Seasonal variation in semen quality of Boer and Angora goat rams using different collection techniques

J.P.C. Greyling and J.A.N. Grobbelaar
Animal and Dairy Science Research Institute, Irene

Semen was collected weekly throughout the year from three Boer goat rams with the aid of the artificial vagina and from two Angora and two Boer goat rams by means of electrical stimulation, to determine seasonal variation in semen quality. Semen characteristics monitored were volume, density, percentage of live sperm, percentage of abnormal sperm, pH and motility. No significant seasonal variation in semen quality was noted. In the Boer goat (artificial vagina) a significant difference ($P \leqslant 0,05$) was obtained in the percentage of live sperm for different months of the year, while the volume ($P \leqslant 0,01$) and pH ($P \leqslant 0,05$) of ejaculates were significantly lower when collected by the artificial vagina and the density and motility were significantly ($P \leqslant 0,01$) higher when compared with sperm collected by electrical stimulation. A negative correlation ($-0,90$) was obtained between the percentage of live sperm and the percentage of abnormal sperm collected from Boer goat rams by the artificial vagina. The Angora goat produced an ejaculate with a significantly higher motility ($P \leqslant 0,01$), density ($P \leqslant 0,01$) and lower volume ($P \leqslant 0,05$) than the Boer goat when electrically stimulated — a significant ($P \leqslant 0,01$) variation in pH between months was obtained by this method of semen collection. The artificial vagina proved to be the most satisfactory method of semen collection in the Boer goat.
S. Afr. J. Anim. Sci. 1983, 13: 250 – 252

Semen is weekliks, deur die jaar, van drie Boerbokramme met behulp van die kunsvagina en van twee Angora- en twee Boerbokramme deur middel van eletriese stimulasie gekollekteer om seisoenale variasie in semenkwaliteit vas te stel. Die semeneienskappe volume, digtheid, persentasie lewende sperme, persentasie abnormale sperme, pH en motiliteit is gemonitor. Geen seisoenale verskille in semenkwaliteit is verkry nie. In die Boerbok (kunsvagina) is 'n betekenisvolle ($P \leqslant 0,05$) verskil tussen maande verkry ten opsigte van die persentasie lewende sperme terwyl die volume ($P \leqslant 0,01$) en pH ($P \leqslant 0,05$) van ejakulate betekenisvol laer was by ramme waar semen met behulp van die kunsvagina gekollekteer is en die digtheid en motiliteit van semen betekenisvol ($P \leqslant 0,01$) hoër is vergeleke met elektriese stimulasie. 'n Negatiewe korrelasie ($-0,90$) is ook verkry tussen die persentasie lewende sperme en persentasie abnormale sperme by Boerbokramme wat met behulp van die kunsvagina gekollekteer is. Die Angorabokram het 'n ejakulaat met 'n betekenisvol hoër motiliteit ($P \leqslant 0,01$) en digtheid ($P \leqslant 0,01$) en laer volume ($P \leqslant 0,05$) met elektriese stimulasie as die Boerbok gelewer — 'n betekenisvolle ($P \leqslant 0,01$) variasie in pH tussen maande is met hierdie metode van semenkolleksie verkry. Die bevindinge het die kunsvagina bewys as die geskikste metode van semenkolleksie by die Boerbokram.
S.-Afr. Tydskr. Veek. 1983, 13: 250 – 252

Keywords: Angora goat, Boer goat, collection techniques, semen quality

J.P.C. Greyling* and J.A.N. Grobbelaar
Animal and Dairy Science Research Institute,
Irene, 1675 Republic of South Africa

*To whom correspondence should be addressed.

Received 11 November 1982

Introduction

A low kidding rate is often only attributed to low fertility in the doe, while the important contribution of the ram is often ignored. The restricted breeding season of many small stock breeds has led to attempts to alter the breeding season so that offspring can be produced during any season of the year. However, these studies concentrated on ewes or does and little information is given about the fertility of rams.

