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Seasonal Variations in Semen Quality of Ossimi and Rahmani Rams

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Trials described here aimed to investigate seasonal fluctuations in semen quality of Ossimi and Rahmani rams. Nine rams 2 to 4 years old (five Ossimi and four Rahmani) were derived from the original flock of this department and were being trained for artificial semen collection. The investigation period comprised four equal intervals of one month each as follows : October (autumn), January (winter), April (spring) and July (summer). During the investigation intervals, semen was collected regularly 3 times/ week/ram. A total of 849 ejaculates was investigated. Semen ejaculates were tested for volume, advanced motility, pH, sperm-cell concentration/mm^3 and methylene blue reduction time (MBRT).

Data of the combined breeding groups show that the overal means for seminal attributes mentioned earlier were 0.53 ± 0.04 ml, 68.0 ± 2.0, 6.85 ± 0.03. $3.98\pm0.23\times10^6$ sperm-cell / mm^3 and 3.61 ± 0.46 min, respectively . Excluding semen reaction breed of ram affected investigated seminal characters non-significantly. Difference between breeds in semen reaction (0.04), however is significant, ($P<.05$) yet biologically is negligible.

Comparing semen characteristics of the two successive ejaculates, semen of the second ejaculate was smaller in volume, higher in motility and its reaction was very closer to neutrality, otherwise, semen characteristics of the two ejaculates were significantly not different. Moreover sperm out put of the second ejaculate (1.84×10^9 sperm cell / ejaculate) fell within the normal range of high quality semen.

Tested rams, however, are continuous breeding, yet seasonal variations in semen charateristics were observed. The best quality semen was that of the summer (volume, 0.70 ± 0.02 ml; motility 69.7 ± 1.0 pH, 6.72 ± 0.02; sperm concentration, $4.53\pm0.11\times10^6$ sperm- cell and MBRT, 2.48 ± 0.21 min. and the poorest quality semen was of the winter (volume, 0.34 ± 0.02 ml; motility, 56.9 ± 0.9; pH, 6.96 ± 0.02; sperm concentration, $2.47\pm0.10\times10$ sperm-cell/mm^3 and MBRT, 6.19 ± 0.24 min). Differences between means of the two seasons for all seminal characters are all significant ($P<.0.01$).

The sperm output of rams during autumn (2.85×10^9 sper-cell/ ejaculate) and spring (2.03×10^9 sperm-cell/ejaculate), however, was significantly ($P<.0.01$) lower than that of summer but excelled that of the winter. Seminal discharge of these two seasons was judged, according to the standard indices of semen characteristics, to be of good quality.

There have been very few experiments in which variations in semen quality of local breeds of sheep have been investigated. Hafez *et al.* (1955) working with Ossimi and Rahmani rams, claimed that the highest semen quality was that of spring and autumn, while semen of the summer was of inferior quality. El-Gamal (1975) noticed obvious deterioration in semen characteristics of Ossimi rams during summer. Thus, conclusion drawn from these researches suggests that summer of this country is associated with the production of inferior quality ram semen. This situation is certainly untolerable that is because the active mating season of Ossimi and Rahmani sheep occurs in summer. Logically, trials described here were being conducted to re-investigate seasonal changes in semen quality of Ossimi and Rahmani rams. Utmost attention will be given to minimize possible sources of variation of semen quality.

Material and Methods

A. *Location of observation animals accomodation and feeding*

Nine fat-tail rams 2 to 4 years old, five Ossimi and four Rahmani, were derived from the original flock of the experimental station of this department. All rams were healthy and clinically free of external and internal parasites. Palpation revealed that their external genitalia were typically normal. The testicular tone was glandular, all epididymal regions were present, both testicles were almost equal in size and moved freely up and down within the scrotal pouches. Copulatory patterns for all tested rams, at the beginning of the trials, were judged to be normal.

Animals were penned in two neighbouring semi-open compartments and were being exposed to the natural photoperiod. They were not permitted to graze, nevertheless, they were left free in open backyards for a considerable time of the day. Intentional exercise, however, was not practiced. Rams were shorn twice a year in April and September.

