

Researches into Sterility of Cows in South Africa. The Influence of: (i) Dry Rations, (ii) Lack of Exercise, and (iii) Lack of Sunlight on Repro- duction of Beef Heifers and Cows.

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This article is an amplification of a previous publication by Quinlan and Roux (1936). It gives details of the complete breeding history of a number of grade Sussex-Afrikander females kept in an environment enforcing dry rations, restricted sunlight and exercise. The relevant literature was discussed in the previous paper. Since that date no further information upon the subjects has, according to the knowledge of the authors, been published.

EXPERIMENTAL OBSERVATIONS.

The treatment and the method of conducting the observations were continued as previously reported (Quinlan and Roux, 1936). Certain of the more important details are repeated in order to facilitate acquaintance with the plan and procedure.

The experiment was commenced in June, 1929, when 27 grade Sussex-Afrikander heifers, approximately 15 months old, were received at the Veterinary Experimental Station, Ermelo, Transvaal. The heifers were uniform in type and they were divided, at random, into three groups, A, B and C.

Five heifers proved to be pregnant so they were discarded temporarily and re-drafted into the experiment after approximately 12 months.

During their first month at the Experimental Station the heifers were tested for tuberculosis, contagious abortion and they were vaccinated against anthrax and quarter-evil. They were again tested subsequently at regular periods for contagious abortion and annually for tuberculosis. All tests were negative.

Three Sussex bulls were used during the course of the observation. All bulls were maintained in good hard working condition by adequate exercise and properly balanced feeding. Their general and genital health were carefully controlled.

Groups A and B, restricted to light and exercise.

The stable occupied by these groups was 46 by 23 feet, a total cubic capacity of 8,217 cubic feet. The animals received their concentrate and hay rations in the stable where they were fastened to the mangers by means of neck-halters. The ventilation of the stable was fair, two doors, 4 by 6½ feet, opening east and west. As much light as possible was excluded from the stable.

The two groups were let out to water for twenty minutes, twice daily.

Group C, not restricted to light and exercise.

The stabling conditions were very similar, the cubic capacity being 6,328 cubic feet. In this case the cattle were fastened in the stable only during the night; they were allowed unrestricted exercise and sunlight in a near-by kraal during the day.

Management.

Suitable hygienic conditions were maintained throughout the course of the observation. The cattle were groomed daily and the stables kept clean and dry. The refuse of the roughage fed, namely teff hay, was used as bedding. Contact with other cattle was not allowed.

The feeding of the three groups was identical. The cattle were stall-fed the following rations per head per day:—

Commencement ration:

Crushed yellow maize: 4 lb.

Wheaten Bran: 1 lb.

Teff hay: *ad lib.* (about 15 lb.).

As the heifers matured the bran ration was increased to 2 lb. and the teff hay to 25-30 lb. per head. No green feed was given and they were not put out to grazing.

During June, July and August every year maize silage was fed at the rate of 10-15 lb. per head per day and the hay ration was reduced.

No minerals were fed to the cattle during the entire period of the observation.

Further details of feeding and the analysis of feeds are given in the previous report (Quinlan and Roux, 1936).

It was estimated that members of Groups A and B walked 295 yards daily during the periods of watering and oestrous observations and they were exposed to sunlight for about ¾ hour daily during those periods.

The stonewalled kraal in which Group C exercised during the day was 50 by 68 feet. The kraal was exposed to sunlight between 7.0 a.m. to 5.0 p.m. in summer and from 8.0 a.m. to 4.0. p.m. in winter.

All cattle were dipped in a 14-day strength arsenite of soda dip when deemed necessary, more frequent dipping occurring during summer. The necessary precautions were taken with in-calf cows.

Calves were allowed to suckle their dams thrice daily during the first months and thereafter twice daily.

The calves were not permitted to eat the cow's rations and were given their own concentrate or roughage rations. The calves were weaned at six months of age when they weighed approximately 400 lb.

Climatic Conditions.

The altitude of Ermelo is 5,690 feet; the annual rainfall is approximately 27 inches, 90 per cent. of which falls during the summer months of October to March. The summer day-temperatures are high, but the nights are cool. During winter the day-temperatures are mild to warm, but the nights are cold and frosty.

Fuller details of rainfall and temperatures are given in the previous paper by Quinlan and Roux (1936).

Observations.

Oestrous observations were made twice daily when the groups were let out to water at 8.30 a.m. and 4.30 p.m. All groups were let out into a yard adjoining the stables where the cattle were allowed to remain for a short period to permit the stockman or the professional officer in charge of the Experiment Station to make observations. However, the examination was continued when the cattle were let out to the water trough in a larger yard. The time taken for the observations of the three groups was approximately 90 minutes a day.

Further details in connection with the oestrous observation and the symptoms of oestrus revealed are given in the previous report (Quinlan and Roux, 1936).

The serving of Groups A and C was commenced when the heifers were 31 months old; Group B heifers were served five to six months later. A new bull was introduced when the bull in use became heavy or inactive.

All animals were under the constant supervision of a stockman or the Officer in Charge of the Experimental Station, who undertook all oestrous observations and supervised all services given by the bulls.

Further details of mating are given in the previous report (Quinlan and Roux, 1936).

All cows were weighed at monthly intervals, but not during advanced stages of pregnancy. All calves were weighed as soon as possible after birth and subsequently at monthly intervals.

Discussion.

The order of the presentation of the data in tables is maintained as in the previous report.

The most important aspect of the study are again considered under the following sections:—

1. Dioestrous cycles.
2. Age and weight at successful service at calving.
3. Number of services required to establish pregnancy.
4. Gestation periods.
5. Birth weight of calves.

All data have been subjected to statistical analysis.

1. *Dioestrous Cycle.*

Data with regard to the periodicity of oestrus are given in Tables I to XI. An analysis of all dioestrous periods is contained in Table XII (*a*), while the frequencies of the periodicity for each of the eleven periods are presented in Tables XIII to XXIII and a further analysis is continued in Table XXIV.

It is seen that oestrous observations were commenced when the heifers were 15 months old and they were continued throughout the period of the life of all cattle some of which attained an age of approximately 13 years.

Although all heifers exhibited their first oestrus before they were 24 months of age, considerable variation exists within groups with regard to the age of sexual maturity, as indicated in the following table:—

Group.	15	16	17	18	19	20	21	22	23	Total.
A.....	0	1	0	0	5	1	0	1	1	9
B.....	0	0	0	1	2	3	0	1	0	7
C.....	0	1	2	1	1	0	0	2	1	8

The variations reflected in the above table are due to individual differences and, therefore, no significance can be attached to the differences between groups.

The frequencies of the periodicity of oestrus given in Tables XIII to XXIII (*a*) have been analysed and the chief points of interest are as follows:—

	Under 18 days.	18-24 days.	25-37 days.	38-45 days.	46-59 days.	60-74 days.	75-82 days.	83 and over days.	Total days.
No. of dioestrous cycles..	64	613	35	81	25	26	16	21	881
Percentage of total.....	7.3	69.5	4.0	9.2	2.84	3.0	1.8	2.4	—

In the above table the subdivision of the period was based upon the concentration of oestrous periods of specific periods in the grand total of all groups during all periods and not upon a constant portion of time in days. In the compilation of all periods for all groups (table not included) it was revealed that the mode was 20 days. 186 out of 881 dioestrous cycles or 21.1 per cent. were of 20 day duration and the next highest 155 or 17.6 per cent., were of 21 day duration. It is seen from the above table that in 69.5 per cent. of cases the dioestrous cycles fall within the period 18 to 24 days. Tables XIII to XXIII (*a*) indicate that while dioestrous cycles of long duration, that is, periods exceeding 24 days, occur uniformly during the 13 periods of breeding, most short periods, that is periods shorter than 18 days occur during the first periods, that is before

the animals were bred and again from the 5th period. During the second to the fourth period, no periods shorter than 19 days were observed. It is also seen from Table XXIV that smaller percentages of dioestrous cycles of long duration occurred during the same periods, second to the fourth period, or when the females were from 41 to 70 months old.

Some differences between the groups receiving different treatment were discussed in the previous report (Quinlan and Roux, 1936).

In that the periods between calving and the subsequent successful services vary greatly within groups [Tables II to XI (a)] any comparisons between groups with respect to the number of dioestrous cycles would be of doubtful value.

2. Age and Weight.

The details of age and weight of the cattle at final service during each period are given in Tables I to XI (a). A summary of the data is given in Table XII (a).

With regard to the approximate age at final service, there is a significant difference between groups which is due only to the age at which the first successful service was given; no significant differences occurred after the 4th service.

The weights indicate that the cattle were in excellent condition throughout the course of the experiment. In fact some individuals could be described as obese.

3. The Number of Services.

Details of the number of services required to establish pregnancy are included in the Breeding Summary, Table XII (a). An analysis of the data has established that there was no significant difference between Groups A, B and C during any period nor between periods within any group.

