DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

EXPERIMENTAL FOX RANCH

SUMMERSIDE, P.E.I.

REPORT OF THE SUPERINTENDENT

G. ENNIS SMITH

FOR THE YEARS 1928, 1929 AND 1930

Published by authority of the Hon. Robert Weir, Minister of Agriculture, Ottawa, 1931

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DOMINION EXPERIMENTAL FOX RANCH, SUMMERSIDE, P.E.I.

REPORT OF THE SUPERINTENDENT, G. ENNIS SMITH

During the period covered by this report seven breeding pens and thirty small pens with board floors were constructed. The pen accommodation at the Ranch consisted of forty-two breeding pens, thirty-five male pens, thirty outside pens with board floors and a covered shed containing twenty pens six by eight feet.

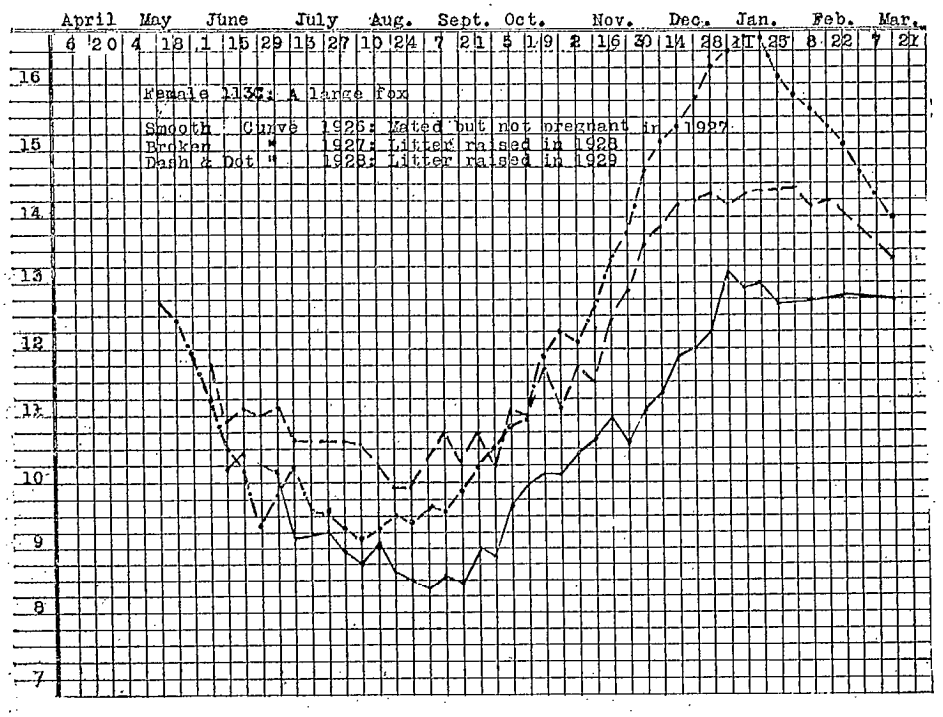
At the end of September, 1929, a conference was held by the Dominion Department of Agriculture with Mr. G. Shelton Sharp and Mr. B. S. Deacon, president and secretary respectively of the Canadian National Silver Fox Breeders' Association, regarding additional land for the Experimental Fox Ranch. At the first meeting a definite understanding was arrived at which was confirmed the following day, that the association would purchase one half of the property of fourteen acres, directly north of the Experimental Fox Ranch, and the Department of Agriculture the other half. The same week the land was purchased by the Association. In the meantime the Prince Edward Island Provincial Government came forward with an offer to relieve the Association of the responsibility of the purchase of one half of the land, as the Experimental Fox Ranch has acted as a service station for fox breeders of Prince Edward Island. In this way the Prince Edward Island Government was implementing a promise that has already been made. This Government also further agreed to lease the land to the Department for a period of ninety-nine years for a nominal sum of one dollar per year, the land to be used for experimental work in connection with the raising of fur-bearing animals in captivity.

