

Results of Breeding Soundness Evaluations of Senepol Bulls in the US Virgin Islands

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What is a Breeding Soundness Evaluation*?

- The Breeding Soundness Evaluation (BSE) is a test developed to predict the potential fertility of a bull
- It is based on an examination that includes tests for physical soundness, testicular size and semen quality

Why Use the BSE?

- Breeding success depends on the reproductive health of both the female and the male
- Breeding usually involves one male mated to many females
- Fertility of an individual animal can vary from year to year
- BSE can be used as a selection tool

Percentage of Senepol Bulls Receiving a Passing Grade in the BSE in Florida

Age	% Pass	Number of bulls
15 mo	15.8	14
18 mo	59.4	14
21 mo	74.0	14

(From Chenoweth et al., 1996)

Components of the BSE

- Scrotal circumference (SC)
- Sperm motility
- Sperm morphology

Scrotal Circumference

- Highly correlated to testicular weight and sperm producing capacity
- Testicular size is an inherited trait
- With advancing age, testicular tissue may lose some sperm producing capacity

Sperm Motility

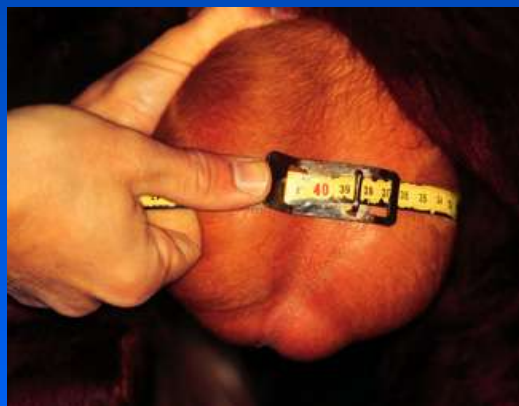
- It is a measure of the ability of sperm to move toward the ovum after ejaculation has occurred
- Abnormal shape of spermatozoa is the most common reason for reduced motility

Sperm Morphology

- Morphology refers to the shape of sperm
- Reduced fertility usually occurs when the numbers of primary defects is greater than 18 to 20%
- Secondary defects are not generally as serious and do not affect fertility unless a large number are present

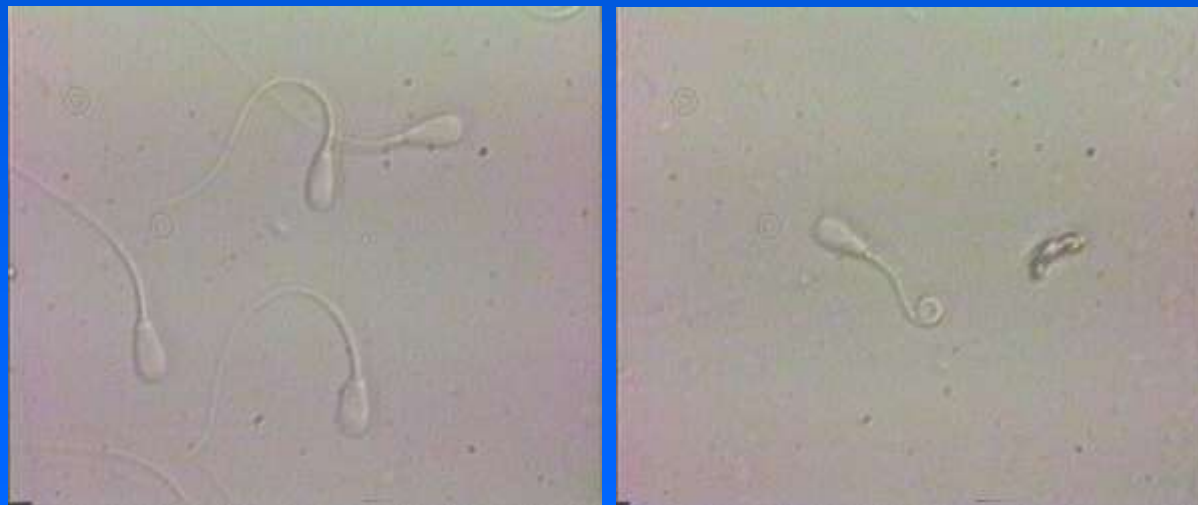
Minimal SC for Satisfactory BSE Score

Age (mo)	Sc (cm)
≤ 15	30
>15 and ≤ 18	31
> 18 and ≤ 21	32
> 21 and ≤ 24	33
> 24	34