During the period from January through May, rams were lot-fed on berseem (*Trifolium alexandrinum*), rice straw and co-op feed, while during the rest of the year they were allowed diets composed of the latter two ingredients. Feed allowances were calculated according to the standards of this department.

B. *Semen collection and semen quality tests*

Prior to the onset of trials, rams were trained to mount anestrous ewe, thereafter, they were not exposed to ewes except at the time of collection. Semen collection was conducted outdoors and was made by the means of a short type artificial vagina. Its internal temperature at the time of collection was kept in the range of 41°-44°. Sterile inner linar and collecting tube were used at each collection. Each ram was scheduled for collection three times

a week at equal intervals and at each collection two successive ejaculates were separately obtained. Throughout the course of the study, time and place of collection and collector were not changed. Moreover, attention was given to protect semen ejaculates from cold shock and direct light.

The investigation period comprised four equal intervals representing the four seasons of the year as follows :

autumn : October, 1974.
winter : January, 1975.
spring : April, 1975.
summer : July, 1975.

After each period of sexual rest and just before intervals of semen investigation, semen was collected and ignored. Therefore, subsequent collection was scheduled according to the collection intervals stated earlier. When the act of ejaculation was not complete, seminal discharge was excluded, otherwise, semen was transferred immediatly to the laboratory and was subjected to the following tests :

Volume

Measured directlly in ml and to the nearest 0.1 ml using a trasparent calibrated tube.

Percentage of progressively motile sperms

Estimated on a microscope stage incubator at 38° under the high power (400 x). The percentage scale used was between 0 and 100. Normal physiological saline was used for dilution.

Hydrogen-ion concentration

Measured by using pH comparative indicator, ranging from 6.0 to 7.5 with 0.3 grades (Reagencio Phan, Czechoslovakia, TP-6-068-013-57).

Methylene blue reduction time

Estimated by using the method adopted by Herman and Madden (1953). Ejaculates of 0.3 ml or less were not tested.

Sperm-cell concentration

Hemocytometric counts of diluted semen (1 : 500) were obtained using the technique described by Herman and Madden (1953).

C. *Statistical procedures*

Since the number of animals in the two breeding groups were not equal. Unweighted means solution (Snedecor and Cochran 1968) was used to analyze

the effect of breed, sequence of ejaculation, season of the year and the interaction between them on different seminal traits. Duncan's multiple range tests (Duncan, 1955) were done to detect differences performed between pairs of means.

Results

Ejaculate volume

Results appeared in Table 1 show that the overall mean ejaculate volume was 0.53 ± 0.4 ml and means of the character for Ossimi and Rahmani rams were 0.53 ± 0.02 ml and 0.54 ± 0.02 ml, respectively. The ANOVA revealed that breed influence on the character was not significant (Table 6). The first ejaculate (0.60 ± 0.02 ml) was significantly ($P < 0.01$) larger in volume than the second ejaculate (0.47 ± 0.03 ml). This finding is valid for Ossimi (0.62 ± 0.02 ml vs. 0.44 ± 0.02 ml) and Rahmani (0.58 ± 0.02 vs. 0.50 ± 0.02 ml) rams. In the former breed; the volume of the second ejaculate accounted for 71.0% that of the first, while in the latter breed the percentage was 86.2%. Difference (15.2%) was statistically significant ($P < 0.01$).

Season of the year exerted a significant ($P < 0.01$) effect on ejaculate volume, being 0.70 ± 0.02 ml in summer, 0.62 ± 0.03 ml in autumn, 0.47 ± 0.02 ml in spring and 0.34 ± 0.02 ml in winter. Duncan's multiple range test revealed significant differences between all pairwise seasons. The interaction between season and breed was also significant ($P < 0.01$). In Ossimi, average ejaculate volume in autumn (0.67 ± 0.01 ml) and winter (0.38 ± 0.01 ml) was higher than the corresponding values of the two seasons for Rahmani (Table 1). The combined data of the two breeding groups show that the descrepancy between the first and the second ejaculates was high in summer and autumn than it was in other seasons of the year. Duncan's test indicated that volume differences between the two successive ejaculates for all pairwise seasons were significant ($P < 0.01$).