It is seen from the data that as many as 7, 9 and even 11 services were required to establish pregnancy. In some such cases when the dioestrous period was abnormally long a retained corpus luteum was found upon examination and when the gland was expressed the cow showed oestrus within three days. By examining the data in Tables I to XI it will be seen that individuals requiring relatively large numbers of services one season to establish pregnancy, require only one or two services the following season. A further summary of this aspect is presented in the following table:—

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total.
Group A.....	49	6	5	4	2	1	0	1	0	0	0	0	0	0	68
Group B.....	48	7	0	3	1	0	2	0	2	0	1	0	1	1	66
Group C.....	60	7	5	2	0	0	0	0	0	0	0	0	0	0	74
Total.....	157	20	10	9	3	1	2	1	2	0	1	0	1	1	208

With regard to the number of pregnancies established, the data reveal no differences between Groups A, B and C for calves born, abortions, or total number of pregnancies.

4. *Gestation Periods.*

The gestation periods of each cow in all groups for all periods are given in Tables I to XI. The mean periods for each group are reflected in Tables XII (b), frequencies are reflected in Table XXVII.

An analysis of the data has revealed no significant differences between the gestation periods of any of the groups in any of the experimental periods, significant differences are revealed when the gestation periods of the first three experimental periods 1929 to 1933 are compared with those of the remaining periods 1934 to 1941. This is reflected in the following table:—

	Periods I, II, III.	Periods IV to XI.	Differences.
A.....	280.08 (24)	278.45 (38)	Significant.
B.....	280.24 (25)	276.65 (31)	..
C.....	281.08 (36)	276.94 (36)	..
All Groups.....	280.48 (75)	277.40 (105)	..

It should be pointed out that, from period seven onwards, the data become more limited, hence too much weight must not be attached to the fluctuations from the seventh period onwards.

5. *Calves.*

Details of the calving of each animal are given in Tables I to XI (a). A summary is presented in Table XII (b) and a comprehensive tabulation of all calving and related data has been made and given in Table XXV.

An analysis of the data has revealed:—

- (a) There is no significant difference with respect to birth weight of calves of Groups A, B and C within any period.
- (b) There is a tendency for lighter calves to be born with advancing age of cows. It was pointed out above that gestation periods become shorter during the later periods.
- (c) There is no significant difference between Groups A, B and C, with respect to sex of calves, nor is there any evidence that the sex-ratio alters with advancing age of cows.

The period between calving and the first subsequent oestrus is important in that it affects the optimum number of calves born during any cow's life-time. Except for differences between Groups A and C and B and C during the second period no significant differences existed [Table XII (b)]. It is likely that differences within groups are so large that differences between groups disappear.

There are also no differences between groups with respect to the length of the period between calving and the last oestrus or the next successful service. While a few calves of exceptionally light weight 34, 37.5 and 43.0 lb. were born, the very great majority weighed over 60 lb. at birth and in several cases calves weighed over 90 lb.

It is most important to note that only a few cases of difficult calving were experienced and these were not serious. Also only a few cases of retention of afterbirth were encountered. Under the enforced environmental conditions difficulties at parturition and with the expulsion of the foetal membranes were visualised, but the sound state of the genital tract, maintained by the hygienic precautions taken, apparently obviated these difficulties.

6. *Summary of the History of Reproduction.*

Table XXVIII is a summary of the most important aspects of the reproductive lives of the cattle in the experiment from the age of 15 months to approximately 13 years.

The average age at first calving was approximately 3.5 years. Three cows died shortly after the commencement of the experiment or after their first calves were born. The calving data are condensed in the following table which reflects the frequencies of the number of calves born out of individual cows; the numbers of abortions are included.

Frequencies of the Numbers of Calves Born.

	0	1	2	3	4	5	6	7	8	9	10	11	Total Calves.	Abor-tions.	Total pregnan-cies.
Group A..	1	1	0	0	0	0	3	0	1	2	1	1	66	2	68
Group B..	0	0	1	2	1	0	1	1	1	2	1	0	59	8	67
Group C..	0	1	0	1	1	1	0	1	0	4	1	0	66	5	71
All Groups	1	2	0	2	3	2	3	2	2	8	3	1	191	15	206

Three cows died after being in the experiment for a relatively short period while others died after producing 3 or 4 calves. The cows that remained in the experiment up to Nov. 1941 produced from 5 to 11 calves.

In view of the fact that the stabling conditions must be considered to have been somewhat crowded and the cows were not dehorned, the number of abortions which must be considered as accidental is not high.

The following table indicates the frequencies of the periods between calvings in months:—

Months between pregnancies.	4	7	8	9	10	11	12	13	14	15	16	17	18	19	20	24	25	35	Total periods.
Group A.....	0	0	0	0	1	3	24	14	6	4	2	0	1	1	2	0	0	0	58
Group B.....	1	1	1	0	0	5	26	10	3	3	1	1	0	0	0	1	1	1	55
Group C.....	0	0	0	0	2	1	27	12	8	7	1	1	0	0	1	0	0	0	60

The short periods of four to eight months are due to abortions, while the normally long periods are due to failure of conception. As stated in the previous report, cows were served approximately three months after calving.

Table XXVIII shows the cause of death of the individual cows in each group, and also the condition of the ovaries and the state of the uterus, pregnant or non-pregnant at the time of death. In Group A two cows died of pneumonia, 3591 at 33 months, slaughtered *in extremis*, and 3596 at 139 months. Cow 3592 died of septicaemia following uterine prolapse at 46 months and cow 3593 from sapraemia at 112 months. The remaining six cows were slaughtered at 168, 171, 124, 176, 175, 124 months respectively; of those slaughtered during advanced age four showed cystic ovaries, one cow, aged 171 months, was pregnant, and one cow aged 175 months showed normal genitalia, but was non-pregnant.

In Group B cow 3602 died of pneumonia at 165 months, 3610 of anaplasmosis at 17 months, 3605 of rectal stenosis at 86 months, and 3608 of collapse, following parturition, at 118 months, the remaining six cows were slaughtered in advanced age. Two were pregnant when slaughtered at 171 months, one slaughtered at 159 months, because of rectal stenosis, showed cystic ovaries, three also showed cystic ovaries at 124 months. The remainder showed normal genitalia, but were non-pregnant. In Group C, cow 3615 died from natural causes at 28 months; no post mortem was made; cow 3618 died from traumatic pericarditis at 80 months and 3618 died from dystokia at 172 months; of the remaining seven slaughtered at 124, 150, 124, 175, 150, 175, 171 months, four showed cystic ovaries, while three showed normal genitalia but were non-pregnant.

21 cows lived to an advanced age, 124 to 175 months, three lived 112, 117 and 118 months respectively, six died of natural causes at 17, 28, 33, 46, 80 and 86 months. This longevity can be considered satisfactory under the conditions prevailing on the high veld in South Africa. In fact the average expectation of life for exogenous cattle and their grades compared with the indigenous afrikander, when run under veld conditions, is considerably shorter. The protection given the cattle by the management during the observation increased their expectation of life and their production.

It will be observed that there was a number of cows in advanced age which showed cystic degeneration of the ovaries. In several cases it was already established at 124 months. The pre-disposition to this pathological ovarian change would appear to be increased with advancing age.

CONCLUSIONS.

1. The effects of a dry ration, high condition, and the restriction of sunlight, and exercise upon sexual activity and reproduction of beef females have been studied.

The observations were conducted on 30 grade (mostly half-bred) Sussex-Afrikander females. The experiment was commenced when the heifers were 15 months old and its duration extended over a continuous period of approximately 13 years. A small number of the animals was eliminated soon after the commencement of the experiment, but 60 per cent. remained under observations for 9 to 13 years. The period of the experiment includes 12 calvings.

2. When a dry ration consisting of maize, wheaten bran and teff hay was fed for nine months of each year and maize silage of good quality was added during the remaining three months of each year, very satisfactory results of growth and reproduction were obtained.

Beef heifers from the age of 15 months attained a satisfactory mean weight of approximately 900 lb. at maturity or when about 24 months of age.

Mature animals maintained good condition on the ration and they were able to acquire considerable weight during the pregnancy periods in most cases resulting in very high condition.

Sexual maturity was reached before the age of 24 months and sexual activity and reproduction cannot be said to have been affected adversely by the treatment.

3. High condition caused no ill-effects upon general health or the reproduction processes.

30 per cent. of the cows lived to the age of 14.4 years.

The total pregnancies were 206, 191 calves were born, 15 abortions occurred. The mean calf production of all groups was 6.4 per cow.

4. The restriction of sunlight and exercise in no way detrimentally affected the health, growth and vigour of heifers and cows being fed dry rations.

There was no significant difference in the body weights of the comparative Groups A and C which attained 957.8 and 995.9 lb. at the age of 31 months respectively.

