

Research Note

Is There an Influence of Individual Rams on Ewe Prolificacy?

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Previous studies have shown that ram introduction near the onset of the breeding season stimulates the initiation of estrous cycles (Sebastian and Inskeep, 1988) and ram libido influences flock conception and flock lambing rates (Fitzgerald, 1992). Twin- and triplet-born rams produce more multiple births than single-born sires (Hodgson et al., 1965; Vakil et al., 1968; Botkin et al., 1988), an effect generally attributed to increased libido (Fitzgerald, 1992) and serving capacity (i.e. testis size; Snowden et al., 1981). Sexual behavior also varies among individual rams (Price, 1987; Fitzgerald and Perkins, 1993; Alexander et al., 1999) and among males of other species (Meisel and Sachs, 1994).

Ovulation rate and prolificacy of ewes are characterized as being lowly heritable characteristics (Botkin et al., 1988) inherent to a ewe's reproductive cycle. In spite of this generalization, limited data (Hodgson et al., 1965; Botkin et al., 1988; Burfening and Davis, 1996) and empirical observations support a role for the male in influencing prolificacy of individual ewes. The observation that clitoral stimulation advanced timing of ovulation in cows (Randel et al., 1973) supports the concept that stimuli associated with mating

may influence time and perhaps rate of ovulation in spontaneously ovulating species such as cattle or sheep. Alternatively, in vitro fertilization studies with rabbits led to the conclusion that semen from selected bucks differentially influenced embryo survival in vivo (Burfening and Ulberg, 1968). More recently, "service sire" was indicated as a significant source of variation for number of lambs born per ewe exposed (Burfening and Davis, 1996) and a paternal effect on initiation and length of the S-phase of embryo development was reported for bulls (Eid et al., 1994). Therefore, the precedence for a sire effect on number of offspring born to individual ewes exists, but mechanisms through which such an effect may be mediated remain an enigma.

Data from single-sire matings performed in a flock of ewes over a ten-year interval were analyzed to determine if individual rams do indeed differ in their ability to sire multiple offspring. This flock consists of approximately 200 western white-faced ewes that had historically been selected for uniformity and multiple births (Saboulard et al., 1995). Ewes were randomly allotted to groups of 20-32 for pen mating to a single ram during the fall breeding season each year. Conception rates averaged $97.1 \pm .4$ percent (range = 90 to 100%) and duration of the lambing season was 31 ± 2 days overall years and

ram groups. The 4 to 6 rams used each year were either 2 (n = 32) or 3 (n = 16) years of age and were replaced annually. Over the ten-year interval, data for 1383 ewe lambing events and 48 sires were accumulated and analyzed. Age of ewes in this data set ranged from 2 to 10 years.

Data for ewes that conceived to the single-sire matings were analyzed by GLM procedures (SAS, 1990) to evaluate effects of year, ram within year, and age of ewe. The effect of ram age was tested separately from ram within year because of the inherent confounding among year, ram age, and ram within year when included together in the same model. Possible interactions were evaluated and found not significant. Differences among means were tested by Fisher's protected LSD procedure (Steel and Torrie, 1980). For purposes of statistical analysis, ewes were grouped into the ages of 2 (n = 338), 3 (n = 278), 4-7 (n = 729), and 8-10 (n = 38) years of age.

Mean numbers of lambs born per ewe lambing differed ($P = .0008$) by year and ranged from $1.7 \pm .06$ to $2.0 \pm .06$. Similarly, age of ewe influenced ($P = .0001$)

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numbers of lambs born with 2, 3, 4 to 7, and 8-10 year-old ewes producing $1.8 \pm .03$, $1.9 \pm .04$, $2.0 \pm .02$, and $1.8 \pm .09$ lambs per ewe, respectively. Effects of ewe age and year on prolificacy are not surprising because of differences in ewe maturity, environmental conditions and feed availability (Botkin et al., 1988). Age of ram did not influence individual ewe lambing rates and averaged $1.9 \pm .03$ and $1.9 \pm .05$ lambs per ewe lambing for 2 and 3 year old rams, respectively.

Of most interest, was the observation that the effect of ram within year on ewe prolificacy was highly significant ($P = .001$). Rams differed in the number of offspring born per ewe lambing with a magnitude of nearly .8 lambs per ewe lambing (Figure 1). Although our analyses do not provide insights into mechanisms through which such effects could be mediated, the large differences observed among rams could have dramatic effects on profitability of a sheep enterprise. These results prompt numerous important questions that warrant further investigation. In addition to determining how such effects may be mediated, it is impor-

tant to determine if such effects are heritable, are repeatable in individual rams used over several breeding season, and perhaps most importantly, how rams which excel in this trait can be identified.

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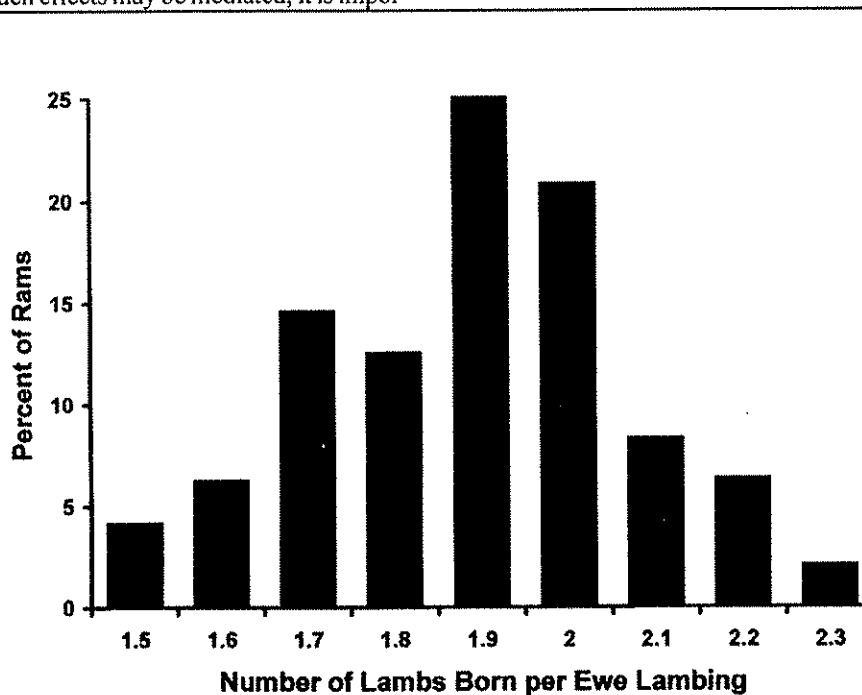


Figure 1. Distribution (%) of rams (n=48) that sired 1.5 through 2.3 lambs per ewe lambing.