FACTORS CONTROLLING REPRODUCTION WITH SILVER FOXES

LIVE WEIGHT DURING DIFFERENT SEASONS OF THE YEAR

The factors that control reproduction with foxes are undoubtedly the most important phases connected with the raising of silver foxes in captivity, not only with regard to the yield of the maximum number of vigorous offspring, but, as our experimental work demonstrates, those factors that tend to produce normal and continuous reproduction, also tend to induce the favourable development of those outstanding qualities of the fur which cause silver foxes to command high prices.

The live weight curves of all adult foxes and pups in the Experimental Ranch since the investigation work was initiated have been rigidly recorded. During the summer and fall months the adult foxes and pups were weighed each week. After the first of the year the foxes were weighed about every other week until the second week in March. The females and pups are weighed when the pups are three or four weeks old. Thus the live weights of the foxes have been taken during the different periods of the year except for a short period during the whelping season. Obviously space and time would not permit the presentation of the weights and curves of all the foxes, but in the following graphs the live weight curves and the breeding results of foxes of different sizes are given, which curves and results are typical and in accordance with the live weight and breeding results of all the foxes that have been under investigation.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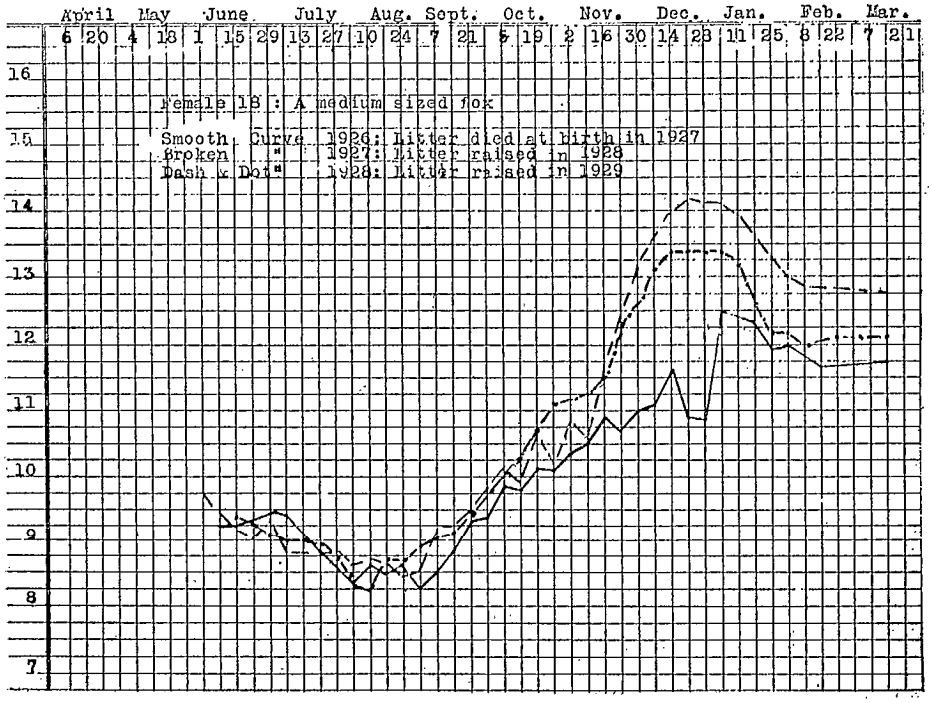
Female 137: A large fox
Smooth Curve 1926: Mated but not pregnant in 1927