The onset of maturity was not delayed. Up to the age of 31 months, or prior to being bred, a large number of dioestrous cycles were seen to have been experienced by the heifers receiving restricted sunlight and exercise. The mean number of dioestrous cycles experienced by the restricted groups was 15.5 as opposed to 12.2 in the unrestricted group.

Considering all groups, the mode of the period of dioestrus was 20 days, and, although cycles as short as 10 days and as long as 123 days were experienced, approximately 75 per cent. of the dioestrous cycles fell between 18 and 23 days. It appears that as the age of the animals advanced under the treatment enforced the percentage of dioestrous cycles between 18 to 23 days decreased.

Considering all groups for all periods, during which time 881 dioestrous cycles were observed, the mode was 20 days, 21.1 per cent. being of that duration. In 69.5 per cent. of cases the periodicity of oestrus was 18 to 24 days.

5. A restriction of sunlight and exercise did not effect the period between calvings.

In all groups for the entire experimental period in 44.5 per cent. of cases, the period between calvings was 12 months.

In the restricted exercise group in 51.7 per cent. of cases the period exceeded 12 months whereas in the group receiving exercise the equivalent figure is 50 per cent.

Generally oestrus was observed to occur 15 to 21 days after calving. Although, in the majority of cases the period of absence of oestrus was in the vicinity of 60 days, many cases of over 100 days occurred and cases of even over 200 days were encountered.

6. Restricted sunlight and exercise had no effect upon conception rate.

In the restricted group, 72·1 per cent. of cows were impregnated by one service, and the equivalent figure for the unrestricted group was 81·1 per cent. The percentages impregnated by 1 and 2 services is 80·9 per cent. and 90·5 per cent. respectively.

Considering all groups only 5·8 per cent. required more than four services to establish pregnancy.

7. The lengths of gestation was unaffected by limiting sunlight and exercise.

The mean gestation period up to the age of 6 years was 280·5 days; gestation periods during later periods or in older cows was 277·4 days, the difference being significant.

8. Unrestricted exercise and sunlight did not reflect any advantage upon the weight of calves produced.

A suspicion exists that the use of different bulls during the course of the experiment influenced the birth weight of the calves during different periods. Considering all groups, few calves born weighed under the 60 lb. at birth, while weights up to 99 lb. were recorded.

There is a tendency for lighter calves to be born with advancing age of cows.

9. High-conditioned heifers, under conditions of restricted sunlight and exercise, showed no tendency towards abnormal sexual activity when breeding was delayed until the heifers were 35 months of age, that is, they calved down at 44 months of age.

The reproductive functions and regularity of calving were unaffected by such delayed breeding.

The disadvantage was that, over the lifetime of the cows, only 59 calves were obtained as compared to 66 in each of the groups bred six months earlier.

10. The environment enforced appears to improve the expectation of life and reproduction of beef cattle on the high veld of the Transvaal. This is, no doubt, due to protection from cold and ticks, as well as from diseases, such as contagious abortion and trichomoniasis, affecting the genital tract.

11. There is a predisposition to the development of cystic degeneration of the Graafian follicle during advancing age in cattle maintained under the environmental conditions enforced even when they are protected from genital infection by suitable hygiene.

REFERENCE.

- QUINLAN, J. AND L. L. ROUX (1936). Researches into sterility of cows in South Africa. The influence of (i) Dry Rations; (ii) Lack of Exercise, and (iii) Lack of Sunlight on reproduction in Beef Heifers and Cows. *Onderstepoort Journal of Vet. Sci. and Anim. Ind.*, Vol. 6, No. 2, pp. 719-772.

TABLE I.
Breeding Table A.—First Period, 1929-1931.

Group and D.O.B. No.	Approximate Age at which Oestrous Observations began. (20.6.29).	Date on which first Oestrus was Observed.	OBSERVATION PERIODS:		Total Number of Di-oestrous Periods.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services required to Establish Pregnancy.	Gestation Period.	Sex of Calf.	Birth-weight of Calf.
			Groups A and C: June 1929-December 1930. Group B: June 1929-April 1931.	The Periodicity of Oestrus in Days.							
GROUP A.	Months.				Months.	Ib.		Days.			Ib.
3591.....	15	3.10.29	40, 18, 18, 21, 20, 19, 20, 21, 21, 21, 20, 21, 20, 21, 20, 21, 20, 21, 21, 22, 21, 23	19	32	937	2 (a)	—	—	—	—
3592.....	15	27.2.30	19, 22, 19, 20, 20, 21, 20, 21, 20, 21, 20, 19, 21	12	31 : 37 (b)	930	1 : 2 (b)	277	Male	82.0	
3593.....	15	5.10.29	25, 21, 38, 18, 19, 38, 39, 19, 20, 19, 20, 22, 21, 19	15	31	882	1	277	Female	60.0	
3594.....	15	30.7.29	55, 23, 20, 17, 26, 10, 28, 21, 38, 20, 20, 21, 20, 20, 20, 19, 21, 20, 40	19	31	989	1	285	Male	86.5	
3595.....	15	16.10.29	63, 15, 61, 19, 37, 19, 20, 20, 19, 19, 21, 18, 18, 30, 17, 18	16	33	1,108	3	275	Male	75.5	
3597.....	15	25.1.30	38, 14, 24, 22, 19, 19, 20, 20, 20, 20, 19, 21	13	31	916	1	280	Male	75.0	
3598.....	15	24.11.29	16, 16, 18, 28, 21, 24, 22, 23, 23, 20, 24, 22, 23, 21, 21, 21, 23	17	32	907	2	281	Female	73.5	
3599.....	15	16.10.29	14, 22, 50, 22, 84, 18, 21, 20, 20, 22, 38, 22, 19, 21	14	32	917	2	281	Female	72.0	
3600.....	15	17.10.29	19, 21, 55, 90, 20, 20, 20, 19, 23, 22, 22, 24, 21, 23	14	32	1,034	2	280	Female	90.5	
GROUP B.											
3601.....	15	26.11.29	122, 19, 19, 20, 20, 21, 20, 21, 20, 19, 19, 22, 20, 21, 19, 21, 20, 19, 19, 18	20	36	901	1	277	Female	66.0	
3602.....	15	26.11.29	14, 18, 18, 20, 38, 21, 19, 18, 19, 19, 20, 19, 21, 19, 20, 20, 24, 20, 19, 20, 20, 22, 21, 19, 18	25	37	1,109	1	272	—	—	
3604.....	15	30.10.29	22, 27, 10, 28, 21, 21, 20, 21, 22, 21, 21, 21, 21, 21, 21, 19, 24, 18, 21, 21, 20, 22, 20, 20, 22	26	37	1,111	1	281	Female	51.0	
3605.....	15	24.11.29	24, 61, 40, 43, 21, 19, 21, 23, 21, 20, 21, 19, 24, 17, 17, 23, 21, 21, 20, 20	20	36	1,132	1	278	Female	61.0	
3606.....	15	30.10.29	59, 72, 24, 37, 40, 19, 20, 20, 22, 19, 23, 22, 20, 20, 20, 20, 20, 21, 20, 20	20	37	1,092	1	287	Male	86.0	
3607.....	15	18.1.30	21, 23, 28, 20, 79, 18, 19, 49, 20, 19, 21, 20, 20, 20, 20	15	36	1,025	1	287	Female	80.0	
3608.....	15	15.9.29	43, 43, 39, 54, 20, 22, 21, 22, 22, 23, 23, 22, 19, 20, 24, 23, 23, 22, 22, 24, 19	21	37	1,142	1	279	Male	70.0	
GROUP C.											
3611.....	15	13.1.30	72, 20, 22, 18, 20, 21, 21, 20, 21, 23, 19, 21.....	12	31	1,057	2	279	Male	65.5	
3612.....	15	30.7.29	117, 18, 63, 16, 40, 22, 23, 22, 23, 23, 20, 46, 27	13	32	1,009	1	271	Male	65.0	
3613.....	15	30.9.29	105, 44, 20, 42, 21, 19, 20, 20, 21, 82.....	10	31	1,092	1	288	Male	96.0	
3616.....	15	5.8.29	40, 16, 22, 51, 63, 20, 21, 21, 21, 21, 20, 21, 21, 22, 22, 22, 21	17	31	1,181	1	286	Female	77.5	
3617.....	15	9.1.30	81, 22, 37, 21, 20, 21, 20, 21, 20, 20, 20.....	10	31	842	1	289	Female	75.0	
3618.....	15	1.10.29	77, 23, 105, 22, 20, 22, 21, 21, 20, 22, 20, 23...	12	31	1,007	1	282	Male	87.5	
3619.....	15	13.2.30	20, 36, 18, 18, 36, 18, 55, 18, 54.....	9	32	842	1	277	Male	69.0	
3620.....	15	7.8.29	55, 77, 23, 48, 20, 16, 24, 19, 20, 38, 21, 19, 20, 20, 20	15	31	937	1	282	Female	75.0	

Note.—(a) No. 3591 was killed in extremis and was found to be non-pregnant.

