that kidded and survival to 90 days was not different between kidding seasons. Price paid for kids at auctions were higher in late winter and early spring when fall born kids would be marketed but the lower conception rate reduced overall income per doe exposed. More research is needed to evaluate the different cost of production between spring- and fall-kidding herds to determine which is more profitable. This study did show that conception rates appear to be the major difference in doe performance between the fall- and spring-kidding herds.

Literature Cited

Andries, K.M. 1992. Genetic and production factors that influence five-year cow weight in beef cows. MS Thesis, Louisiana State University, Baton Rouge.

Carter, R.C., G.M. Carman, F.S. McClaugherty, and P.S. Haydon. 1971. Genotype-Environment interaction in sheep II. Lamb performance traits. J. Anim. Sci. 33:732-735.

Casas, E., B.A. Freking, and K.A. Laymaster. 2004. Evaluation of Dorset, Finnsheep, Romanov, Texel, and Montadale breeds of sheep: II. Reproduction of F1 ewes in fall mating seasons. J. Anim. Sci. 82:1280-1289.

Coffey, L. 2002. Sustainable Goat Production: Meat Goats. ATTRA publication IP200.

Delgadillo, J.A., M.A. De Santiogo-Miramontes, and E. Carrillo. 2007. Season of birth modifies puberty in female and male goats raised under subtropical conditions. Animal 1:858-864.

Gaertner, S.J., F.M. Rouquette, Jr., C.R. Long, and J.W. Turner. 1992. Influence of calving season and stocking rate on birth weight and weaning weight of Simmental – sired calves from Brahman – Hereford F1 dams. J. Anim. Sci. 70:2296-2303.

Hussin, SS, AP Horst, ABMM Islam. 1995. Effects of Different factors on pre-weaning survivability of Black Bengal kids. Small ruminant Research. 18:1-5.

Lemenager, R.P., L.A. Nelson, and K.S. Hendrix. 1980. Influence of cow size and breed type on energy requirements. J. Anim. Sci. 51:566-576.

Lewis, R.M., D.R. Notter, D.E. Hogue, and R.H. Magee. 1996. Ewe fertility in the STAR accelerated lambing system. J. Anim. Sci. 74:1511-1522.

Marai, IFM, EL Abou-Faudoud, AH Daader, AA Abu-Ella. 2002. Reproductive doe traits of the Nubian (Zaraibi) goat in Egypt. J. Small Ruminant Research. 46:201-205.

Marlow, T.J. and J.A. Gaines. 1958. The influence of age, sex, and season of birth of calf, and age of dam on preweaning growth rate and type score of beef calves. J. Anim. Sci. 17:706-713.

McCarter, M.N., D.S. Buchanan, and R.R. Frahm. 1991. Comparison of crossbred cows containing various proportions of Brahman breeding in spring or fall calving systems: IV. Effects of genotype X environment interaction on lifetime productivity of young cows. J. Anim. Sci. 69:3977-3982.

Ndlovu, L.R. and L. Simela. 1996. Effects of season of birth and sex of kid on the production of live weaned single born kids in smallholder East African goat flocks in north east Zimbabwe. Small Ruminant Res. 22:1-6.

Nichols, C.W. and J.V. Whiteman. 1966. Productivity of farm flock ewes in relation to body size. J. Anim. Sci. 25:460-464.

Notter, D.R., L.A. Swiger, and W.R. Harvey. 1975. Adjustment factors for 90-day lamb weight. J. Anim. Sci. 40:383-391.

Notter, D.R. and J.S. Copenhaver. 1980. Performance of Finnish Landrace crossbred ewes under accelerated lambing. I. Fertility, prolificacy, and ewe productivity. J. Anim. Sci. 51:1033-1042.

Pereq-Razo, MA. F. Sanchez, and C. Maya. 1998. Factors affecting kid surviaal in five goat breeds. Canadian J. Anim. Sci. 78:407-411.

Shelton, M. and T. Willingham. 2002. Lamb mortality. Sheep and Goat Res. J. 17:15-19.

Wilson, R.T. and D. Light. 1986. Livestock production in central Mali: Economic characters and productivity indices for traditionally managed goats and sheep. J. Anim. Sci. 62:567-575.