Corteel (1978) postulated that the low fertility observed in the middle of summer was linked principally to the quality of the sperm produced during that period and not to a drop in fertility by the does. Periods of low sperm motility were contemporaneous with the periods of low fertility, suggesting that the fertilizing capacity of goat spermatozoa becomes drastically reduced for some months each year during the non-breeding season. Most researchers allege that semen production (and not so much semen quality) is affected by seasonal changes (Colas & Brice, 1976; Colas & Courot, 1976). Shelton (1960) found a greater seasonal effect with the ram than with the doe.

According to Courot (1976), sperm motility and the percentage live sperm, determine the quality of the semen. The object of this trial was to evaluate the quality of Angora and Boer goat semen collected throughout the year by means of artificial vagina and/or electrical stimulation, for the purpose of freezing semen and doing AI throughout the year.

Procedure

Semen from five Boer and two Angora goat rams was collected at regular weekly intervals (October, 1980 to September, 1981) by means of the artificial vagina and/or electrical stimulation. From three of the Boer goat rams, semen was collected by means of an artificial vagina while electrical stimulation was used on the other two Boer goat rams and on the Angora rams. After collection, the following properties were evaluated:

(i) The volume of the ejaculate was measured by collecting the semen in a calibrated test-tube.
(ii) The colour of the ejaculate was noted as an indication of the semen density and the possibility of semen contamination.
(iii) The motility of the ejaculate was assessed microscopically and a value (between 0 and 5) awarded according to the motility of the semen. Simultaneously as estimation of the percentage of live sperm was made.
(iv) Actual sperm counts were done using a hemocytometer (dilution rate of 1:200 was used) to calculate the density of the ejaculate.
(v) The percentage of live sperm was determined by means

of a nigrosine eosine stain — this slide was then also used for the determination of the percentage of abnormalities.

(vi) The pH of the semen was measured with a pH-meter as soon after the collection of the semen as possible.

Daylight lengths and average monthly temperatures for the observation period were obtained from the Weather Bureau at Irene, Pretoria. The method of semen collection (artificial vagina *vs* electrical stimulation), the breed of goat (Boer goat *vs* Angora) and the seasonal changes in semen quality (summer — December to February *vs* autumn – March to May *vs* winter – June to August *vs* spring – September to November) were compared in this experiment. The data were analysed by analyses of variance and the calculation of correlations.

Results

Artificial vagina *versus* electrical stimulation in the Boer goat ram

The annual macroscopic variation in semen production and motility (mean ± S.D.) obtained by the different techniques of semen collection is set out in Table 1 and Figure 1. The artificial vagina yielded significantly ($P \leqslant 0{,}01$) less semen by volume (mean 1,56 *vs* 2,48 mℓ) and a higher ($P \leqslant 0{,}05$) motility compared with the semen collected by the technique of electrical stimulation.

No significant difference in pH (Table 2) between the various months of the year was observed, but a significantly ($P \leqslant 0{,}05$) higher pH for semen collected by means of electrical stimulation was noted. The density (concentration) of the semen and the percentage of live sperm were significantly ($P \leqslant 0{,}01$ and $P \leqslant 0{,}05$ respectively) higher in semen collected by means of the artificial vagina (see Figure 2). No significant difference was found in the percentage of abnormalities for the different techniques of semen collection.

Electrical stimulation — Angora *versus* Boer goat rams

The volume of semen yielded (Table 1 and Figure 1) in the

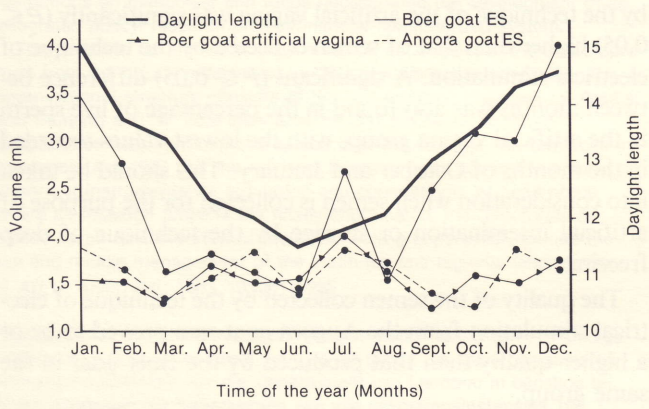

Figure 1 Semen production (volume) through the year in Boer and Angora goat rams using the different collection techniques (artificial vagina (AV) and electrical stimulation (ES)).