(b) No. 3592 aborted after 4½ months pregnancy, conceived again after two services. Inverted uterus after calf-birth.

(c) No. 3602 aborted 272 days after conception, cause unknown.

TABLE II.
Breeding Table B.—Second Period, 1931-1932.

Group and D.O.B. No.	Approximate Age at First Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and last Oestrus or next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
GROUP A.											
3593.....	40	61	44, 19, 123, 20.....	4	Days. 267 (c)	Months. 54	lb. 1,002	3	Days. 281	Male	82.0
3594.....	40	104	—	—	104	44	1,125	1	279	Male	77.0
3595.....	42	66	—	—	66	44	1,340	1	284	Female	67.0
3596.....	—	(a)	21.....	1	—	46	960	1	277	Male	73.5
3597.....	40	85	33, 19.....	2	137	45	1,053	1	272	Female	86.0
3598.....	41	92	80, 42, 96.....	3	310	51	1,020	4	284	Female	77.0
3599.....	41	81	50.....	—	81	44	1,074	1	282	Male	80.0
3600.....	41	67	—	1	117	45	1,210	1	286	Female	94.0
GROUP B.											
3601.....	45	57	20, 20.....	2	97	49	1,079	1	282	Male	79.0
3602.....	46	Aborted 13.1.32 (b)	21, 21, 21, 44, 79	5	—	53	1,171	4	284	Female	56.5
3603.....	—	(a)	21, 21, 23, 20.....	4	—	48	1,175	1	281	Male	79.5
3604.....	46	51	23.....	1	74	49	1,325	1	281	Female	60.0
3605.....	45	46	43.....	1	89	48	1,290	1	286	Female	75.0
3606.....	46	73	—	—	73	49	1,075	1	264	Female	52.0
3607.....	45	91	—	—	91	48	1,150	1	285	Female	77.0
3608.....	46	99	—	—	99	49	1,177	1	279	Female	77.5
3609.....	—	(a)	—	—	—	48	1,065	1	282	Female	83.5
GROUP C.											
3611.....	40	73	66, 45.....	2	184	46	1,015	1	281	Male	78.0
3612.....	41	100	—	—	100	44	1,120	1	274	Female	67.0
3613.....	40	124	—	—	124	44	1,225	1	284	Female	84.0
3614.....	—	a)	—	—	—	45	980	1	282	Female	71.0
3616.....	40	73	22, 20, 57.....	3	172	46	1,208	2	281	Female	80.0
3617.....	40	127	—	—	127	44	963	1	284	Female	90.0
3618.....	40	72	22, 22.....	2	116	44	1,095	1	286	Male	94.0
3619.....	41	63	21, 60.....	2	144	45	1,018	1	277	Female	66.0
3620.....	40	84	21, 22.....	2	127	44	1,034	1	280	Male	69.0

NOTE.—(a) Nos. 3596, 3603, 3609 and 3614 were drafted back into the experiment on 11.12.31.

(b) No. 3602 aborted and was served about 3 months after the abortion.

(c) No. 3593 conceived to this service, but aborted after 4½ months and was served again 19 days after the abortion, to which service she conceived and eventually calved.

TABLE III.
Breeding Table C.—Third Period, 1932-1933.

Group and D.O.B. No.	Approximate Age at Second Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.	
	Months.	Days.	Days.		Days.	Months.	lb.		Days.		lb.	
GROUP A.												
3593.....	63	58	—	—	58	65	1,105	1	281	Female	69.0	
3594.....	53	56	22, 21.....	2	99	56	952	1	282	Female	74.5	
3595.....	53	61	21, 19, 39, 40, 78, 22, 54.....	7	334	64	1,353	4	278	Male	71.0	
3596.....	55	85	—	—	85	58	899	1	275	Female	64.0	
3597.....	54	84	19.....	1	103	57	958	1	281	Male	81.0	
3598.....	60	70	22, 112, 20, 67.....	4	224	70	978	3	276	Female	53.0	
3599.....	53	98	64.....	1	162	58	1,061	1	283	Male	87.0	
3600.....	54	107	—	—	107	58	1,062	1	285	Male	99.0	
GROUP B.												
3601.....	58	39	39, 44.....	2	122	62	1,000	1	282	Female	78.0	
3602.....	63	102	—	—	102	66	1,114	1	286	Male	69.5	
3603.....	57	128	—	—	128	61	1,204	1	281	Male	68.0	
3604.....	58	38	80, 23, 28, 21.....	4	190	64	1,375	4	281	Female	53.0	
3605.....	57	37	21, 67.....	2	125	61	1,274	1	276	Male	76.0	
3606.....	58	36	42, 21, 21.....	3	120	62	1,272	1	276	Female	75.0	
3607.....	57	29	41, 51, 50, 21, 62, 33, 22, 21, 19, 88, 39	11	319	72	—	10	280	Male	69.0	
3608.....	58	29	52, 24, 21 Aborted 22.8.33	5	266	67	—	1, aborted	279	Female	70.0	
3609.....	57	69	44, 21	3	133	61	1,170	2	280	Male	98.0	
			22, 21, 22.....					2				
GROUP C.												
3611.....	55	126	22, 20.....	2	168	61	1,105	1	279	Female	75.0	
3612.....	53	70	27.....	1	97	56	1,022	1	276	Male	75.5	
3613.....	53	115	—	—	115	57	1,107	1	277	Male	82.0	
3614.....	54	164	—	—	164	59	892	1	284	Male	75.0	
3616.....	55	77	—	—	77	58	1,127	1	284	Female	86.0	
3617.....	53	117	77, 42.....	2	236	61	850	3	279	Female	73.0	
3618.....	53	57	43.....	1	100	56	1,011	1	286	Female	87.0	
3619.....	54	99	—	—	99	57	983	1	274	Female	71.0	
3620.....	53	119	—	—	119	57	925	1	286	Male	76.0	

TABLE IV.
Breeding Table D.—Fourth Period, 1933-1934.

Group and D.O.B. No.	Approximate Age at Third Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
	Months.	Days.	Days.		Days.	Months.	lb.		Days.		lb.
GROUP A.											
3593.....	74	44	21, 20.....	2	85	77	815	1	285	Female	59.0
3594.....	65	21	41, 21, 20.....	3	103	68	960	1	283	Female	77.5
3595.....	73	41	21, 21.....	2	87	76	1,202	1	273	Male	65.0
3596.....	67	67	20.....	1	87	70	892	1	272	Female	61.0
3597.....	66	55	20, 21.....	2	96	69	985	1	278	Male	75.0
3598.....	79	79	—	—	79	82	1,000	1	276	Female	53.0
3599.....	67	62	42.....	1	104	70	1,083	1	279	Male	78.0
3600.....	67	40	24, 44.....	2	108	71	1,127	1	282	Female	54.5
GROUP B.											
3601.....	71	39	21, 20, 21, 20.....	4	121	75	917	1	282	Male	51.0
3602.....	75	77	19.....	1	96	78	997	1	—	—	—
3603.....	70	27	44, 22.....	2	93	73	1,800	1	272	Female	57.0
3604.....	73	36	19, 41.....	2	96	76	1,317	1	273	Male	59.0
3605.....	70	33	22, 21, 24.....	3	100	73	1,214	1	277	Male	53.0
3606.....	71	120	—	—	120	75	1,247	1	276	Male	66.0
3607.....	81	52	20, 40, 40.....	3	132	86	1,263	—	—	—	—
3608.....	76	49	19, 24.....	2	92	79	1,122	1	279	Female	70.0
3609.....	70	52	24, 22.....	2	98	73	1,094	1	279	Male	79.0
GROUP C.											
3611.....	70	64	21.....	1	85	73	1,148	1	278	Female	60.0
3612.....	65	47	23, 27.....	2	97	68	1,075	1	269	Female	51.0
3613.....	66	186	—	—	186	72	1,130	1	269	Female	47.5
3614.....	68	211	20, 20, 82.....	3	333	79	1,002	4	—	—	—
3616.....	67	49	22, 22.....	2	93	70	1,065	1	276	Male	77.0
3617.....	70	60	51.....	1	111	74	864	1	278	Female	44.0
3618.....	65	37	45, 69.....	2	151	70	1,034	1	272	Female	57.0
3619.....	66	60	41.....	1	101	69	998	1	280	Male	72.5
3620.....	66	35	23, 41.....	2	99	69	891	1	—	—	—

TABLE V.
Breeding Table E.—Fifth Period, 1934-1935.