Minimal Semen Parameters for a Satisfactory BSE Score

- The minimum recommended threshold for individual motility is 30% motile spermatozoa
- The minimum recommended threshold for sperm morphology is 70% normal spermatozoa



Bull BSE Classifications

Satisfactory

equal or surpass the minimum thresholds for SC, sperm motility and morphology, and do not show genetic, infectious or other problems or faults which compromise breeding or fertility

Unsatisfactory

below one or more thresholds; highly unlikely to ever improve their status; show genetic faults or irrevocable physical problems which would compromise breeding or fertility are included

Deferred

does not fit into the previous categories; could benefit from a retest; bulls with an “immature” semen profile; semen of improvement.

Objective

- Evaluate Senepol bulls using the BSE to determine the proportions that pass at various ages
- Determine if there is a relationship between BSE results and inbreeding coefficients in Senepol bulls on St. Croix

Materials and Methods



Animals

- Senepol bulls on 3 farms on St. Croix, USVI
- Evaluated using the BSE as described by the Society for Theriogenology (Chenoweth et al., 1992,1993).
- Data was collected over a 7-yr period
- Bulls were divided into 2 categories prior to data analysis - SELECT and UNSELECT

Parameters of Bull Categories

	SELECT	UNSELECT
No. of bulls	71	491
No. of BSE tests	102	928
Age range, months	12.7 to 89.3	6.5 to 86
Test frequency	random	every 4 mo

Data Collected

- Measurements collected included scrotal circumference (SC) and sperm motility and morphology
- Semen was collected by electroejaculation
- If a bull had a SC less than the minimum 30 cm necessary for a Satisfactory rating, semen was not collected (bull would not have received a Satisfactory rating regardless of the semen quality ratings)
- Inbreeding coefficients were determined for a subset of the UNSELECT bulls (n = 316) using Pedigree Viewer 5.0 software

