Fact Sheet Series on Meat Goat Herd Management Practices

#3 - Flushing

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This fact sheet is about flushing as an on-farm management tool for New York meat goat farms. Flushing is the herd management practice of feeding diets with high nutrient concentrations to female animals shortly before breeding in an attempt to increase ovulation rates at breeding and, potentially, litter size. Obviously, if a doe develops only one egg or ova during the first heat the buck is exposed to her, only one egg is available to be fertilized and her litter size is limited to one, except in the unlikely event that she fails to conceive during that first heat. In contrast, if the doe develops multiple eggs in the first heat after the buck is put in the herd, her litter size can be as large as the number of eggs she developed, assuming all eggs are fertilized and all fetuses come to term. Please note that "flushing" as discussed in this article does not refer to the very specialized practice of "flushing" embryos from donor does for embryo transfer. Instead, "flushing" as referenced here is a low technology tool available to any goat farmer.

Flushing is usually practiced by increasing the nutrients available to a doe herd about 3 weeks prior to breeding and continuing the improved nutrition for at least 2 weeks after the breeding buck has been brought into the herd. Commonly, the does have been on an all forage diet, and a supplemental high energy concentrate feed is added to their ration at the rate of about 0.5 to 1 pounds each daily. However, flushing can also be practiced by switching does from low quality pastures to pastures with extremely good levels of total digestible nutrients (TDN) or by increasing the amount of concentrate fed to does that have been receiving some concentrated feed previously. Previous studies on various livestock species have indicated that the body condition of the female animals can influence the effectiveness of flushing. Lean females are

most likely to increase their ovulation rates as a response to flushing while flushing appears to have less effect on the ovulation rates of females that are in excessive body condition (fat).

In 2005, the Cornell Animal Science Department in cooperation with the Empire State Meat Goat Producer's Association was awarded a grant from the Northeast Sustainable Agriculture Research and Education Program (NE SARE) to observe the effectiveness of various herd practices including flushing on NY meat goat farms. In the fall of 2006, a NY meat goat farm agreed to split their doe herd three weeks prior to breeding so that half the herd was fed extra concentrate while the other half was not. The does were scored for body condition at the same time the ration was increased and their age, breed, and the service sire they had been assigned to was recorded. Each of these factors can affect litter size. For example, does that are kidding for the first time tend to have smaller litter sizes than does that are on their 2nd to 5th kidding while all bucks and breeds are not equally fertile. Does were randomly assigned to flushing or not after making sure that similar distributions of age, body condition, genetics and service sire were represented in each group.

Does were removed from pasture and dewormed at the beginning of the 3-week study. Each treatment group was fed grass hay and offered some ear corn daily with the restriction that the same amount of ear corn was to be offered to each group and that the daily amount (including ears and cobs) was not to exceed ½ lb per doe per day. In addition, the does in the "flushed" group were fed 1 pound each of a 16% crude protein (CP), high energy, pelleted feed. At the end of three weeks, the two groups were combined with one of two service sires and all does were fed 1 pound of the 16% CP pelleted feed on a daily basis during the breeding period. The bucks joined their breeding groups on December 1, 2006 and all does kidded within

approximately 150 to 169 days later. Thus, it appeared that all the does were bred and conceived upon their first heat after exposure to the breeding bucks.

Table 1 summarizes the make up of each treatment group and the results. With the exception of one Nubian doe, all does were high percentage Boers. The majority of the does were relatively lean with body condition scores (Body CS) of 2.0 (13does), 2.5 (6 does) and 3.0 (1 doe) on a scale of 1 (dangerously lean) to 5 (dangerously obese). All but one doe in each treatment was assigned to and bred by the first service sire. However, one doe in each treatment was a daughter of this first service sire and was bred instead to the second service sire. Each treatment consisted of two 2 yr old does that had never kidded before, five 2 yr old does that had kidded previously as yearlings, and three 3 to 4 yr old does that had kidded twice previously.

Table 1. Breakdown of breed, age class, service sire, and body condition and results for each treatment

Flushed Group						**Not Flushed Group**					
ID#	Body CS	Age[1]	Breed	Service Sire	Litter Size	ID#	Body CS	Age[1]	Breed	Service Sire	Litter Size
1	2.0	3	Boer	1	Twins	4	2.0	3	Boer	1	single
3	2.0	3	Boer	1	Twins	Nub	2.0	3	Nubian	1	twins
7	2.0	2	Boer	2	Twins	5	2.0	2	Boer	2	twins
18	2.0	3	Boer	1	Twins	15	2.5	3	Boer	1	twins
4093	2.5	1	Boer	1	Twins	4106	2.0	2	Boer	1	single
4114	2.5	2	Boer	1	Single	4107	2.5	2	Boer	1	single
4116	2.5	1	Boer	1	Twins	4118	2.0	1	Boer	1	single
4119	2.0	2	Boer	1	Triplets	4120	2.0	2	Boer	1	single
4124	2.0	2	Boer	1	Twins	4133	3.0	1	Boer	1	single
4138	2.5	2	Boer	1	Twins	4139	2.0	2	Boer	1	twins
Total number of kids					**20**	**Total number of kids**					**14**
Average litter size					**2.0**	**Average litter size**					**1.4**

[1] Age classes are as follows, 1 = 2 yr old doe never kidded before, 2= 2 yr old doe, kidded as yearling, 3 = 3 to 4 yr old doe, kidded twice previously.