Table 2 The effect of season on the pH of the semen ejaculates for the differrent collection techniques in Boer and Angora goats

			Electrical stimulation	
Months	Mean daylight length (h)	Artificial vagina Boer goat pH	Boer goat pH	Angora goat pH
Jan.	15,00	6,82 ± 0,19	6,75 ± 0,28	6,85 ± 0,21
Feb.	13,75	6,79 ± 0,14	6,89 ± 0,14	6,91 ± 0,17
Mar.	13,40	6,76 ± 0,22	6,78 ± 0,23	6,75 ± 0,17
April	12,30	6,50 ± 0,32	6,82 ± 0,36	6,74 ± 0,34
May	12,00	7,02 ± 0,21	6,94 ± 0,15	6,95 ± 0,14
Jun.	11,50	6,59 ± 0,24	6,95 ± 0,18	6,84 ± 0,17
Jul.	11,75	6,79 ± 0,23	6,96 ± 0,21	6,93 ± 0,18
Aug.	12,10	6,93 ± 0,10	7,19 ± 0,15	7,00 ± 0,13
Sept.	13,00	6,61 ± 0,12	6,94 ± 0,18	7,02 ± 0,34
Oct.	13,50	6,68 ± 0,23	6,72 ± 0,20	6,59 ± 0,11
Nov.	14,25	6,63 ± 0,23	6,93 ± 0,25	6,84 ± 0,40
Dec.	14,50	6,40 ± 0,28	6,64 ± 0,20	6,51 ± 0,38
Mean	13,08	6,71	6,88	6,83
Range		6,40 – 7,02	6,64 – 7,19	6,51 – 7,02

Table 1 The effect of season on semen production and motility for the different collection techniques in Boer and Angora goat rams

		Artificial vagina		Electrical stimulation			
		Boer goat		Boer goat		Angora goat	
Month	Mean monthly Temp. °C	Semen volume (mℓ)	Motility (1 – 5)	Semen volume (mℓ)	Motility (1 – 5)	Semen volume (mℓ)	Motility (1 – 5)
Jan.	20,8	1,54 ± 0,78	2,77 ± 0,93	3,56 ± 2,32	2,29 ± 0,99	1,86 ± 0,64	3,19 ± 1,19
Feb.	19,0	1,52 ± 0,73	3,73 ± 0,52	2,89 ± 2,28	2,13 ± 1,36	1,68 ± 1,37	3,63 ± 0,88
Mar.	17,4	1,31 ± 0,46	3,46 ± 0,78	1,78 ± 0,30	2,80 ± 1,01	1,33 ± 0,43	3,20 ± 0,71
Apr.	16,6	1,73 ± 0,75	3,42 ± 0,51	1,89 ± 0,97	2,36 ± 0,75	1,54 ± 0,78	3,13 ± 0,95
May	12,4	1,50 ± 0,68	3,65 ± 0,34	1,62 ± 1,05	2,17 ± 0,82	1,83 ± 0,85	3,38 ± 0,48
Jun.	9,4	1,53 ± 0,54	2,83 ± 0,88	1,46 ± 0,59	1,65 ± 0,71	1,46 ± 0,46	3,00 ± 0,78
Jul.	10,4	2,03 ± 1,21	1,96 ± 0,72	2,78 ± 1,60	1,75 ± 0,85	1,87 ± 1,00	2,94 ± 0,78
Aug.	18,7	1,60 ± 0,30	2,69 ± 0,46	1,50 ± 0,67	1,75 ± 1,08	1,75 ± 0,79	2,42 ± 1,66
Sept.	15,3	1,20 ± 0,30	2,75 ± 1,06	2,40 ± 1,02	2,31 ± 0,37	1,40 ± 0,82	2,06 ± 1,24
Oct.	19,3	1,56 ± 0,84	2,04 ± 0,99	3,05 ± 1,17	1,50 ± 0,89	1,25 ± 0,54	3,69 ± 0,46
Nov.	18,3	1,52 ± 0,57	3,38 ± 0,83	3,05 ± 1,35	2,00 ± 0,93	1,88 ± 1,06	3,13 ± 1,30
Dec.	19,9	1,73 ± 0,51	3,14 ± 0,82	3,82 ± 2,01	2,05 ± 0,98	1,69 ± 0,54	3,45 ± 0,86
Mean	16,46	1,56	2,99	2,48	2,06	1,63	3,10