Sperm-cell concentration/mm³

The overall mean sperm-cell concentration/mm³ was 3.98 ± 0.23 × 10^6 cell (Table 2). Means of the character for Ossimi (4.02 ± 0.15 × 10^6 cell) and Rahmani (3.94 ± 0.18 x 10^6 cell) were statistically not different, thus breed was without significant contribution to the character. Similary, sequence of ejaculation affected the trait non-significantly (Table 6). Also, the ANOVA, between breed and sequence of ejaculation lacked significance. The ANOVA, however, revealed highly significant ($P < 0.01$) differences among seasons. Starting from spring through autumn, a gradual increase in sperm-cell counts was noticed. The lowest counts were recorded for winter. Duncan's test indicated that difference in sperm-cell counts between summer (4.53 ± 0.11 × 10^6 cell) and autumn (4.60 ± 0.11 x 10^6 cell) was not significant, otherwise, all seasons differed significantly ($P < 0.01$) from each other.

Seasonal influence on sperm-cell counts in the two breeding groups was different. This was shown by the highly significant ($P < 0.01$) breed / season interaction. In Ossimi, sperm counts of the winter ($2.84+0.07$ 10^6 cell) and spring (4.50 ± 0.08 x 10^6 cell) were significantly ($P<0.01$) higher than the corresponding values of Rahmani. The reverse is correct for autumn as counts of Ossimi (4.27 ± 0.07 / 10^6 cell) were significantly lower ($P < 0.01$) than those for Rahmani ($4.92 \pm 0.08 \times 10^6$ cell). In summer, means of the character for the two breeding groups differed non-significantly. There was a significant ($P < 0.01$) interaction between season and sequence of ejaculation on sperm concentration/mm_3. First ejaculate sperm counts in winter and autumn were significantly lower than those of the second ejaculate of the same seasons. In spring and summer, sperm counts of the first ejaculate were higher than those of the second ejaculate. Difference in spring was only significant and in summer it was highly significant.

Advanced motility

The overall mean percentage of advanced motility was $68.0+2.0$. The means for Ossimi and Rahmani rams were 68.1 ± 1.3 and 67.9 ± 1.6 (Table 3). Difference between means of the two breeding groups was not significant. The percentage of progressively motile sperms in the first ejaculate (66.4%) was significantly ($P < 0.01$) lower than that of the second ejaculate (69.6%). Advanced motility percentage was high in autumn ($74.2 \pm 1.0\%$) and obviously low in the winter ($56.9 \pm 1.0\%$). Values of spring and summer were $71. \pm 1.2$ and $69.9 \pm 1.0\%$ Duncan's test indicated that difference between all pairwise seasons are significant. Possible interactions of variables considered here did not influence the character significantly (Table 6).

Methylene blue reduction time (MBRT)

The overall average time required for the complete reduction of the colour of methylene blue was 3.61 ± 0.46 min (Table 4). Breed, sequence of ejaculation and the interaction between them did not exert any significant effect on the character. Season of the year, however, was shown to influence the character significantly ($P < 0.01$). The shortest reduction time was that of spring (2.30 ± 0.25 min) and summer (2.48×0.21 min), while the longest was that of the winter (6.19 ± 0.24 min). Autumn's estimate (3.46 ± 0.21 min) was of intermediate value between summer and winter. The interactions between breed / season and season x sequence of ejaculation were non-significant.

Semen reaction

The combined data of both breeding groups show that semen reaction was very close to neutral (6.85 ± 0.03). Values for Ossimi (6.83 ± 0.02) and Rahmani (6.87 ± 0.02), however are very close but differ significantly ($P < 0.05$). The reaction of the first ejaculate (6.80 ± 0.02) was slightly lower than that of the second ejaculate (6.89 ± 0.02), yet, difference between the means was significant (P 0.01). The ANOVA revealed highly significant ($P < 0.01$) differences among seasonal groups. Semen reaction in winter was 6.96 ± 0.02,

decreased gradually till became minimal in summer. In autumn, semen reaction restored its high value of the winter (Table 5). Duncan's test indicated that difference between autumn and winter was not significant, otherwise, values of any pair of seasons differ significantly ($P < 0.01$). Semen reaction was shown to be influenced by the interaction between season and breed (Table 6). In autumn and summer, semen reaction for Ossimi rams was significantly higher ($P < 0.01$) than that for Rahmani and the reverse is correct for winter and spring.