Broken " 1927: Litter raised in 1928
Dash & Dot " 1928: Litter raised in 1929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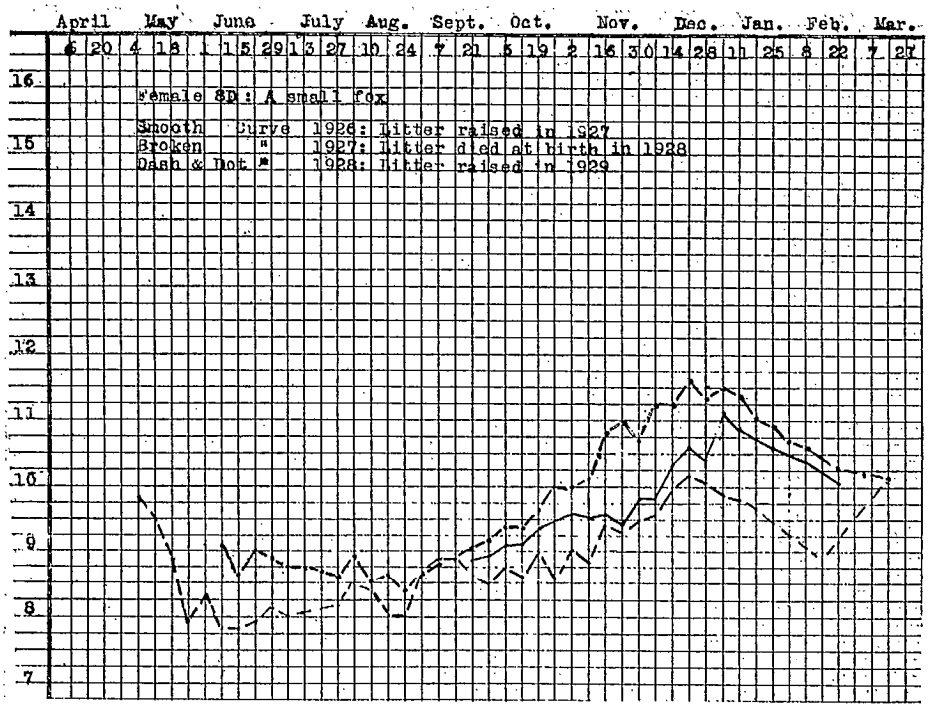
Female 18 : A medium sized fox
Smooth Curve 1926: Litter died at birth in 1927
Broken " 1927: Litter raised in 1928
Dash & Dot " 1928: Litter raised in 1929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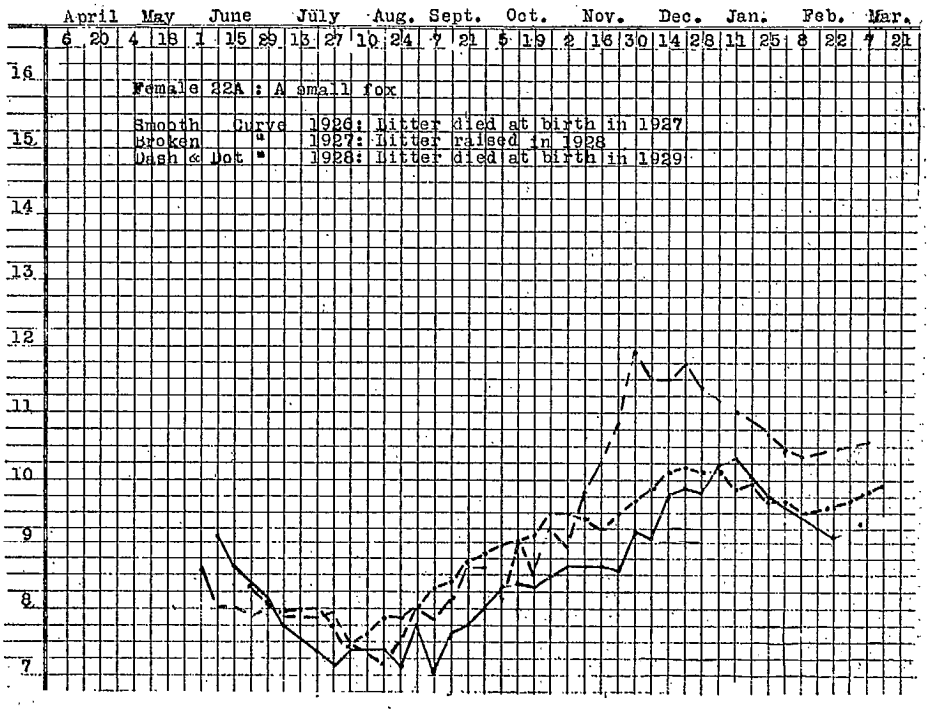
Female 8D : A small fox
Smooth Curve 1926: Litter raised in 1927
Broken " 1927: Litter died at birth in 1928
Dash & Dot " 1928: Litter raised in 1929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6 20 4 18 1 15 29 13 27 10 24 7 21 5 19 2 16 30 14 28 11 25 8 22 7 21
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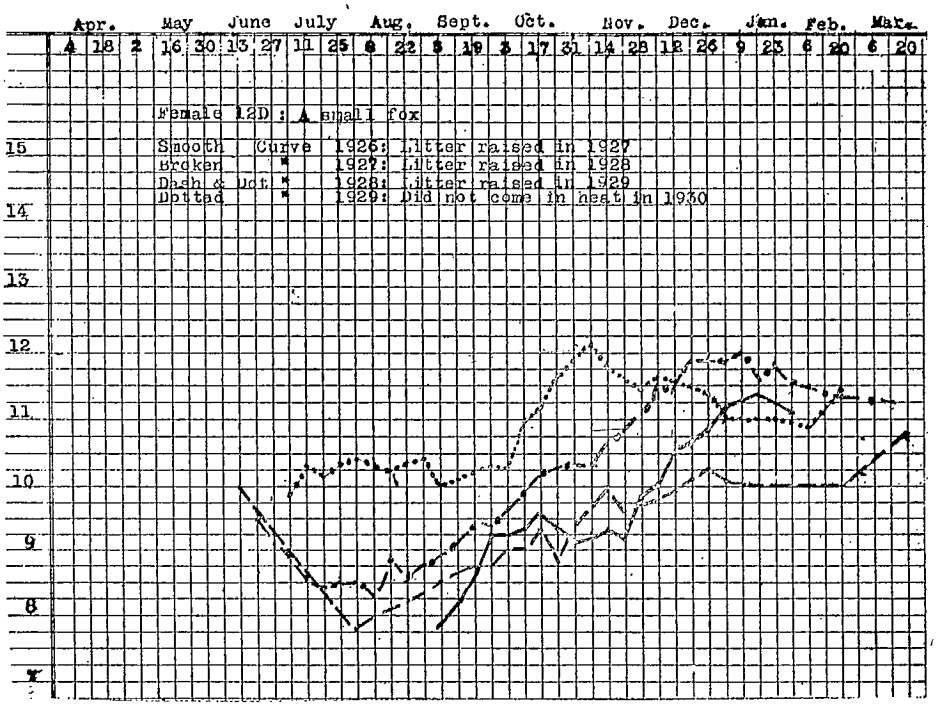
Female 22A : A small fox
Smooth Curve 1926: Litter died at birth in 1927