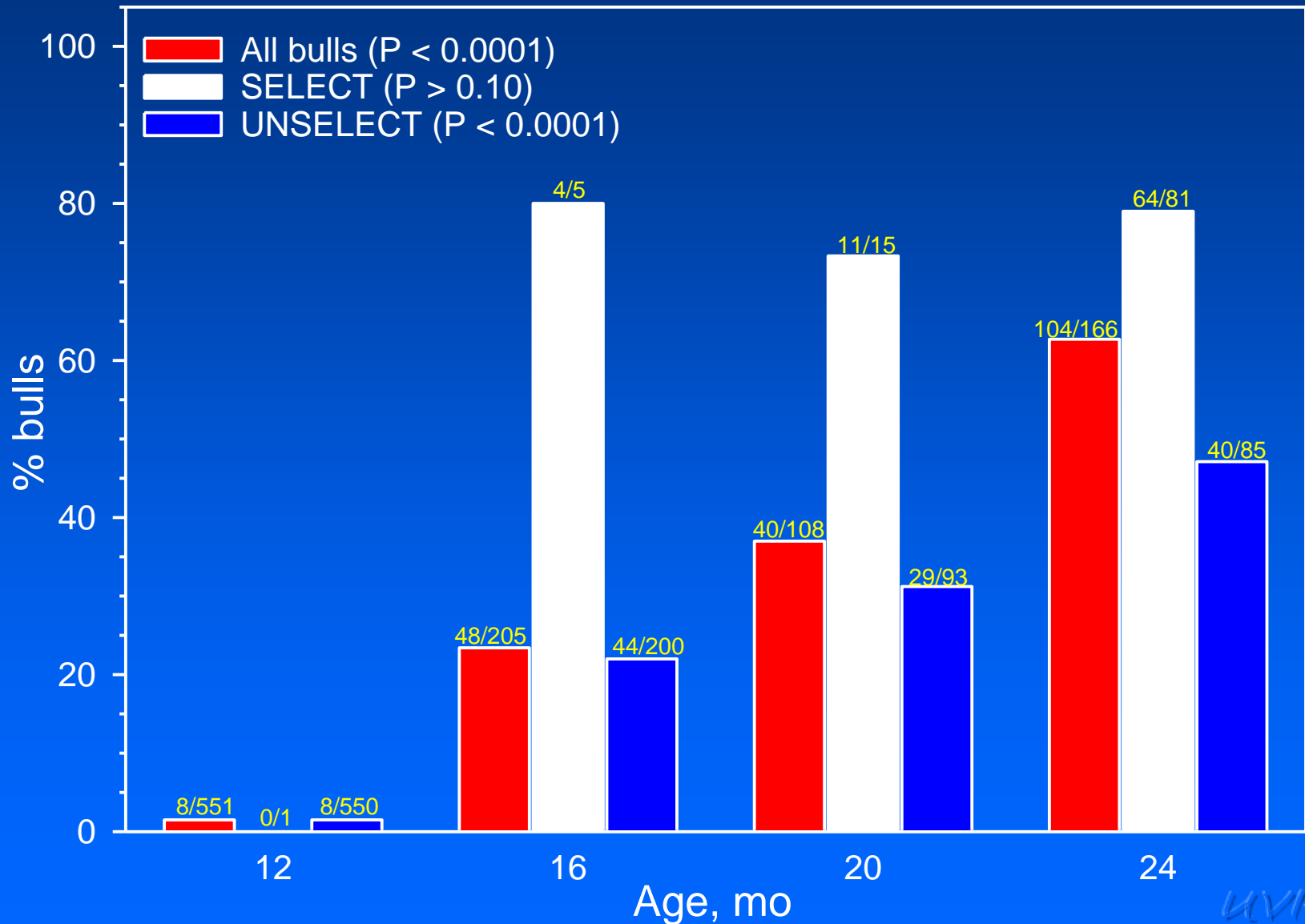
Data Analysis

- Analyzed using General Linear Models procedures of SAS to determine means (\bar{x} SEM) for BSE traits at various ages
- Correlation analysis was done to determine the relationship between BSE results and inbreeding level of bulls
- Chi-squared analysis was used to analyze the proportions of bulls within age and SELECT vs UNSELECT groups that received Satisfactory or Unsatisfactory BSE ratings