Discussion

It is intentionally planned to discuss the basic conclusions that receive the support of the present data. Conclusions appear debatable, for one reason or another, were left without discussion. For instance, the significantly longer MBRT of the winter could be due to a lower dehydrogenase activity of sperm-cells but possibly could be attributed to any interference with the normal process of breakdown or resynthesis of ATP such as cold shock. Measurements were taken to protect semen against cold shock may not be satisfactory. Similarly, it could not be outlined with certainty, whether the lower sperm output in this particular season was to a lower spermatogenic activity or resulted from a relatively less effective sympathetic impulses of ejaculation. These issues and many others were not considered in the present discussion.

Overall means

The overall mean ejaculate volume reported here (0.53 ± 0.04 ml) is smaller than volumes reported by other fat-tail rams investigators of this locality (Hafez *et al.*, 1955; El-Mikkawi *et al.*, 1967; El-Chahidi, 1973 and El-Gamal, 1975). None of these investigators did practice the intensive semen collection done here (25 ejaculate/ram/month). Their values were calculated on the basis of one ejaculate every 5 to 10 days. The system of collection adopted here approximated the usual frequency of breeding during the active mating season (about 6 weeks) where the ram is assigned to join 35 - 50 ewes/season.

Obvious decrease in ejaculate volume of the present study could be explained on dietary basis, as it is claimed that feeding programme of this study was below convential. Thus, rams, unitentionally, were being underfed. Research is in progress to investigate this possibility. Mann (1969) mentioned that underfeeding of mature males seemed not to influence the normal spermatogenic functions of the testicles but it did affect the functions of the accessory sex glands.

Sperm-cell concentration/mm^3 in the present study ($3.98 \pm 0.23 \times 10^6$) was very close to estimates elaborated by Hafez *et al.* (1955) and El-Chahidi (1973). Nevertheless, the present estimate is obviously higher than values reported by El-Mikkawi *et al.* (1967) and El-Gamal (1975). All authors were working with fat-tail rams. It should be mentioned that the overall mean of the character, given here, fell within the normal range ($2\text{-}5 \times 10^6$ cell/mm^3) reported for the species (Mann, 1969).

Semen reaction of the two breeding groups is very close to neutral and the overall mean reported here (6.85 ± 0.03) is very close to that (6.90), reviewed by White (1958) for several breeds sheep. El-Gamal (1975) gave a lower estimate of 6.61 for Ossimi rams. In rams and bulls, pH should be measured immediately after collection and any delay is accompanied by a drop in semen reaction due to accumulation of lactic acid.

The overall average MBRT was 3.61 ± 0.46 min. This figure was higher than estimates reported for fat-tail rams of this locality (El-Mikkawi *et al.*, 1967, El-Chahidi, 1973 and El-Gamal, 1975). Existing differences in MBRT are to a great extent, due to differences in techniques adopted. In the present study, the test was proved to be sensible to variations in semen density and motility. Thus, indicating that the test was measuring the dehydrogenase activity of sperm-cells. Moreover, time to complete decolorization was only considered.

The overall mean of advanced motility (68.0 ± 2.0) is considered normal. Most semen of good quality will not routinely contain more than 70% progressively motile sperms, the only exception to that is the dog semen which normally contains about 80% advanced motile sperms (Foote and Trimberger, 1968).

Breed effect

Excluding semen reaction, breed of ram was shown to influence all the investigated seminal attributes non-significantly. That is to say semen quality of Ossimi and Rahmani rams was not different, This conclusion is in accordance with that reached by Smyth and Gordon (1967), Land (1969), Sahni and Roy (1972) and El-Gamal (1975). All reported that breed of ram is without significant contribution to semen quality. It was noticed, however, that individual rams within breeds vary widely in most of the investigated seminal characters. The same conclusion was drawn from the researches of Ortavant *et al.* (1948), Hafez *et al.* (1955) and Sahni and Roy (1969). Thus, the picture depicted is that variations in semen charateristics within the two tested breeds of rams, under this locality, are much more important than those between breeds.