Group and D.O.B. No.	Approximate Age at Fourth Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Dioestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birthweight of Calf.
	Months.	Days.	Days.		Days.	Months.	lb.		Days.		lb.
GROUP A.											
3593	87	69	20	1	89	90	831	1	279	Male	70.0
3594	79	35	19, 42	2	96	82	951	1	279	Male	60.0
3595	86	32	21, 41	2	94	89	1,126	1	278	Female	67.0
3596	79	87	—	—	87	82	844	1	275	Female	71.0
3597	79	75	18, 22, 20, 20	4	84	84	864	4	275	Male	71.0
3598	91	61	43	1	103	94	918	1	281	Male	77.0
3599	80	36	19, 21, 21	3	97	83	1,083	1	281	Female	66.0
3600	80	78	42, 74, 21	3	215	87	875	3	268	Male	37.5
GROUP B.											
3601	85	69	20	1	89	88	895	1	276	Female	55.0
3602	88	52	21	1	73	90	974	1	279	Male	61.5
3603	83	127	—	—	127	87	11,776	1	276	Male	55.5
3604	86	43	35, 26, 19, 6, 1, 156, 36	7	322	97	1,436	7	—	Aborted on 27.5.36	—
3605	—	—	—	—	—	—	—	—	—	—	—
3606 (c)	84	563	82, 42, 48, 11, 20, 65, 22, 20	8	873	113	1,519	9?	—	Died on 2.12.37 (c)	—
3607	97	40	18, 20, 21	3	99	100	1,300	2	283	Male	80.5
3608 (a)	—	—	—	—	—	—	—	—	—	—	—
3609	84	46	23	1	69	86	1,096	1	276	Female	82.0
GROUP C.											
3611	83	95	21	1	116	87	1,084	1	275	Male	Not recorded
3612	78	62	23, 22, 21, 21, 22	5	171	84	1,007	4	269	Male	43.0
3613	82	349	398, 9, 437, 27	4	1,220	123	1,732	3?	—	Slaughtered on 21.7.38	—
3614	90	107	—	—	107	92	955	1	277	Female	65.0
3616	79	53	20	1	73	81	974	1	283	Female	79.5
3617	84	15	14, 38, 20	3	87	87	876	1	279	Female	58.5
3618 (b)	—	—	—	—	—	—	—	—	—	—	—
3619	Aborted	28.11.34	—	—	—	—	—	—	—	—	—
3620	79	33	20, 38	2	91	82	1,065	1	275	Male	64.0
3620	79	61	20	1	81	82	801	1	279	Male	64.0

(a) Last calf born 31.7.34. Slaughtered on 21.7.38. See final summary Table XXVIII for condition of ovaries.

(b) Died 4.12.34. Traumatic pericarditis. Ovaries normal. See final summary Table XXVIII.

(c) Died 27.12.37. Toxaemia, 5 Months pregnant. See final summary Table XXVIII.

TABLE VI.
Breeding Table F.—Sixth Period, 1935-1936.

Group and D.O.B. No.	Approximate Age at Fifth Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
GROUP A.											
3593.....	99	34	20, 43.....	2	97	102	929	1	285	Male	77.0
3594.....	91	9	4, 10, 21, 20.....	5	84	94	1,126	1	293	Female	76.0
3595.....	98	69	20, 100, 21, 24, 21.....	5	255	107	1,371	5	276	Female	54.0
3596.....	91	99	62, 21.....	2	182	97	853	2	268	Male	34.0
3597.....	93	37	21.....	1	58	95	1,053	1	277	Male	70.0
3598.....	103	40	20, 20, 21.....	3	101	106	1,013	1	277	Female	70.0
3599.....	93	37	18, 20.....	2	75	96	1,107	1	278	Male	60.0
3600.....	96	42	21, 23, 20.....	3	106	100	1,238	1	277	Male	73.5
GROUP B.											
3601.....	97	76	22.....	1	98	100	1,024	1	274	Female	63.5
3602.....	99	31	20, 21.....	2	72	101	1,130	1	273	Female	48.5
3603.....	97	63	22.....	1	85	100	1,340	1	277	Female	65.5
3604.....	98	31	Aborted 27.5.36, and 5.10.36	—	—	—	—	—	—	—	—
3605.....	Died on 31.5.35	—	—	—	—	—	—	—	—	—	—
3606.....	Died on 27.12.37	—	—	3	95	112	1,156	1	278	Female	78.0
3607.....	109	32	20, 22, 21.....	—	—	—	—	—	—	—	—
3608 (c).....	—	—	—	—	—	—	—	—	—	—	—
3609.....	95	52	20.....	1	72	97	1,409	1	277	Female	66.0
GROUP C.											
3611 (b).....	96	66	16, 18, 30, 35, 51, 13, 20, 17, 17, 20, 14, 14, 24, 18, 13, 19, 12, 19, 19, 16, 14, 41, 17, 13, 35, 10, 14, 16, 20, 19, 19, 53, 19, 11, 24, 24, 74.....	—	—	—	—	—	—	—	—
3612.....	92	62	20.....	2	184	98	1,200	2	270	Female	51.0
3613.....	Died 21.1.35	—	—	—	—	—	—	—	—	—	—
3614.....	103	153	20.....	1	173	109	880	2	282	Male	60.5
3616.....	91	79	—	—	79	94	972	1	280	Female	76.5
3617.....	95	41	20, 41.....	2	102	98	962	1	279	Male	89.0
3618.....	Died 4.12.34	—	—	—	—	—	—	—	—	—	—
3619.....	91	41	31.....	1	72	93	1,105	1	279	Female	65.0
3620.....	91	95	40.....	1	135	96	910	1	281	Male	78.5

(a) See note, Table V.
(b) Last calf born 6.3.36. Slaughtered on 21.7.38. See final summary, Table XXVIII for condition of ovaries.

TABLE VII.
Breeding Table G.—*Seventh Period, 1936-1937.*

Group and D.O.B. No.	Approximate Age at Sixth Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
	Months.	Days.	Days.		Days.	Months.	lb.		Days.		lb.
GROUP A.											
3593.....	111	Days.	on 25.7.1937	—	—	—	—	—	—	—	—
3594.....	103	34	7, 22, 20, 10, 10, 6, 12, 19	8	140	108	963	6	291	Male	73.0
3595.....	115	218	—	—	218	122	1,219	1	274	Male	67.0
3596.....	106	34	20, 24.....	2	78	109	1,147	1	274	Male	60.0
3597 (a).....	104	46	466.....	—	—	—	—	—	—	—	—
3598.....	116	73	20, 21, 24.....	3	138	121	920	2	282	Male	66.5
3599.....	106	39	15, 44.....	2	98	108	1,213	1	281	Female	69.5
3600 (b).....	109	—	—	—	—	—	—	—	—	—	—
GROUP B.											
3601.....	109	36	22, 22, 19, 25, 25, 22, 20	7	191	115	1,025	4	270	Female	66.0
3602.....	110	44	21, 21, 21, 20.....	4	127	114	1,079	2	278	Male	60.0
3603.....	108	26	44, 21.....	2	91	111	1,328	1	278	Female	66.0
3604.....	103	91	22, 42, 13, 23, 30, 60, 115, 45, 22	9	503	119	1,575	9	280	Male	60.5
3605.....	—	—	—	—	—	—	—	—	—	—	—
3606.....	—	—	—	—	—	—	—	—	—	—	—
3607.....	122	38	21, 20, 60.....	3	139	126	1,105	1	284	Female	57.0
3608.....	—	—	—	—	—	—	—	—	—	—	—
3609.....	106	58	26.....	1	84	109	1,380	1	276	Female	75.0
GROUP C.											
3611.....	—	—	—	—	—	—	—	—	—	—	—
3612.....	107	46	22, 24.....	2	92	110	1,162	1	273	Male	40.5
3613.....	—	—	—	—	—	—	—	—	—	—	—
3614.....	117	38	20, 21, 22.....	3	101	120	965	1	281	Female	58.0
3616.....	103	92	—	—	92	106	1,125	1	282	Female	65.0
3617.....	108	36	21, 22, 20.....	3	99	111	950	1	282	Male	73.0
3618.....	—	—	—	—	—	—	—	—	—	—	—
3619.....	103	40	20, 21, 20.....	3	101	106	1,078	1	278	Female	57.0
3620.....	105	35	21, 21.....	2	77	108	937	1	280	Female	67.5

(a) Last oestrus exhibited 13.4.38. Slaughtered 21.7.38. See final summary Table XXVIII for condition of ovaries.
(b) Last calf born 6.4.37. Slaughtered 21.7.38. See final summary Table XXVIII for condition of ovaries.