Broken " 1927: Litter raised in 1928
Dash & Dot " 1928: Litter died at birth in 1929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Female 12D: A small fox
Smooth Curve 1926: Litter raised in 1927
Broken " 1927: Litter raised in 1928
Dash & Dot " 1928: Litter raised in 1929
Dotted " 1929: Did not come in heat in 1930
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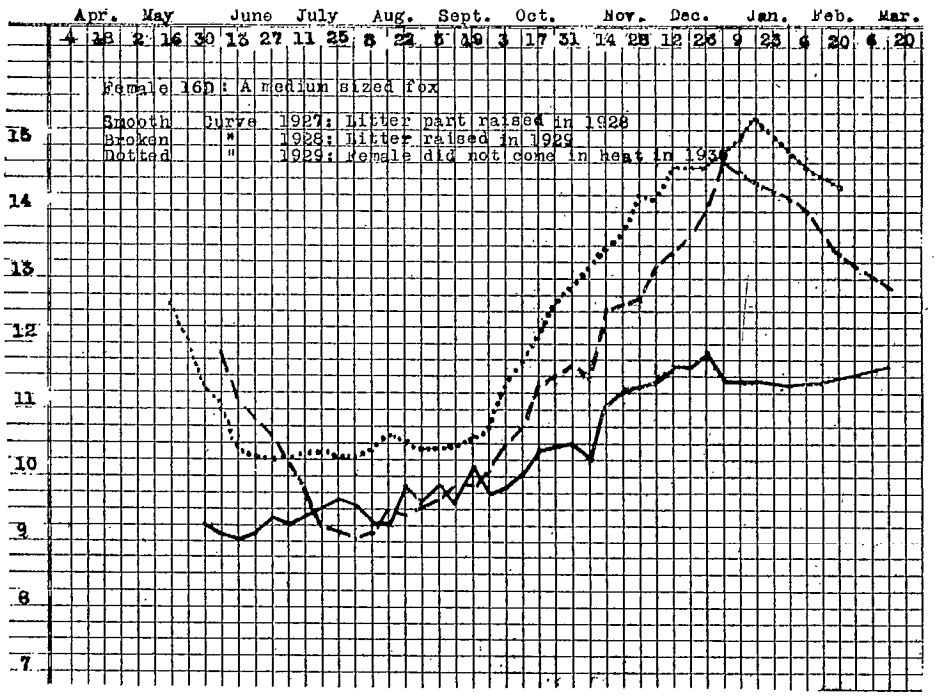
Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar.
4 18 2 16 30 13 27 11 25 8 22 5 19 3 17 31 14 28 12 26 9 23 6 20 6 20
Female 16D: A medium sized fox
Smooth Curve 1927: Litter part raised in 1928
Broken " 1928: Litter raised in 1929
Dotted " 1929: Female did not come in heat in 1930
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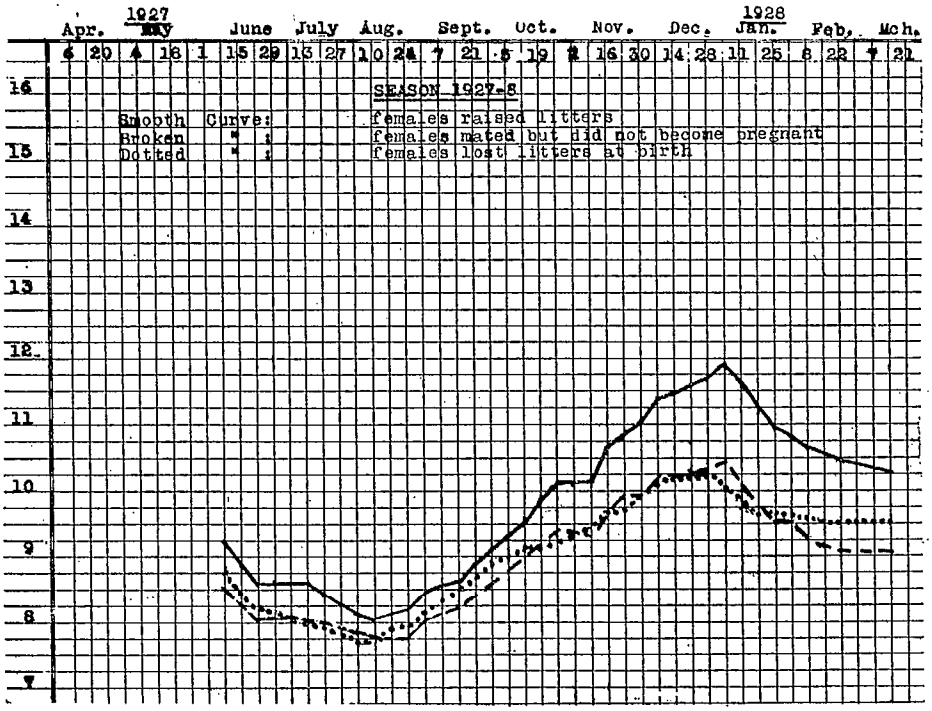
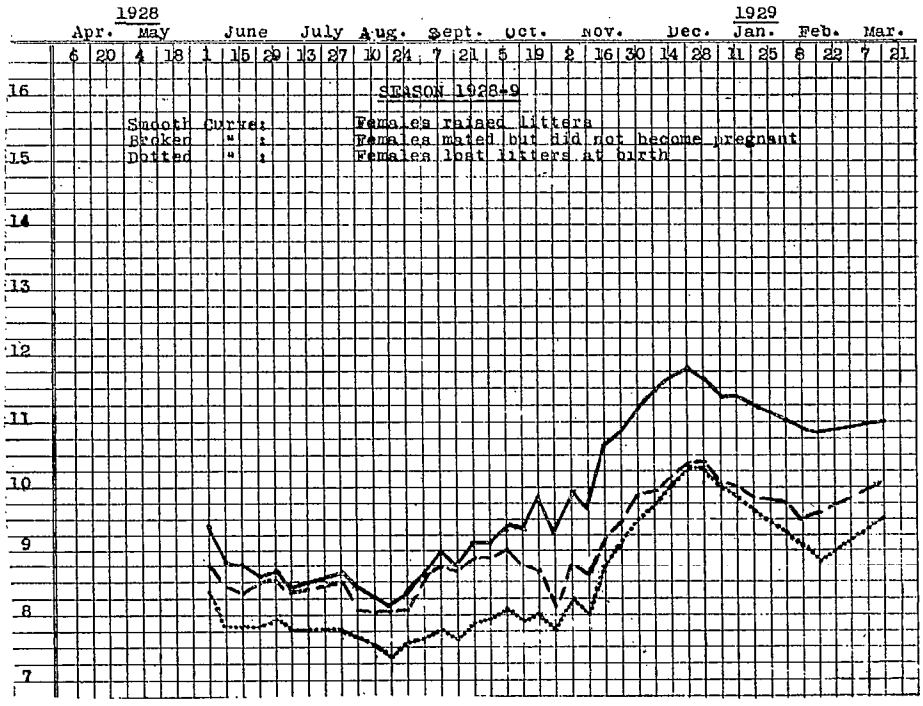