Semen reaction of Rahmani rams was significantly ($P < 0.05$) higher than that of Ossimi, but the difference between pH means (0.04) is actually negligible when considering the sensitivity of the pH measure and the biological significance of the test.

The effect of sequence of ejaculation

Comparing seminal characteristics of the two successive ejaculates, semen volume of the second ejaculate was smaller (78.3% of the first), motlity rating was higher (the finding is correct for mass and advanced motility) and the pH was comparatively closer to neutrality, otherwise, semen characteristics of the two ejaculates are statistically not different. The total sperm counts of the second ejaculate (1.84×10^9 cell/ejaculate) is even higher than the lower limit of the character for high quality ram semen (Foote and Trimberger,

1968). Thus small ejaculate volume is not harmful unless if accompanied by low sperm concentration, it lowers the total number of sperms available below desirable limits. From the biological point of view, the semen from the two successive ejaculates was of high quality.

Season effect

Data clearly show that Ossimi and Rahmani rams are continuous breeding as they are capable of producing semen all the year around. Seasonal fluctuations in semen characteristics, however, are observed. The highest spermatogenic output was recorded in summer (3.17×10^9 cell/ejaculate) and the lowest was that of the winter (0.84×10^9 cell/ejaculate). The former season is characterized by the longest day (13.6 hr), the highest average ambient temperature(27.1°) and less availability of green fodder. In winter, the day length is shorter (10,6hr), average temperature is the lowest (13.4° hr) and green fodder is available. Eventhough, semen of the best quality ; as judged byseminal tests tried here, was obtained in summer, meanwhile, semen of inferior quality was associated with the winter.

The ram of the temperate areas of the world retain a certain degree of fertility throughout the whole year, but in many cases fertility is curtailed during the spring and summer months. During summer, seminal degeneration may be severe enough that it causes temporary summer sterility (Moule, 1956; Dutt and Simpson, 1957; Loggins *et al.*, 1964 and Sahni and Roy, 1967). Two exteroceptive stimuli are usually considered in discussing season influence upon semen quality of rams. These are light and ambient temperature. Concerning the role of light some investigators (McDonald, 1961 ; Bruckner and Bauer, 1972 and Jackson and Williams, 1973) do believe that day length is the most important stimulus related to fluctuations of semen characteristics in the ram. Testicular weight, number of testicular and epididymal spermatozoa, ejaculate volume, sperm concentration and total number of sperms/ejaculate were greater during periods of short day length (Ortavant, 1956). Fowler (1962), working with ram semen, was able to show that increasing the natural day length by the administration of artificial light was against semen quality of rams. In this species it is claimed that 12 hr daily illumination gave optimal stimulus to sepermatogenesis (Ortavant, 1952). It should be mentioned however that experiments of light effect were conducted without controlling other exteroceptive stimuli known to be involved in semen production and characteristics. Possibley for this reason Clegg and Ganong (1969) believe that the influence of light duration upon semen characteristics in the ram has not yet been ruled out.

Some authors have suggested that the deterioration of ram semen during summer of the temperate localities is due to high ambient temperatures. This concept receives a rather strong experimental support. Semen from rams maintained at 45-48°F during summer has a better quality than that of animals kept under uncontrolled environment (Dutt and Bush, 1955 and Dutt and Simpson, 1957). Shearing of rams results in lower rectal temperature, was shown to improve conception rates (Dutt and Hamm, 1957).