TABLE VIII.
Breeding Table H.—*Eighth Period, 1937-1938.*

Group and D.O.B. No.	Approximate Age at Seventh Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
	Months.	Days.	Days.		Days.	Months.	lb.		Days.		lb.
GROUP A.											
3593.....	—	—	—	—	—	—	—	—	—	—	—
3594.....	118	30	22, 24, 19.....	3	95	121	1,035	1	279	Female	75.5
3595.....	131	31	19, 79, 41, 20.....	4	190	137	1,220	3	273	Male	62.0
3596.....	117	62	20, 42.....	2	124	121	1,037	2	273	Male	72.0
3597.....	—	—	—	—	—	—	—	—	—	—	—
3598.....	130	54	22, 22.....	2	98	133	984	1	276	Male	64.0
3599.....	117	37	41, 61.....	2	139	122	1,092	1	280	Female	68.0
3600.....	—	—	—	—	—	—	—	—	—	—	—
GROUP B.											
3601.....	124	44	40, 21.....	2	105	128	1,085	2	269	Female	56.0 Still born.
3602.....	124	68	20.....	1	88	127	1,220	1	270	Female	45.0
3603.....	121	27	21, 21, 20, 24.....	4	113	125	1,387	1	282	Male	61.0
3604.....	128	98	31.....	1	129	132	1,422	2	—	Aborted on 1.8.1939	—
3605.....	—	—	—	—	—	—	—	—	—	—	—
3606.....	—	—	—	—	—	—	—	—	—	—	—
3607.....	135	51	20, 20.....	2	91	138	1,016	1	275	Female	66.0
3608.....	—	—	—	—	—	—	—	—	—	—	—
3609 (a).....	118	—	—	—	—	—	—	—	—	—	—
GROUP C.											
3611.....	—	—	—	—	—	—	—	—	—	—	—
3612.....	119	45	69, 22.....	2	136	124	1,065	1	—	Aborted on 24.11.38	—
3613.....	—	—	—	—	—	—	—	—	—	—	—
3614.....	130	26	107.....	1	133	134	955	1	283	Male	60.0
3616.....	115	50	21, 22.....	2	93	118	1,025	1	280	Male	75.0
3617.....	120	16	11, 20, 21, 20.....	4	88	123	986	1	277	Female	57.0
3618.....	—	—	—	—	—	—	—	—	—	—	—
3619.....	115	40	78, 42.....	2	160	120	983	2	280	Female	73.0
3620.....	117	39	20, 20, 25.....	3	104	120	930	1	280	Female	71.5

(a) Last calf born 25.1.38. Died, post parturient collapse, 12.2.38. See final summary Table XXVIII for condition of ovaries.

TABLE IX.
Breeding Table I.—Ninth Period, 1938-1939.

Group and D.O.B. No.	Approximate Age at Eighth Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
GROUP A.											
3593	—	Days.	Days.	—	Days.	Months.	lb.	—	Days.	—	lb.
3594	130	43	—	2	146	135	—	1	286	Male	82.0
3595	147	55	41, 62	1	94	150	1,021	1	279	Female	56.0
3596 (a)	130	32	39	3	90	133	1,152	1	—	—	—
3597	—	—	15, 21, 22	—	—	—	1,085	—	—	—	—
3598	142	42	21, 44	2	107	146	930	1	278	Male	72.5
3599	131	37	19, 20, 23	3	99	134	1,142	1	280	Female	43.0
3600	—	—	—	—	—	—	—	—	—	—	47.5
GROUP B.											
3601	136	23	20, 20, 18	3	81	139	1,150	1	272	Female	57.5
3602	136	13	13, 6, 6, 7, 22, 23	6	90	139	1,200	1	278	Male	51.0
3603	134	33	21, 43	2	97	137	1,285	1	278	Male	67.0
3604	Aborted 136	1	7, 8, 20, 20, 106, 9, 17, 19	8	207	143	1,460	5	—	Aborted on 14.8.1940	—
3605	—	—	—	—	—	—	—	—	—	—	—
3606	—	—	—	—	—	—	—	—	—	—	—
3607	147	56	43, 22, 21, 20, 22, 20, 22	7	225	155	832	7	282	Female	53.0
3608	—	—	—	—	—	—	—	—	—	—	—
3609	—	—	—	—	—	—	—	—	—	—	—
GROUP C.											
3611	—	25	44, 29	2	98	131	1,156	3	264	Male	31.1
3612	Aborted 128	—	—	—	—	—	—	—	—	—	“Still Born”
3613	—	—	—	—	—	—	—	—	—	—	—
3614	144	35	23, 20, 22	3	103	147	998	1	278	Female	58.0
3616	127	67	20	1	87	130	1,087	1	278	Male	58.0
3617	132	88	—	—	88	135	916	1	—	Aborted on 23.1.1940	—
3618	—	—	—	—	—	—	—	—	—	—	—
3619	130	35	80	1	115	134	1,004	1	274	Female	47.0
3620	129	27	22, 43, 117	3	209	136	881	2	279	Male	69.0

(a) Last calf born 2.2.39. Died pneumonia 11.11.39. 6½ Months pregnant. See final summary Table XXVIII for condition of ovaries.
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TABLE X.
Breeding Table "J".—Tenth Period, 1939-1940.

Group and D.O.B. No.	Approximate Age at Ninth Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
	Months.	Days.	Days.		Days.	Months.	lb.		Days.		lb.
3593.....	144	71	41.....	1	112	148	1,112	1	274	Female.	65.0
3594.....	160	30	40, 39, 19, 29, 21, 19, 19, 21, 20	9	248	168	1,270	8	(b)	—	—
3596.....	—	—	—	—	—	—	—	—	—	—	—
3597.....	—	—	—	—	—	—	—	—	—	—	—
3598.....	154	67	22, 17, 24, 22, 24.....	5	176	160	909	5	282	Male.	77.0
3599.....	143	33	20, 23, 19.....	3	95	146	1,126	1	283	Female.	62.0
3600.....	—	—	—	—	—	—	—	—	—	—	—
GROUP B.											
3601.....	148	65	19, 20, 20, 19, 18, 18, 19, 20, 21, 20, 19, 21, 19, 19, 24, 20, 28, 20, 21, 20, 19, 67, 54, 19.	24	629	168	1,276	24	(c)	—	—
3602.....	148	87	19, 19, 19, 19, 19, 20, 21, 20, 21, 20, 22, 67, 20.	13	393	160	1,168	13	75 (aborted)	—	—
3603.....	146	53	22, 21.....	2	96	149	1,320	1	277	Female.	58.0
3604 (a).....	149 (aborted)	—	—	—	—	—	—	—	—	—	—
3605.....	—	—	—	—	—	—	—	—	—	—	—
3606.....	—	—	—	—	—	—	—	—	—	—	—
3607 (d).....	163	—	—	—	—	—	—	—	—	—	—
3608.....	—	—	—	—	—	—	—	—	—	—	—
3609.....	—	—	—	—	—	—	—	—	—	—	—
GROUP C.											
3611.....	—	—	—	—	—	—	—	—	—	—	—
3612 (e).....	140	—	—	—	—	—	—	—	—	—	—
3613.....	—	—	—	—	—	—	—	—	—	—	—
3614.....	156	77	43, 20.....	2	140	161	978	2	289	Male.	73.5
3616.....	139	136	48, 33, 14, 2, 49, 3, (f).....	—	—	—	—	—	—	—	—
3617.....	142 (aborted)	53	16, 20, 20, 20, 21.....	5	150	147	1,115	4	283	Female.	42.5
3618.....	—	—	—	—	—	—	—	—	—	—	—
3619.....	142	32	19, 20, 19.....	3	90	145	947	1	285	Male.	65.0
3620.....	145	37	22, 21, 21.....	3	101	148	876	1	197 (aborted.)	Male.	14.5

(a) Slaughtered 2/7/41—rectal stenosis and vaginal prolapse—for conditions of ovaries see final summary Table XXVIII.
 (b) Slaughtered 3/7/42—three months pregnant—for conditions of ovaries see final summary Table XXVIII.
 (c) Slaughtered 10/7/42—three months pregnant—for conditions of ovaries see final summary Table XXVIII.
 (d) Slaughtered 10/7/42—for conditions of ovaries see final summary Table XXVIII.
 (e) Slaughtered 19/9/40—for conditions of ovaries see final summary Table XXVIII.
 (f) Slaughtered 19/9/40—for conditions of ovaries see final summary Table XXVIII.

TABLE XI.
Breeding Table "K"—Eleventh Period, 1940-1941.