Graph 7—Average live weight curves of all adult females, season 1927-28.



Graph 8—Average live weight curves of all adult females, season 1928-29.

TABLE 1.—AVERAGE LIVE WEIGHT OF ADULT FEMALES, SEASON, 1927-8

Dates	Raised litters		Mated, not pregnant		Litters died at birth		Not in heat	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
June 1	9	6	8	12	8	5	8	14
8	8	13	8	7	7	13	8	5
15	8	12	8	5	7	13	8	3
22	8	9	8	8	7	13	7	15
29	8	11	8	9	7	15	7	12
July 6	8	7	8	6	7	12	7	10
27	8	10	8	8	7	12	7	13
Aug. 3	8	6	8	1	7	10	6	15
10	8	4	8	0	7	8	6	6
17	8	3	8	0	7	5	6	15
25	8	5	8	1	7	9	7	3
31	8	9	8	8	7	14	7	6
Sept. 7	9	0	8	11	8	0	7	12
14	8	12	8	9	7	14	7	9
21	9	2	8	14	8	2	8	1
28	9	2	8	14	8	3	8	2
Oct. 5	9	6	9	0	8	5	8	4
12	9	6	8	12	8	3	8	1
19	9	13	8	11	8	4	8	11
26	9	4	8	2	8	0	8	1
Nov. 2	9	14	8	12	8	8	8	11
9	9	11	8	10	8	4	8	8
16	10	10	9	3	9	0	9	3
23	10	14	9	8	9	6	9	4
30	11	3	9	14	9	12	9	6
Dec. 7	11	7	9	15	10	0	9	9
14	11	10	10	6	10	5	9	14
21	11	12	10	6	10	10	10	3
28	11	10	10	7	10	10	10	1
Jan. 4	11	6	10	1	10	5	9	15
11	11	6	10	0	10	2	9	12
18	11	4	9	14	9	14	9	9
Feb. 1	11	0	9	12	9	8	9	6
8	10	14	9	8	9	5	9	4
15	10	13	9	10	9	1	9	3
Mar. 16	11	0	10	2	9	12	9	8

The following outstanding characteristics will be observed with regard to the data in the accompanying graphs:—

(1) When the weights of the females were reduced to a marked extent during the summer months, followed by a pronounced gain during the fall months, the females successfully raised their litters.

(2) When the gains in weight of the females did not exceed a certain point during the fall months, even though there had been a marked reduction of weight during the summer months, the females either did not become pregnant after they had mated, or their pups died at birth.

(3) When there was not a marked reduction in weight during the summer months, even though there was subsequently a favourable gain in weight during the fall months, the females failed to come in heat.

(4) For favourable breeding results large females should make a greater percentage gain in weight during the fall months than small females.