TABLE 1. The effect of breed, sequence of ejaculation and season of the year on ejaculate volume (ml) ·

Season	Ossimi Rams			Rahmani Rams			Overall		
	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2
All . . .	0.62±0.02	0.44±0.02	0.53±0.02	0.58±0.02	0.50±0.02	0.54±0.03	0.60±0.02	0.47±0.03	0.53±0.04
seasons .	(263)	(246)	(509)	(181)	(159)	(340)	(444)	(405)	(849)
Winter. .	0.44±0.03	0.33±0.02	0.38±0.01	0.31±0.02	0.29±0.02	0.30±0.01	0.37±0.01	0.31±0.01	0.34±0.02
	(66)	(63)	(129)	(49)	(37)	(86)	(115)	(100)	(215)
Spring .	0.51±0.03	0.39±0.02	0.45±0.01	0.49±0.02	0.48±0.03	0.49±0.01	0.50±0.01	0.43±0.01	0.47±0.02
	(69)	(63)	(132)	(57)	(42)	(93)	(120)	(105)	(225)
Summer .	0.70±0.04	0.51±0.02	0.61±0.01	0.83±0.04	0.76±0.04	0.80±0.02	0.76±0.01	0.63±0.01	0.70±0.02
	(60)	(54)	(114)	(32)	(33)	(65)	(92)	(87)	(179)
Autumn .	0.81±0.03	0.53±0.03	0.67±0.01	0.68±0.04	0.44±0.02	0.56±0.01	0.74±0.01	0.48±0.01	0.62±0.03
	(68)	(66)	(134)	(49)	(47)	(96)	(117)	(113)	(230)

Ej_1 = the first ejaculate and Ej_2 = the second ejaculate.

Number of ejaculates is given in parenthesis.

TABLE 2. The effect of breed, sequence of ejaculation and season of the year on sperm-cell count (million/mm³).

Season	Ossimi Rams			Rahmani Rams			Overall		
	Ej_1	Ej_2	Ej_1Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2
All . . .	4.14±0.10	3.90±0.11	4.02±0.15	3.92±0.12	3.95±0.13	3.94±0.18	4.03±0.16	3.92±0.17	3.98±0.23
Seasons .	(170)	(154)	(324)	(119)	(104)	(223)	(289)	(258)	(547)
Winter. .	2.74±0.11	2.93±0.12	2.84±0.07	1.87±0.12	2.33±0.16	2.10±0.08	2.30±0.07	2.63±0.08	2.47±0.10
	(46)	(43)	(89)	(41)	(31)	(72)	(87)	(74)	(161)
Spring .	4.67±0.09	4.32±0.09	4.50±0·08	4.05±0.19	4.23±0.16	4.14±0.10	4.36±0.09	4.27±1.0	4.32±0.13
	(34)	(29)	(63)	(23)	(17)	(40)	(57)	(46)	(103)
Summer .	4.92±0.11	4.03±0.13	4.48±0.07	4.89±0.19	4.27±0.24	4.58±0.09	4.90±0.08	4.15±0.08	4.53±0.11
	(45)	(39)	(84)	(26)	(27)	(53)	(71)	(66)	(137)
Autumn .	4.23±0.17	4.31±0.13	4.27±0.07	4.89±0.17	4.95±0.19	4.92±0.08	4.56±0.08	4.63±0.08	4.60±0.11
	(45)	(43)	(88)	(29)	(29)	(58)	(74)	(72)	(146)

Ej_1 = the first ejaculate and Ej_2 = the second ejaculate.
Number of ejaculates is given in parenthesis.

TABLE 3. The effect of breed, sequence of ejaculation and season of the year on the percentage of progressively motile sperm.

Seasoon	Ossimi Rams			Rahmani Rams			Overall		
	Ej	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2
All . . .	66.7±0.9	69.5±0.9	68.1±1.3	66.1±1.1	69.7±1.1	67.9±1.6	66.4±1.4	69.6±1.5	68.0±2.0
Seasons .	(170)	(154)	(324)	(119)	(104)	(223)	(289)	(258)	(547)
Winter .	56.4±1.4	60.7±1.7	58.5±0.6	54.9±1.3	55.8±2.3	55.3±0.7	55.6±0.6	58.2±0.7	56.9±0.9
	(46)	(43)	(89)	(41)	(31)	(72)	(87)	(74)	(161)
Spring .	69.1±1.3	71.9±1.6	70.5±0.7	68.5±1.4	75.0±1.5	71.7±0.2	68.8±0.8	73.2±0.7	71.1±1.2
	(34)	(29)	(63)	(23)	(17)	(40)	(57)	(46)	(103)
Summer .	69.4±1.3	71.0±1.4	70.2±0.6	68.3±1.5	70.0±1.2	69.1±0.8	68.8±0.7	73.4±0.9	69.7±1.0
	(45)	(39)	(84)	(26)	(27)	(53)	(71)	(66)	(137)
Autumn .	71.8±1.7	74.5±1.6	73.1±0.6	72.8±1.2	77.9±0.8	75.3±0.7	72.3±0.7	76.2±0.7	74.2±1.0
	(45)	(43)	(88)	(29)	(29)	(58)	(74)	(72)	(146)