Group and D.O.B. No.	Approximate Age at Tenth Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate Age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
Group A.											
3593	—	Days.	Days.	—	Days.	Months.	lb.	—	Days.	—	lb.
3594	157	30	36, 6, 24, 22, 21, 16, 56, 16	8	227	163	1,422	—	—	—	—
3595	171 (slaughtered).	—	—	—	—	—	—	not pregnant (c)	—	—	—
3596	—	—	—	—	—	—	—	—	—	—	—
3597	—	—	—	—	—	—	—	—	—	—	—
3598 (c)	169	—	—	—	—	—	—	—	—	—	—
3599	155	56	21, 20, 20, 19, 20,	5	156	160	1,026	4	277	Male.	72.5
3600	—	—	—	—	—	—	—	—	—	—	—
Group B.											
3601	—	Days.	Days.	—	Days.	Months.	lb.	—	Days.	—	lb.
3602	162 (abortion).	5	19, 21 (a),	—	—	—	—	—	—	—	—
3603	158	32	44, 86, 45,	3	207	164	1,363	2 (d)	—	—	—
3604	—	—	—	—	—	—	—	—	—	—	—
3605	—	—	—	—	—	—	—	—	—	—	—
3606	—	—	—	—	—	—	—	—	—	—	—
3607	—	—	—	—	—	—	—	—	—	—	—
3608	—	—	—	—	—	—	—	—	—	—	—
3609	—	—	—	—	—	—	—	—	—	—	—
Group C.											
3611	—	Days.	Days.	—	Days.	Months.	lb.	—	Days.	—	lb.
3612	—	—	—	—	—	—	—	—	—	—	—
3613	—	—	—	—	—	—	—	—	—	—	—
3614	169	146	None,	—	146	174 (not served).	1,075 (g)	—	—	—	—
3616	—	Days.	Days.	—	Days.	Months.	lb.	—	Days.	—	lb.
3617	156	117	None,	—	117	160	922	1	308	Female.	39.0
3618	—	—	—	—	—	—	—	—	—	—	—
3619	155	259	None,	—	259	164	760	1	273	Male.	41.0 (e)
3620	155	1	144, 244, 22,	3	411	168	1,280	3	(f)	—	—

(a) Died 28/1/42—Pneumonia—for conditions of ovaries see final summary Table XXVIII.
 (b) Slaughtered 28/5/42—Pneumonia—for conditions of ovaries see final summary Table XXVIII.
 (c) Slaughtered 9/11/42—Pneumonia—for conditions of ovaries see final summary Table XXVIII.
 (c) Slaughtered 9/11/42—Pneumonia—for conditions of ovaries see final summary Table XXVIII.
 (d) Slaughtered 8/7/42—General debility—7 months pregnant—for conditions of ovaries see final summary Table XXVIII.
 (e) Died 31/7/42—During parturition (full term) (calf still born)—for conditions of ovaries see final summary Table XXVIII.
 (f) Slaughtered 3/7/42—2½ months pregnant, macerated foetus—for conditions of ovaries see final summary Table XXVIII.
 (g) Slaughtered 9/11/42—2½ months pregnant—for conditions of ovaries see final summary Table XXVIII.

TABLE XI A.
Breeding Table "L"—Twelfth Period, 1941-1942.

Group and D.O.B. No.	Approximate Age at Eleventh Calving.	Period between Calving and First Oestrus.	The Periodicity of Oestrus.	Total Number of Di-oestrous Periods.	Period between Calving and Last Oestrus or Next Service.	Approximate age at Final Service.	Weight at Final Service.	Number of Services to Establish Pregnancy.	Length of Gestation Period.	Sex of Calf.	Birth-weight of Calf.
GROUP A.	Months.	Days.	Days.		Days.	Months.	lb.		Days.		lb.
3593.....	—	—	—	—	—	—	—	—	—	—	—
3594.....	—	—	—	—	—	—	—	—	—	—	—
3595.....	—	—	—	—	—	—	—	—	—	—	—
3596.....	—	—	—	—	—	—	—	—	—	—	—
3597.....	—	—	—	—	—	—	—	—	—	—	—
3598.....	—	—	—	—	—	—	—	—	—	—	—
3599.....	169	101	41.....	1	142	174 (not served)	11.40	Not pregnant.	(a)	—	—
3600.....	—	—	—	—	—	—	—	—	—	—	—
GROUP B.											
3601.....	—	—	—	—	—	—	—	—	—	—	—
3602.....	—	—	—	—	—	—	—	—	—	—	—
3603.....	—	—	—	—	—	—	—	—	—	—	—
3604.....	—	—	—	—	—	—	—	—	—	—	—
3605.....	—	—	—	—	—	—	—	—	—	—	—
3606.....	—	—	—	—	—	—	—	—	—	—	—
3607.....	—	—	—	—	—	—	—	—	—	—	—
3608.....	—	—	—	—	—	—	—	—	—	—	—
3609.....	—	—	—	—	—	—	—	—	—	—	—
GROUP C.											
3611.....	—	—	—	—	—	—	—	—	—	—	—
3612.....	—	—	—	—	—	—	—	—	—	—	—
3613.....	—	—	—	—	—	—	—	—	—	—	—
3614.....	—	—	—	—	—	—	—	—	—	—	—
3616.....	—	—	—	—	—	—	—	—	—	—	—
3617.....	169	96	41.....	1	137	173 (not served.)	1.030	Not pregnant.	(b)	—	—
3618.....	—	—	—	—	—	—	—	—	—	—	—
3619.....	171	—	—	—	—	—	—	—	—	—	—
3620.....	—	—	—	—	—	—	—	—	—	—	—

(a) Slaughtered 12/11/42—For conditions of ovaries see final summary Table XXVIII.
(b) Slaughtered 12/11/42—For conditions of ovaries see final summary Table XXVIII.

TABLE XIIb.

Breeding Table.—Summary.

	No. in Group.	Approximate age at calving.		Length of gestation period.		Birth-weight of Calves.		Sex of Calves.		Period between calving and first oestrus.		Period between calving and last oestrus or next service.	
		Range.	Average.	Range.	Average.	Range.	Average.	Males.	Female.	Range.	Average.	Range.	Average.
		Months.	Months.	Days.	Days.	lb.	lb.			Days.	Days.	Days.	Days.
GROUP A.													
1st Period.....	8	40-42	41	275-285	279.5	60-90	79.9	4	4	61-104	79.4	66-267	153.7
2nd Period.....	8	53-63	56	272-286	280.6	67-94	77.3	4	4	56-107	77.4	58-334	146.5
3rd Period.....	7	63-79	70	275-285	280.7	64-99	77.9	4	3	21-79	51.1	79-108	93.1
4th Period.....	8	77-91	82	272-285	287.5	53-78	65.4	3	5	32-87	60.3	79-155	103.2
5th Period.....	8	91-103	96	268-281	277.0	37.5-77	64.9	5	3	9-99	45.9	58-255	119.8
6th Period.....	8	103-116	108	268-293	278.9	34-77	64.3	3	3	34-218	74.0	78-218	134.4
7th Period.....	5	117-131	122.4	274-291	280.4	60-73	67.2	4	4	30-62	42.8	95-190	129.2
8th Period.....	5	130-147	136	273-280	276.2	62-75.5	68.3	3	2	32-55	41.8	90-140	107.2
9th Period.....	4	143-160	150.3	278-286	281.3	43-82	60.2	2	3	30-71	50.3	95-248	157.8
10th Period.....	3	155-171	165.0	274-283	279.6	62-77	68	1	2	30-56	43.0	156-227	191.5
11th Period.....	1	169	169	277	277	72.5	72.5	1	1	101	101	142	142
GROUP B.													
1st Period.....	6	45-46	46	272-287	280.1	51-86	69.0	2	4	46-99	69.5	73-99	87.2
2nd Period.....	9	58-63	58	264-286	280.4	52-83	71.7	2	7	39-128	56.3	102-266	148.2
3rd Period.....	9	70-81	73	276-286	280.1	53-98	73.4	5	4	27-120	54.0	92-152	107.6
4th Period.....	7	82-95	85	272-282	276.1	51-79	62.1	5	2	—	—	—	—
5th Period.....	5	95-109	99	276-283	278.0	55-82	66.9	3	2	31-76	47.5	72-98	84.4
6th Period.....	5	106-122	111	273-287	275.8	48.5-78	64.3	—	5	26-91	48.9	84-503	189.2
7th Period.....	6	120-135	126.2	270-284	277.8	57-75	64.0	2	4	27-98	57.6	88-129	105.2
8th Period.....	5	134-147	137.8	269-282	274.0	45-66	57.0	2	3	1-56	25.2	81-225	140.0
9th Period.....	4	146-163	151	272-282	277.5	51-67	58.5	2	2	53-87	68.3	96-629	339.0
10th Period.....	1	158	158	277	277	58	58	0	1	32.0	32.0	207.0	207.0
11th Period.....	1	171	171	—	—	—	—	—	—	—	—	—	—
GROUP C.													
1st Period.....	8	40-41	40	271-289	281.8	65-96	76.3	5	3	63-127	89.5	100-184	136.9
2nd Period.....	9	53-55	54	274-286	281.0	66-94	77.7	4	5	57-164	104.9	77-236	130.6
3rd Period.....	9	65-70	67	274-286	280.5	71-87	77.8	4	5	35-211	83.2	85-333	139.6
4th Period.....	7	77-85	80	269-280	274.6	44-79	58.4	3	4	15-95	53.2	73-171	103.2
5th Period.....	7	91-103	94	269-283	275.4	43-79.5	62.3	4	3	41-153	76.7	72-184	124.0
6th Period.....	6	103-117	107.1	270-282	278.5	51-89	70.0	3	3	35-92	47.8	77-101	93.7
7th Period.....	6	115-130	119.3	273-282	279.3	40.5-73	60.2	3	4	16-50	36.0	88-160	119.0
8th Period.....	6	127-144	131.7	277-283	280.0	57-75	67.3	2	3	25-88	46.1	87-209	116.1
9th Period.....	5	139-156	144.4	264-279	274.6	31.8-69	52.8	3	2	32-136	67.0	90-150	120.3
10th Period.....	4	155-169	158.7	283-289	285.6	42.5-73.5	60.3	2	1	1-146	130.8	117-411	240.5
11th Period.....	2	169-171	170.0	273-308	280.5	39-41	40.0	1	1	96	96	137	137

TABLE XIII.
Frequencies of the Periodicity of Oestrus.—First Period, 1929-1931.