All our results obtained up to the present time would indicate that favourable breeding results cannot be expected when females do not make a gain of over forty per cent during the fall months. While, as a matter of fact, we have raised a number of litters from females that have made a gain in weight in the vicinity of thirty per cent, in a number of those cases a great proportion of the litters have been lost, and in all cases, including those where the entire litter has been raised, none of the pups which have been kept for breeding purposes, have been successful breeders, as there has not been a single case in which any

TABLE 2.—AVERAGE LIVE WEIGHT OF ADULT FEMALES, SEASON, 1928-29

Dates	Raised litters		Mated, not pregnant		Litters died at birth		Not in heat	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
June 6	9	4	8	8	8	12	8	13
13	8	14	8	3	8	4	8	8
20	9	10	8	1	8	4	8	4
27	9	10	8	3	8	3	8	5
July 4	8	10	8	2	8	1	8	1
11	8	9	8	1	8	0	8	3
18	8	6	8	0	8	0	8	0
25	8	4	7	14	7	14	8	0
Aug. 2	8	2	7	13	7	10	7	15
8	8	1	7	11	7	11	8	0
15	8	6	7	14	7	15	8	2
22	8	3	7	12	7	15	8	1
29	8	7	8	0	8	2	8	4
Sept. 5	8	9	8	2	8	5	8	7
12	8	10	8	3	8	4	8	10
19	8	14	8	7	8	8	8	13
26	9	1	8	9	10	11	8	15
Oct. 3	9	4	8	12	8	14	9	2
10	9	8	9	0	8	15	9	4
17	9	14	9	3	9	2	9	10
26	10	1	9	7	9	2	9	11
31	10	1	9	5	9	6	9	11
Nov. 7	10	2	9	5	9	6	9	15
14	10	10	9	12	9	7	10	1
21	10	13	9	15	9	12	10	5
28	11	0	9	15	9	15	10	7
Dec. 5	11	5	10	4	10	5	10	11
12	11	7	10	4	10	7	10	11
19	11	9	10	4	10	8	10	12
26	11	3	10	5	10	8	10	14
Jan. 2	11	14	10	8	10	9	11	2
9	11	10	10	1	10	4	10	13
17	11	3	9	12	10	2	10	8
23	10	15	9	8	9	15	10	5
30	10	13	9	8	9	15	10	4
Feb. 6	10	11	9	4	9	12	10	1
20	10	7	9	1	9	13	9	14
Mar. 13	10	4	9	1	9	12	9	9

of the offspring of females that have made a gain in weight of less than 35 per cent during the fall months, have produced any pups whatever. In all cases with females that have not made a favourable gain in weight during the fall months and have lost their litters at birth, the post mortem examination of the pups showed that the ribs were badly bruised and in many cases broken, probably at birth, and both sides were highly inflamed, which undoubtedly would be the direct cause why such a large percentage of pups have not sufficient vitality to nurse. The condition of pups that have sufficient vitality to nurse their mother, yet have been badly bruised at birth, would so handicap their development that it could not be expected that these would eventually grow into normal foxes. In our experimental work females that have gained over forty per cent in weight during the fall months, have uniformly raised their litters, but it is absolutely essential that there should be a reduction in weight to near the minimum of the foxes during the summer months. In all of our experimental work, where the weights of the females were maintained above the normal standard during the summer months, they practically all failed to come in heat. At the same time all the experimental work during the breeding season would positively indicate that overfeeding of females foxes should be rigidly avoided during that time of the year.

The evidence that we have obtained regarding the live weight of silver foxes with regard to breeding results would appear to be in accordance with

what would be expected under natural conditions. In the wild state a variety of silver foxes has survived whose gestation period is in the dead end of winter when food is scarce, the prey of the fox in poor condition and the pregnant female and her prey snowed in for long periods. There can be no question whatever that the natural gestation period of foxes in the wild state is at that time of the year when the food supply is at the lowest ebb. Therefore, this would tend to substantiate the results that we have obtained during the breeding season that overfeeding of foxes should be rigidly avoided. If it should have been found that favourable results were obtained from feeding the foxes large quantities during the breeding season, then it would have been expected that under natural conditions a variety of foxes would have persisted whose gestation period would have been during the fall months when food was plentiful and the prey of the foxes in good condition. The results of our experimental work would definitely indicate that during the fall months when the food supply of the fox is plentiful and their prey is in good condition, the females should store up in their bodies those constituents required for the normal development of the foetus so that when the females are carrying their young, the foetus would be insured of a plentiful supply of the food constituents required for their normal development, independent of whether the mother would be able to obtain food or otherwise.