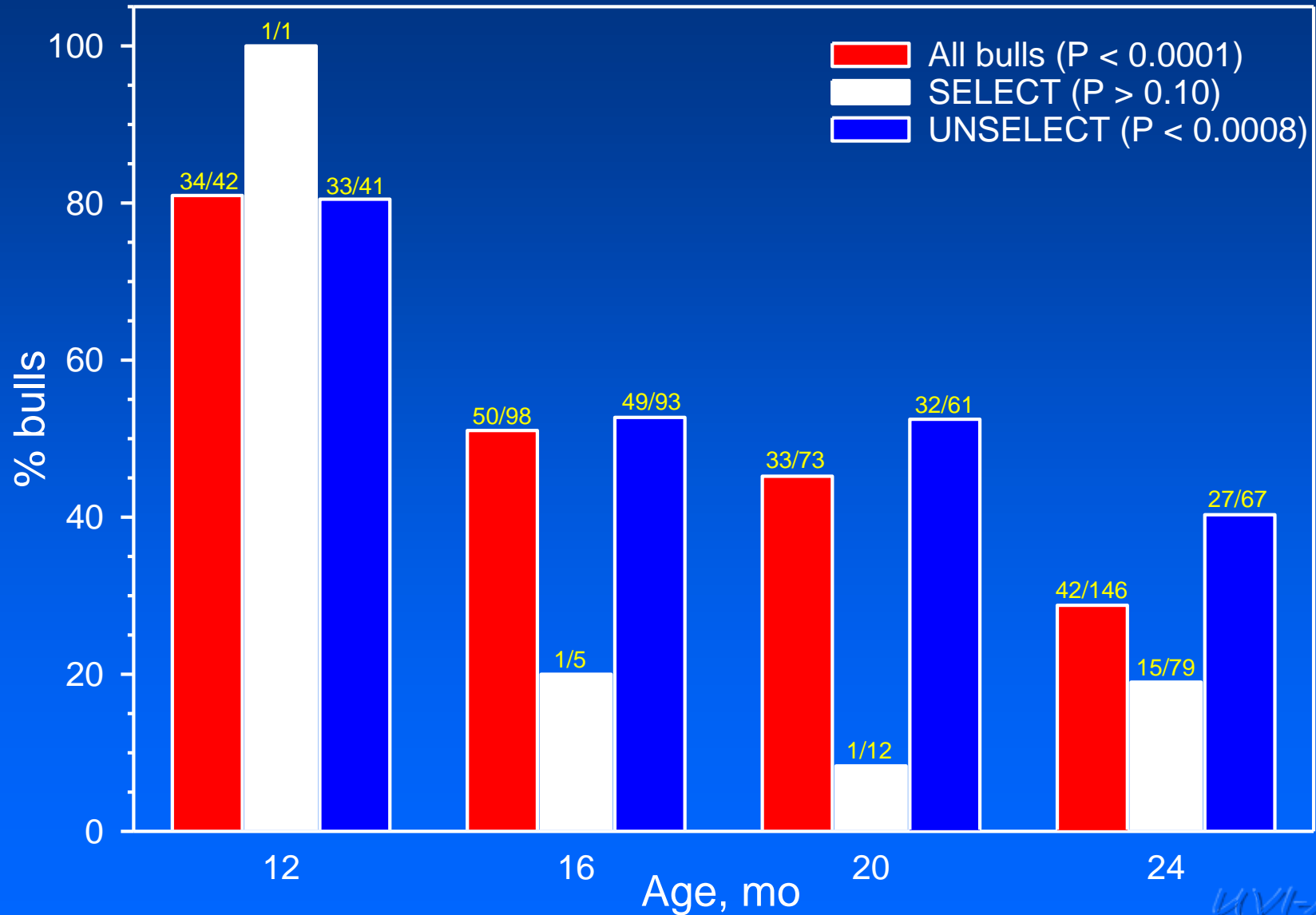
RESULTS



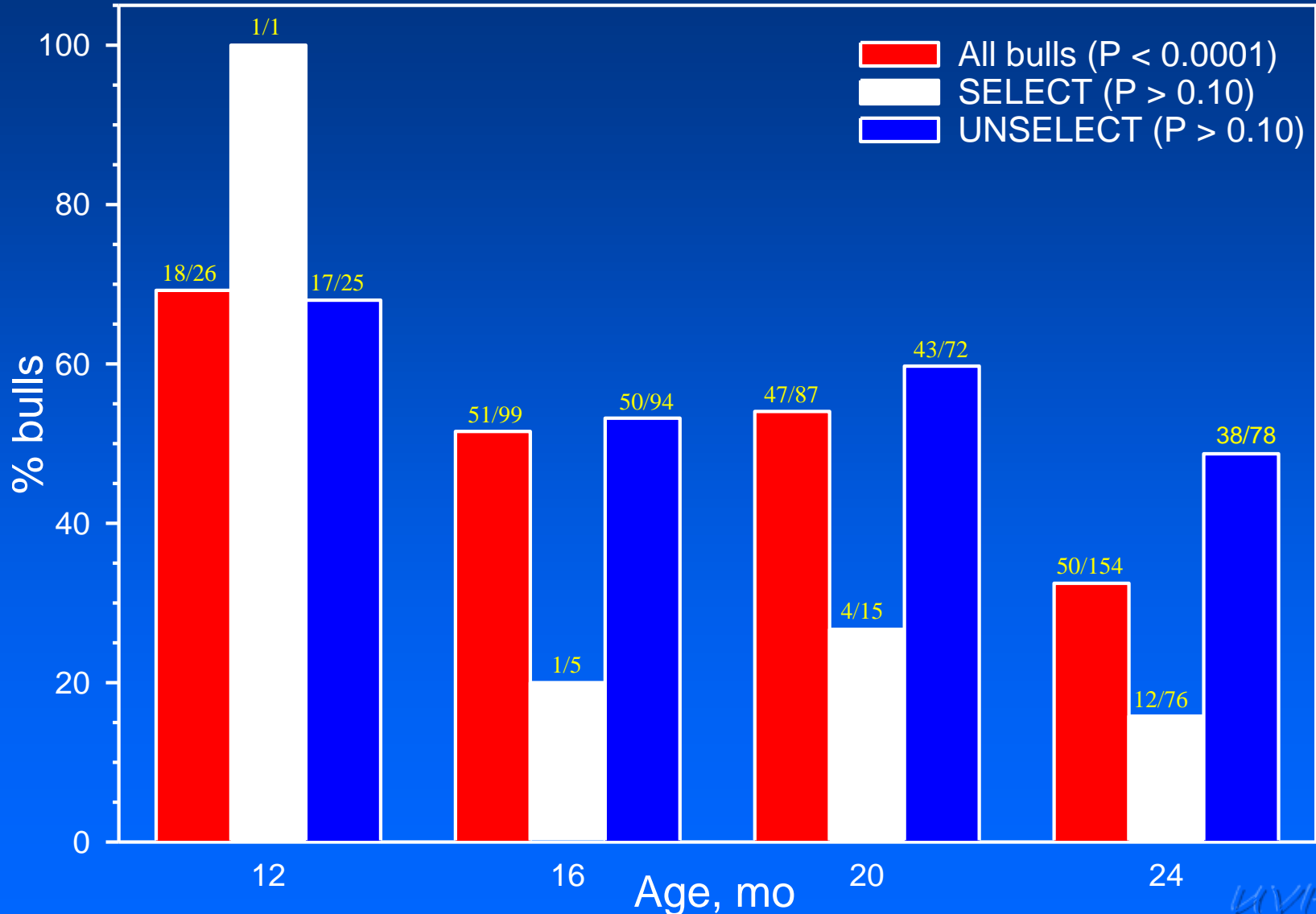
Proportion of Bulls Receiving a Satisfactory BSE Rating