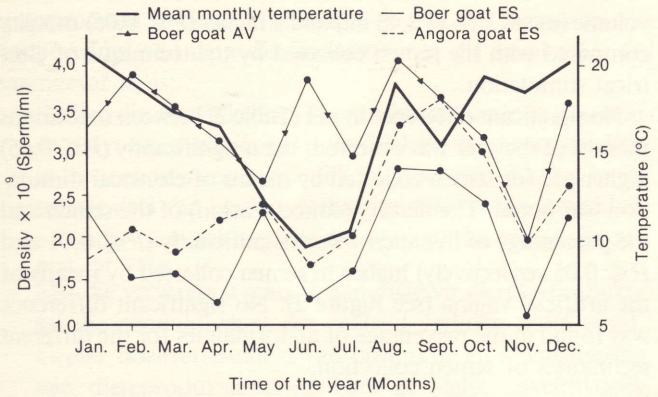

Figure 2 Semen density (concentration) through the year in Boer and Angora goat rams using different techniques (artificial vagina (AV) and electrical stimulation (ES)).

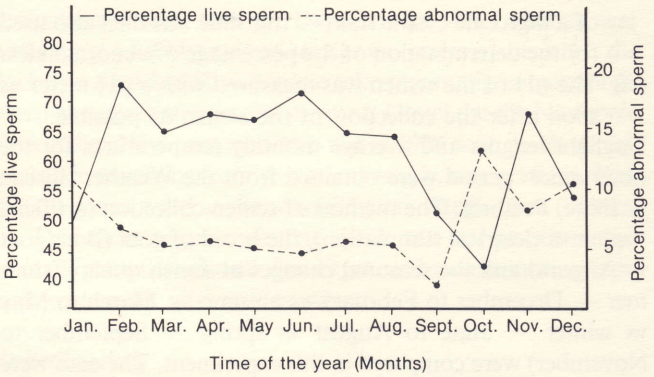

Figure 4 The effect of season on the percentage of live and abnormal sperm per ejaculation in Boer goat rams collected by means of the artificial vagina.

Angora by electrical stimulation was significantly ($P \leqslant 0,05$) lower (1,63 mℓ *vs* 2,48 mℓ) with a higher ($P \leqslant 0,01$) motility (3,1 *vs* 2,06) when compared to that of the Boer goat. No significant difference in pH between the two breeds was obtained, but a significant ($P \leqslant 0,01$) difference between months was obtained (Table 2). The Angora produced an ejaculate with a higher ($P \leqslant 0,01$) sperm density (Figure 2) and percentage of live sperm (Figure 3), with no significant difference in the percentage of abnormalities between the breeds.

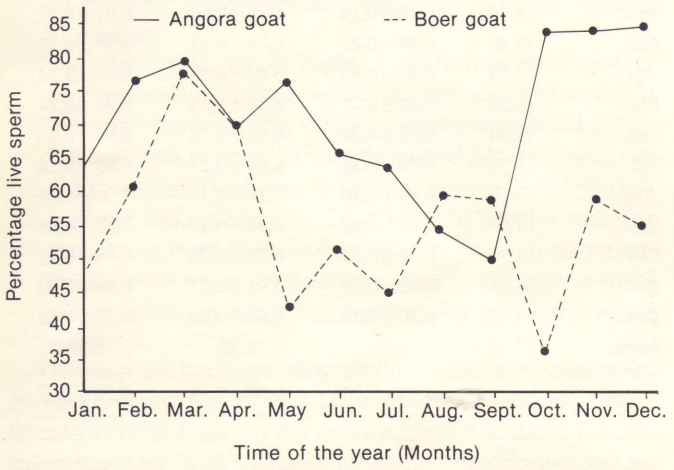

Figure 3 Seasonal variation in the percentage of live sperm per ejaculate in Boer and Angora rams collected by means of electrical stimulation.