Periodicity of oestrus in days:—

Number of Individuals.	10	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	33	36	37	38	39	40	42	43
Group A: 9.....	1	2	1	2	2	8	19	31	27	12	8	4	1	1	—	2	—	—	1	5	3	2	—	—
Group B: 7.....	1	1	—	—	2	7	23	38	28	14	8	7	—	—	1	2	—	—	1	1	1	2	—	3
Group C: 8.....	—	—	—	3	—	6	4	23	19	11	7	1	—	—	1	—	—	2	1	1	—	2	1	—
TOTAL: 24....	2	3	1	5	4	21	46	92	74	37	23	12	1	1	2	4	—	2	3	7	4	6	1	3

Number of Individuals.	44	46	48	49	51	54	55	59	60	61	63	72	75	77	79	81	82	84	90	105	117	122	Totals.
Group A: 9.....	—	—	—	—	—	—	2	—	1	1	1	1	—	—	—	—	—	1	1	—	—	—	139
Group B: 7.....	—	—	—	1	—	1	—	1	—	1	—	—	—	—	1	—	—	—	—	—	—	1	147
Group C: 8.....	1	1	1	—	1	1	2	—	—	—	2	1	—	2	—	1	1	—	—	2	1	—	98
TOTAL: 24.....	1	1	1	1	1	2	4	1	1	2	3	2	—	2	1	1	1	1	1	2	1	1	384

Frequencies of the Periodicity of Oestrus.—Periodicity of Oestrus in Days.

TABLE XVII.—FIFTH PERIOD, 1934-1935.

No. of Individuals.	1	6	9	11	14	18	19	20	21	22	23	26	27	35	38	41	42	43	48	65	74	82	156	398	437	Totals.
Group A: 7.....	—	—	—	—	—	1	2	3	4	1	—	—	—	—	—	1	2	1	—	—	1	—	—	—	—	16
Group B: 8.....	1	1	—	1	—	1	1	4	2	1	1	1	—	1	—	—	1	—	1	1	—	1	1	—	—	20
Group C: 8.....	—	—	1	—	1	—	—	4	3	2	1	—	1	—	2	—	—	—	—	—	—	—	—	1	1	17
TOTALS: 23.....	1	1	1	1	1	2	3	11	9	4	2	1	1	1	2	1	3	1	1	1	1	1	1	1	1	53

TABLE XVIII.—SIXTH PERIOD, 1935-1936.

No. of Individuals.	4	10	11	12	13	14	16	17	18	19	20	21	22	23	24	30	31	35	40	41	43	44	51	53	62	74	100	Totals.
Group A: 8.....	1	1	—	—	—	—	—	—	1	—	8	7	—	1	1	—	—	—	—	—	1	—	—	—	1	—	1	23
Group B: 5.....	—	—	—	—	—	—	—	—	—	—	3	2	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	8
Group C: 6.....	—	1	1	1	3	4	3	4	2	6	5	—	—	—	3	1	1	2	1	2	—	—	1	1	—	—	—	43
TOTALS: 19.....	1	2	1	1	3	4	3	4	3	6	16	9	3	1	4	1	1	2	1	2	1	—	1	1	1	1	1	74

TABLE XIX.—SEVENTH PERIOD, 1936-1937.

No. of Individuals.	6	7	10	12	13	15	19	20	21	22	23	24	25	26	30	42	44	45	60	155	Totals.
Group A : 5.....	1	1	2	1	—	1	1	3	1	1	—	2	—	—	—	—	1	—	—	—	15
Group B : 6.....	—	—	—	—	1	—	1	3	5	5	1	—	2	1	1	1	1	1	2	1	26
Group C : 5.....	—	—	—	—	—	—	—	4	5	3	—	1	—	—	—	—	—	—	—	—	13
TOTALS : 16.....	1	1	2	1	1	1	2	10	11	9	1	3	2	1	1	1	2	1	2	1	54

TABLE XX.—EIGHTH PERIOD, 1937-1938.

No. of Individuals.	11	19	20	21	22	23	24	25	31	40	41	42	61	69	78	79	107	Totals.
Group A : 5.....	—	2	2	—	3	—	1	—	—	—	2	1	1	—	—	1	—	13
Group B : 5.....	—	—	4	3	—	—	1	—	1	1	—	—	—	—	—	—	—	10
Group C : 6.....	1	—	4	2	2	—	—	1	—	—	—	1	—	1	1	—	1	14
TOTALS : 16.....	1	2	10	5	5	—	2	1	1	1	2	2	1	1	1	1	1	37

TABLE XXI.—NINTH PERIOD, 1938-1939.

Number of Individuals.	6	7	8	9	13	15	17	18	19	20	21	22	23	29	39	41	42	43	44	62	80	106	117	Totals.
Group A : 5.....	—	—	—	—	—	1	—	—	1	1	2	1	1	—	1	1	—	—	1	1	—	—	—	11
Group B : 5.....	2	2	1	1	1	—	1	1	1	6	2	4	1	—	—	—	—	2	—	—	—	1	—	26
Group C : 5.....	—	—	—	—	—	—	—	—	—	2	—	2	1	1	—	—	—	1	1	—	1	—	—	10
TOTALS : 15.....	2	2	1	1	1	1	1	1	2	9	4	7	3	1	1	1	—	3	2	1	1	1	1	47

TABLE XXII.—TENTH PERIOD, 1939-1940.

Number of Individuals.	2	3	8	9	14	16	17	18	19	20	21	22	23	24	28	33	39	40	41	43	48	49	54	67	Totals.
Group A : 4....	—	—	—	—	—	—	1	—	4	3	2	2	1	2	—	—	1	1	1	—	—	—	—	—	18
Group B : 3....	—	—	—	—	—	—	—	2	13	11	6	2	—	1	1	—	—	—	—	—	—	—	1	2	39
Group C : 5....	1	1	—	—	1	1	—	—	2	5	3	1	—	—	—	1	—	—	—	1	1	1	—	—	19
TOTALS: 12....	1	1	—	—	1	1	1	2	19	19	11	5	1	3	1	1	1	1	1	1	1	1	1	2	76

TABLE XXIII.A.—TWELFTH PERIOD,
1941-1942.

TABLE XXIII.—ELEVENTH PERIOD, 1940-1941.

Number of Individuals.	6	16	19	20	21	22	24	36	44	56	75	86	144	244	Totals.	Number of Individuals.	41	Totals.
Group A : 2.....	1	2	1	3	2	1	1	1	—	1	—	—	—	—	13	Group A : 1.....	1	1
Group B : 2.....	—	—	1	—	1	—	—	—	1	—	1	1	—	—	5	Group B : 0.....	—	—
Group C : 1.....	—	—	—	—	—	1	—	—	—	—	—	—	1	1	3	Group C : 1.....	1	1
TOTALS: 5.....	1	2	2	3	3	2	1	1	1	1	1	1	1	1	21	TOTALS: 2	2	2

TABLE XXIV.
The Dioestrous Periods, 1929-1941.

GROUP.	FIRST PERIOD, 1929-1931.			SECOND PERIOD, 1931-32.		
	Dioestrous Periods.		Percentage of Cases in which Oestrus recurred after Normal Interval of 18-23 days.	Dioestrous Periods.		Percentage of Cases in which Oestrus recurred after Normal Interval of 18-23 days.
	Range.	Mode.		Range.	Mode.	
A.....	Days. 10-90	20	76.0	Days. 19-123	19	27.3
B.....	10-122	20	80.0	20-79	21	76.9
C.....	16-117	20	70.0	20-66	22	63.6
ALL GROUPS....	10-122	—	75.3	19-123	—	55.9

GROUP.	THIRD PERIODS, 1932-33.			FOURTH PERIOD, 1933-34.		
	Dioestrous Periods.		Percentage of Cases in which Oestrus recurred after Normal Interval of 18-23 days.	Dioestrous Periods.		Percentage of Cases in which Oestrus recurred after Normal Interval of 18-23 days.
	Range.	Mode.		Range.	Mode.	
A.....	Days. 19-112	22	75.1	Days. 20-44	21	30.8
B.....	19-80	21	50.0	19-44	19, 20, 21, 22 and 24	36.8
C.....	20-77	—	33.3	20-82	20, 22, 23, 41	50.0
ALL GROUPS....	19-112	—	46.8	19-82	—	39.2