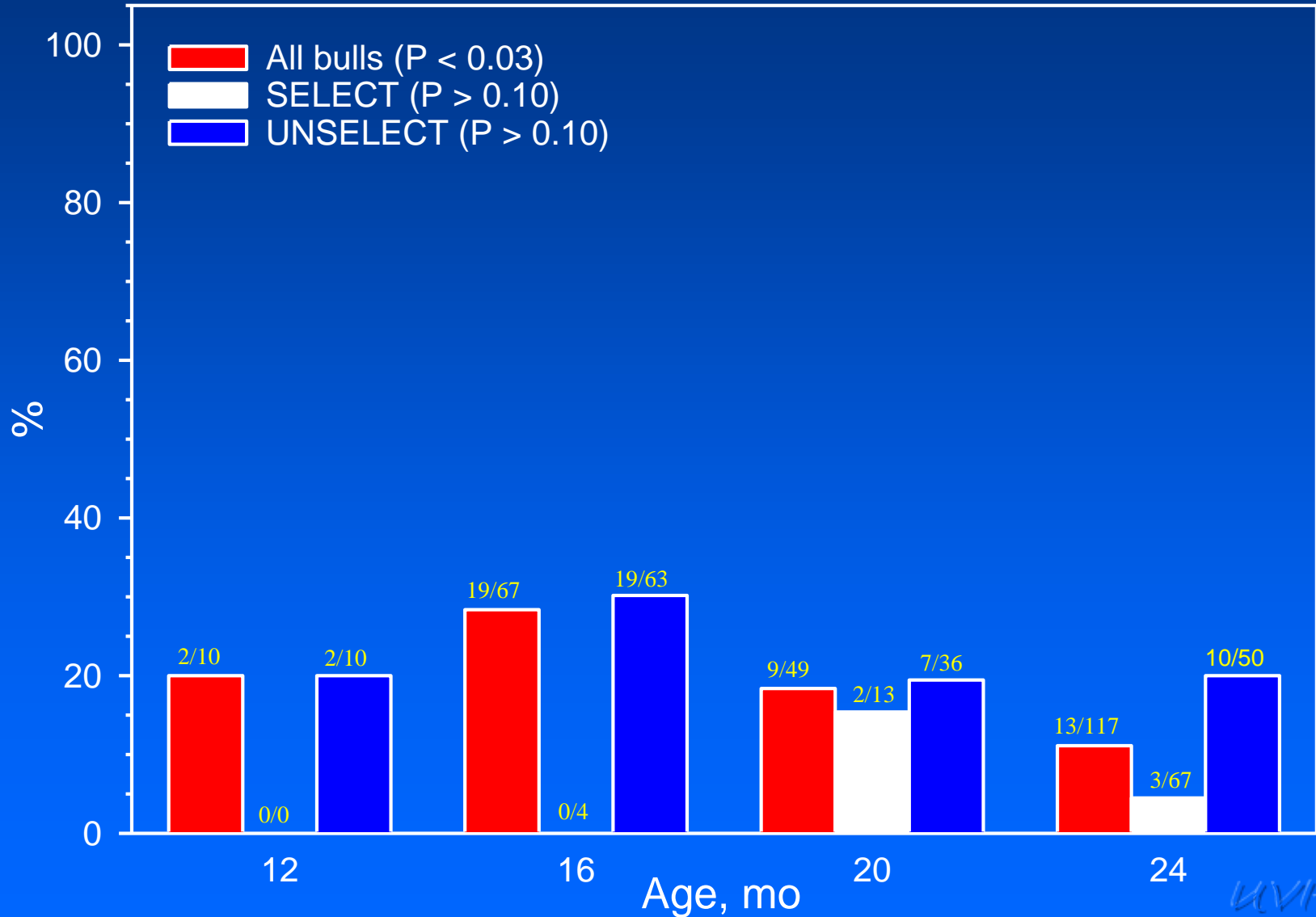
Proportion of Bulls Receiving an Unsatisfactory BSE Rating but a Satisfactory Rating for SC



Proportion of Bulls Receiving an Unsatisfactory BSE Rating but a Satisfactory Rating for Sperm Motility



Proportion of Bulls Receiving an Unsatisfactory BSE Rating but a Satisfactory Rating for Sperm Morphology



Traits of UNSELECT Senepol Bulls Based on Results of the BSE

Age (mo)	SC (cm)		Motility (%)		Normal Morphology (%)	
	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory
12	33.6 ✂ 1.1 ^a	24.9 ✂ 0.1 ^b	80.0 ✂ 7.6 ^c	61.5 ✂ 4.8 ^d	81.9 ✂ 3.8 _a	56.1 ✂ 2.4 ^b
16	33.4 ✂ 0.4 ^a	29.9 ✂ 0.3 ^b	84.4 ✂ 3.2 ^e	69.1 ✂ 2.8 ^f	80.9 ✂ 1.6 _a	66.3 ✂ 1.4 ^b
20	35.1 ✂ 0.6 ^a	32.0 ✂ 0.4 ^b	85.6 ✂ 3.9	80.1 ✂ 3.2	83.5 ✂ 1.9 _a	63.7 ✂ 1.6 ^b
≥ 24	38.6 ✂ 0.5 ^a	35.3 ✂ 0.5 ^b	85.5 ✂ 3.4	77.3 ✂ 3.3	84.8 ✂ 1.7 _a	63.6 ✂ 1.6 ^b
Pooled	35.5 ✂ 0.4^a	27.1 ✂ 0.2^b	84.8 ✂ 1.9^a	73.3 ✂ 1.6^b	82.9 ✂ 0.9_a	63.7 ✂ 0.8^b