Dicussion

No seasonal variation in semen concentration and sperm production indicated by the volume of the ejaculate was recorded. This is in agreement with work done by Loubser (1980) on the Angora ram. Semen motility tended to be lower from June to October for the Boer goat and June to September for the Angora goat, while sperm density declined to a minimum value in November for Boer goat rams (both collection techniques) and in June for Angora goat rams. A negative correlation (−0,90) was obtained (Figure 4) between the percentage of live sperm and the percentage of abnormal sperm in the Boer goat ram when the artificial vagina was used. It is of interest to note that, although non-significant, the positive correlation (0,65) between the percentage of abnormal sperm and daylight length as well as the percentage of abnormal sperm and temperature (0,61) in the same group. The percentage of abnormalities per ejaculate, with which lowered fertility is associated, stayed relatively low throughout the observation period and never exceeded 20% (Foote, 1974).

The most acidic pH of the semen was noted during December for both breeds. A negative correlation (−0,79) was found in the Angora goat ram between pH and the percentage of live sperm in the ejaculate — this is in agreement with Chahal, Rattan & Parshad (1979).

In the Boer goat ram the percentage of live sperm yielded by the technique of the artificial vagina was significantly ($P \leqslant 0,05$) higher than that of semen collected by the technique of electrical stimulation. A significant ($P \leqslant 0,05$) difference between months was also found in the percentage of live sperm in the artificial vagina group, with the lowest values recorded in the months of October and January. This should be taken into consideration when semen is collected for the purpose of artificial insemination or storage by the technique of deep freezing.

The quality of the semen collected by the technique of electrical stimulation from the Angora goat ram proved to be of a higher quality than that produced by the Boer goat in the same group.

As in sheep (Hulet, Foote & Blackwell, 1964) the artificial vagina technique of semen collection in the goat once again proved to be the most desirable technique, but the final and most important criterion for the evaluation of semen quality and freezability lies in the fertilizing capacity of the semen.

References

CHAHAL, A.S., RATTAN, P.J.S. & PARSHAD, O., 1979. Some physico-chemical studies on semen and their interrelationship during different seasons in Corriedale rams. *Ind. J. Anim. Sci.* 49(6), 433.

COLAS, G. & BRICE, G., 1976. Seasonal variations of the fertilizing capacity of deep-frozen ram semen. *Proc. VIIIth Int. Congr. Anim. Prod. and A.I.* Cracow.

COLAS, G. & COUROT, M., 1976. Storage of ram semen. *Proc. Int. Sh. Br. Congr.* Muresk.

CORTEEL, J.M., 1978. Seasonal variations in motility and fertilizing ability of goat spermatozoa. *Anim. Breed. Abstr.* 46, 41.

COUROT, M., 1976. Semen quality and quantity in the ram. *Proc. Int. Sh. Br. Congr.* Muresk.

FOOTE, R.H., 1974. Artificial insemination. In: Reproduction in farm animals. Ed. Hafez E.S.E., Lea and Febiger, Philadelphia, p.409.

HULET, C.V., FOOTE, W.C. & BLACKWELL, R.L., 1964. Effect of natural and electrical ejaculation on predicting fertility in the ram. *J. Anim. Sci.* 23, 418.

LOUBSER, P.G., 1981. Die seisoenale veranderinge in geslagsaktiwiteit en semenkwaliteit by die Angoraram en die diepvriesing van Angoraboksemen. M.Sc (Agric.) thesis, University of Stellenbosch.

SHELTON, M., 1960. Influence of the presence of a male goat on the initiation of oestrous cycling and evaluation of Angora does. *J. Anim. Sci.* 19, 368.