Ej_1 = first ejaculate and Ej_2 = second ejaculate
Number of ejaculates is given in parenthesis.

TABLE 4. The effect of breed, sequence of ejaculation and season of the year on methylene blue reduction time (min).

Season	Ossimi Rams			Rahmani Rams			Overall		
	Ej_1	Ej_2	Ej_1Ej_2	Ej_1	Ej_2	$Ej + Ej_2$	Ej_1	Ej_2	$Ej_1 + Ej_2$
All . . .	3.50±0.20	3.73±0.21	3.61±0.30	3.79±0.25	3.41±0.26	2.48±0.21	3.64±0.31	3.57±0.34	3.61±0.46
Seasons .	(145)	(127)	(272)	(96)	(83)	(179)	(241)	(210)	(451)
Winter . .	6.13±0.50	6.13±0.56	6.13±0.15	7.33±0.73	5.16±0.42	6.24±0.18	6.73±0.16	5.64±0.18	6.19±0.24
	(30)	(26)	(56)	(23)	(17)	(40)	(53)	(43)	(96)
Spring . .	2.34±0.13	2.39±0.13	2.36±0.16	2.31±0.14	2.15±0.14	2.23±0.19	2.32±0.16	2.27±0.19	2.30±0.25
	(30)	(22)	(52)	(21)	(16)	(37)	(51)	(38)	(89)
Summer .	2.33±0.12	2.72±0.16	2.52±0.13	2.23±0.15	2.64±0.22	2.43±0.16	2.28±0.14	2.68±0.15	2.48±0.21
	(40)	(38)	(78)	(26)	(27)	(53)	(66)	(65)	(131)
Autumn .	3.20±0.31	3.68±0.31	3.44±0.12	3.28±0.24	3.68±0.46	3.48±0.16	3.24±0.14	3.68±0.15	3.46±0.21
	(45)	(41)	(86)	(26)	(23)	(49)	(71)	(64)	(135)

Ej_1 = first ejaculate and Ej_2 = second ejaculate.
Number of ejaculates is given in parenthesis.
Ejaculates of 0.3 ml or less were not tested.

TABLE 5. Semen reaction as influenced by breed of ram, sequence of ejaculation and season of the year.

Season	Ossimi			Rahmani			Overall		
	Ej_1	Ej_2	Ej_1+Ej_2	Ej_1	Ej_2	Ej_1+Ej_2	Ej^1	Ej_1	Ej_1+Ej_2
All Seasons	6.78±0.01 (263)	6.88±0.01 (246)	6.83±0.02 (509)	6.83±0.02 (181)	6.90±0.02 (159)	6.87±0.02 (340)	6.80±0.02 (444)	6.89±0.02 (405)	6.85±0.03 (849)
Winter	6.81±0.02 (66)	6.93±0.03 (63)	6.87±0.01 (129)	7.01±0.04 (49)	7.08±0.04 (37)	7.04±0.01 (86)	6.91±0.01 (115)	7.00±0.01 (100)	6.96±0.2 (215)
Spring	6.72±0.02 (69)	6.79±0.02 (63)	6.75±0.01 (132)	6.78±0.03 (51)	6.83±0.03 (42)	6.80±0.0[illegible] (93)	6.75±0.01 (120)	6.81±0.01 (105)	6.78±0.01 (225)
Summer	6.70±0.02 (60)	6.79±0.02 (54)	6.75±0.01 (114)	6.65±0.03 (32)	6.73±0.03 (33)	6.69±0.04 (65)	6.67±0.01 (92)	6.76±0.01 (87)	6.72±0.02 (179)
Autumn	6.89±0.02 (68)	7.03±0.03 (66)	6.96±0.01 (134)	6.91±0.03 (49)	6.98±0.03 (47)	6.94±0.01 (96)	6.90±0.01 (117)	7.00±0.01 (113)	6.95±0.01 (230)

Ej_1 = first ejaculate and Ej_2 = second ejaculate.
Number of ejaculates is given in parenthesis.