a,bP < 0.0001, c,dP < 0.04, e,fP < 0.0004

Traits of SELECT Senepol Bulls Based on Results of the BSE

Age (mo)	SC (cm)		Motility (%)		Normal Morphology (%)	
	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory	Satisfactory	Unsatisfactory
12	----	38.6	----	70	----	64
16	36.3 ✕ 1.8	33.0 ✕ 3.5	69.0 ✕ 9.8	85.0 ✕ 19.6	81.0 ✕ 4.5 ^g	50.0 ✕ 8.8 ^h
20	34.9 ✕ 1.1 ^a	29.2 ✕ 1.8 ^b	88.0 ✕ 5.9	75.0 ✕ 9.8	85.6 ✕ 2.3 ^g	61.5 ✕ 4.4 ^h
≥ 24	39.7 ✕ 0.4	39.8 ✕ 0.9	81.8 ✕ 2.5 ^c	67.9 ✕ 5.2 ^d	83.5 ✕ 1.1 ^g	61.2 ✕ 2.4 ^h
Pooled	38.8 ✕ 0.5	37.6 ✕ 0.9	81.9 ✕ 2.4^e	70.3 ✕ 4.7^f	83.7 ✕ 1.2ⁱ	60.8 ✕ 2.4^j

a,bP < 0.006, c,dP < 0.04, e,fP < 0.03, g,hP < 0.002, i,jP < 0.0001

Traits of Senepol Bulls With More Than One BSE Test			
Age (mo)	SC (cm)	Motility (%)	Normal Morphology (%)
12	29.1 \times 0.8 ^a	67.8 \times 5.5 ^e	67.3 \times 3.4 ^e
16	32.5 \times 0.3 ^b	78.9 \times 2.4 ^{e,f}	70.1 \times 1.5 ^e
20	34.2 \times 0.4 ^c	82.5 \times 2.5 ^f	72.8 \times 1.5 ^{e,f}
\geq 24	35.9 \times 0.4 ^d	80.7 \times 2.3 ^f	75.4 \times 1.4 ^f
a,b,c,dP < 0.0001		e,fP < 0.04	

Inbreeding Coefficient (IC) and Percentage of a Subset of UNSELECT Senepol Bulls Receiving a Satisfactory BSE by Age

Age (mo)	IC (%)	Bulls Receiving Satisfactory Rating (%)
12	1.74 \times 0.62	1.4 ^a
16	2.14 \times 0.25	24.1 ^b
20	2.08 \times 0.33	33.8 ^c
≥ 24	1.74 \times 0.35	41.3 ^d
a,b,c,dP < 0.0001		

Correlation of Inbreeding Coefficient (IC) With BSE Traits in Unselected Senepol Bulls ^a

Age (mo)	BSE Trait		
	SC (cm)	Motility (%)	Normal Morphology (%)
12	-0.11 (0.04)	-0.42 (0.06)	0.009 (0.97)
16	-0.14 (0.08)	0.002 (0.98)	-0.05 (0.66)
20	-0.21 (0.07)	-0.29 (0.03)	-0.11 (0.43)
≥ 24	-0.39 (0.001)	-0.17 (0.19)	0.001 (0.99)
Pooled	-0.12 (0.002)	-0.12 (0.07)	-0.02 (0.77)

^aValues represent simple correlation coefficient, r , and (P)

Conclusions

- A low proportion of young Senepol bulls were able to achieve a Satisfactory BSE rating, but the percentage increased with age
- Scrotal circumference and sperm motility did not appear to have as strong an impact on achieving a Satisfactory BSE rating as sperm morphology did

Conclusions

- A higher proportion the bulls that received an Unsatisfactory BSE rating had Satisfactory SC or motility ratings than had Satisfactory morphology ratings
- The very low level of inbreeding in the Senepol herds on St. Croix did not have a measurable effect on the breeding potential of the bulls as evaluated using the BSE

Conclusions

- It appears that the limited number of Senepol cattle on St. Croix can be managed to minimize the level of inbreeding without introducing new animals to the herds for breeding



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