The data were evaluated statistically using an analysis of variance method to determine if any of the differences in litter size among experimental factors were not due to chance. The

Nubian doe was removed from the analysis because she was the only representative for her breed. The statistical model was:

$$Y = \mu + BCS + Age + SS + \varepsilon$$

where Y = Litter Size, μ = herd constant, BCS = the fixed effect of body condition score, Age = the fixed effect of age and parity (the number of times the goat has already kidded), SS = the fixed effect of the buck the doe was bred to and ε = the residual variance including the random effect of the doe herself.

A data set with only 19 does is a very small data set. Therefore, differences had to be extreme to detect significant differences in litter size. For example, even though does in Age Class 3 tended toward larger litters than did does in Age Classes 1 and 2, the differences were not noticeable enough in this small data set to render them statistically significant. Possible differences in litter size due to either service sire or body condition score were also too small in this data set to conclude that they had an influence on litter size. In contrast, differences in litter size due to flushing **were** significant statistically ($P < 0.05$) with does that were flushed averaging 2.0 kids and does that were not flushed averaging only 1.4 ($\pm$ 0.33) kids. In this meat goat herd under the environmental and genetic conditions for the year studied, flushing appeared to increase kidding rate from 140% to 200% or about 6 more kids for every 10 breeding does. Even with rising prices for concentrate feeds, flushing 3 weeks prior to the breeding period appeared to be a sound financial decision for meat goat herds with BoerX does in relatively lean body condition. Keep in mind, that only one of the does observed in this on-farm study had a body condition score of 3 or greater. Thus, the results of this study may not indicate the effectiveness of flushing in does carrying extra weight at breeding.

There are two additional factors to point out from this study. All does, regardless of whether they were in the "flushed" group or not, were fed some ear corn on a daily basis for 3 weeks prior to breeding. However, litter size was much improved in the group of does that additionally received 1 pound of a 16% CP high energy pelleted feed per day. The small amount of ear corn fed appears to have been insufficient to cause a "flushing effect" in the does. In contrast, the additional pound of 16% CP pellets did "flush" the does. Would we have had the same response if we had substituted the pelleted feed with 1 pound of shell corn or with a high quality pasture? This study does not answer that question. However, one reason we had put the does on a relatively high protein pellet was because the extension educator involved (tLS) had anecdotally observed in her own herd that litter size was disappointing in the years she flushed with shell corn versus in the years she flushed with a mixture of shell corn and grain byproducts adjusted to raise the protein level to 14 to 16 % CP. This study indicates that flushing can be achieved by feeding a 16% CP high energy pellet for three weeks prior to breeding and for 2 to 3 weeks into the breeding period. Further observations are warranted to see what other methods of flushing are effective and whether flushing requires increased nutrients in terms of protein, minerals and vitamins, as well as energy, to be effective.

A second factor to stress is that all of the does (flushed or control) were fed 1 lb of the 16% CP concentrate on a daily basis as soon as they were put in with the buck. However, these additional nutrients appeared to have come too late to improve ovulation rate and, thus, litter size. The results of this study help to emphasize that flushing is unlikely to be effective if delayed until the buck is actually in the breeding group because most does will be bred during the first following heat. Flushing needs to be started about 3 weeks before introduction of the bucks.

Flushing is a simple management tool that meat goat farmers can use to try to improve litter size and potential productivity of their herds. The study demonstrated one situation where flushing increased litter size from 140% to 200%. It leaves open questions about whether flushing would be as effective 1) for does in heavier body condition or 2) for situations where the additional nutrients used for flushing are in the form of shelled corn or extremely high quality pastures. It does not indicate whether severely decreasing nutrition for 3 weeks prior to breeding on fleshy does would result in decreased litter size for herds desiring smaller litter sizes (i.e. is there such a thing as "de-flushing"?). Our observations indicate that flushing is an excellent tool to consider for any New York meat goat herd desiring increases in litter size. Your own observations and records will help to evaluate its effectiveness for your herd.

Our funding agencies need to evaluate whether this fact sheet was useful to you. If you are a meat goat producer, we ask thatyou take the time to complete the following questions and return to tatiana Stanton, Rm 114 Morrison Hall, Cornell Univ., Ithaca, NY 14853 or TLS7@cornell.edu.

Flushing Questionnaire

1. Did you flush your does last year? Why or why not?

2. Do you plan to flush your does this year? Why or why not?

3. Did reading this article have any effect on your decision to flush this year? Please explain.

4. How informative would you rate this article on a score of 1 to 5 (with 1 =not informative at all and 5 = very informative). ____