TABLE 6. **Mean squares for different sources of variation for different seminal characters.**

Source of variation	Vol./Ej.	Sperms/mm³	Motility	MBRT	pH
Season (S)	0.1011**	4.1090**	231.7**	963.6**	0.0607**
EjaculateNo. (Ej)	0.0655**	0.0496NS	41.5**	6.2NS	0.0291*
Breed (B)	0.0002NS	0.0286NS	0.2NS	0.5NS	0.0050*
B × Ej	0.0088**	0.0723NS	0.5NS	2.2NS	0.0009NS
B × S	0.0184**	0.3545**	5.9NS	10.7NS	0.0101**
S × Ej	0.0080**	0.2141**	1.8NS	6.1NS	0.0004NS
S×B×Ej	0.0003NS	0.0128NS	2.4NS	4739.4**	0.0002NS

** Significan ta t1% level.
* Significant at 5% level.
NS Non-significant.

More direct evidence for the deleterious influence of high ambient temperatures on semen characteristics was introduced by scrotal insulation (Moule and Waites, 1963 ; Braden and Mattner, 1970 and Glover 1955 and 1956) or direct exposure of rams to elevated temperatures (Dutt and Hamm, 1957 and Smith, 1971).

The present findings, indicating that the best quality semen was that of the summer, could not be explained on the basis of the researches discussed earlier. In the present work, the period of the highest ambient temperature and the longest daylight hr is related to the best semen quality and *vice versa.*

The sperm output of rams during autumn (2.85×10^9 cell/ejaculate) and spring (2.03×10^9cell/ejaculate), however/is significantly ($P < 0.01$) lower than that of the summer but it is 2.4 to 3.4 times higher than that of the winter. Moreover, according to the known indices, semen of these two seasons is judged to be of good quality.

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التغيرات الموسمية فى صفات السائل المنوى للكباش الأوسيمى والرحمانى

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استعمل فى البحث خمس كباش أوسيمى واربع كباش رحمانى مدربه على الجمع الصناعى للسائل المنوى •

شملت التجربه أربعة فترات، طول كل منها شهر، تمثل فصول السنة الأربعة على النحو التالى :

الخريف : اكتوبر ، الشتاء : يناير ، الربيع : ابريل ، الصيف : يوليو • وأثناء كل فتره من هذه الفترات كان يتم جمع السائل المنوى من كل كبش على فترات منتظمة بمعدل ثلاث مرات أسبوعيا ، وتتكون الجمعة الواحدة من قذفتين متتاليتين وكان مجموع القذفات المتحصل عليها هو ٨٤٩ قذفة • وكانت كل قذفة تختبر للصفات التالية : الحجم فى القذفة الواحدة ، النسبة المئوية للحيوانات المتحركة حركة تقدمية ، درجة تركيز أيون الأيدروجين ، عدد الحيوانات المنوية/مم٣ والوقت اللازم لاختزال أزرق الميثلين •

ودلت النتائج على عدم وجود اختلافات معنوية بين متوسط صفات القذفة — باستثناء درجة تركيز أيون الأيدروجين — للكبش الأوسيمى عن تلك للكبش الرحمانى كما أشارت النتائج أن الكباش تحت الدراسة لها القدرة على انتاج السائل المنوى فى فصول السنه الأربعة وكانت أجود الصفات هى للسائل المنوى المتحصل عليه فى الصيف بينما كانت صفات السائل المنوى المتحصل عليه فى الشتاء متدهوره فى حين كانت نوعية السائل المنوى للربيع والخريف وسط بين الشتاء والصيف •