Recommendations

Foxes, both males and females, should be so fed during the summer months that there will be a marked reduction in weight to somewhere near a minimum. This is not dependent upon the amount of food that has been fed, but more upon the class of food, the most favourable results being obtained when the foxes are being fed in step with the season. During the fall months the rations must be again readjusted so as to be in step with the season and insure the favourable increase of weight, and during the breeding season overfeeding should be rigidly avoided. Fox breeders are recommended to weigh all the female foxes in the ranch during the first week of September and again at the end of December and it would repay them to pelt all females that have not made a gain in weight of over thirty-five per cent between these two dates. The same procedure should be carried out with the male foxes, but probably it would be advisable that these should be weighed during the middle of December.

SEASONAL NUTRITIONAL REQUIREMENTS OF SILVER FOXES

One of the prime objects of the investigation work on the Fox Ranch has been to ascertain the variation, if any, of the nutritional requirements of silver foxes during the different seasons of the year, this being absolutely necessary to outline intelligently the daily rations for foxes throughout the year. A summary is being shown here of the results that were obtained with feeding cereal rations, cereals and green vegetable rations and rice and green vegetable rations during the summer months, also the results obtained with feeding cereals prepared in different manners during the fall months, and the effect of feeding a low meat ration and a high meat ration, which rations were outlined to ascertain the variation in the nutritional requirements of the foxes during the different seasons of the year.

TABLE 3.—CEREAL RATION—FED FROM MAY 30 TO SEPTEMBER 5

Morning meal	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Whole wheat flour, cooked	2	6	¼	9/32	5/16	11/32
Corn meal, cooked	2	6	¼	9/32	5/16	11/32
Rolled oats, cooked	2	6	¼	9/32	5/16	11/32
Rice, cooked	2	7	¼	9/32	5/16	11/32
			cc	cc	cc	cc
Milk	35	25	140	156	171	186
			oz.	oz.	oz.	oz.
Yeast	½	.....	1/16	9/128	5/64	11/128

Evening meal	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Whole wheat flour, cooked	2	6	¼	9/32	5/16	11/32
Corn meal, cooked	2	6	¼	9/32	5/16	11/32
Rolled oats, cooked	2	6	¼	9/32	5/16	11/32
Rice, cooked	2	7	¼	9/32	5/16	11/32
Meat	16	22	2	2¼	2½	2¾
Bone meal	1·6	.....	1/5	9/40	5/20	11/40

The majority of foxes fed this cereal ration were not considered to be in ideal condition. As the summer progressed the fur of the foxes became very dry and there was no indication of the foxes shedding the fur. At the middle of August a large number still retained a complete coat of guard hair and underfur of the previous year. Some fatalities occurred and the post mortem examination of those showed a pronounced inflammation of the intestinal tract. This inflammatory condition of the intestines may have been caused directly by the ration or through the direct action of some infective agent or through an unfavourable ration, lowering the resistance of the animals so that they became susceptible to an infective agent, although the examination of the feces failed to give any positive evidence other than that excessive quantities of blood were present in the feces.

When the foxes on this ration were fed green vegetables late in the month of August, the underfur began to lift immediately but it was badly matted and pulled the guard hair out with it and left the foxes entirely bare.

TABLE 4.—CEREAL AND VEGETABLE RATION—FED FROM MAY 31 TO SEPTEMBER 6

Morning meal	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Whole wheat flour, cooked	2	6	¼	9/32	5/16	11/32
Corn meal, cooked	2	6	¼	9/32	5/16	11/32
Rolled oats, cooked	2	6	¼	9/32	5/16	11/32
Rice, cooked	2	7	¼	9/32	5/16	11/32
Milk	32	24	4	4½	5	5½
Tripe	8	8	1	1⅛	1¼	1⅜
Yeast	½	.....	1/16	9/128	5/64	11/128

Evening meal	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Whole wheat flour, cooked	2	6	1/4	9/32	5/16	11/32
Corn meal, cooked	2	6	1/4	9/32	5/16	11/32
Rolled oats, cooked	2	6	1/4	9/32	5/16	11/32
Rice, cooked	2	7	1/4	9/32	5/16	11/32
Meat	16	22	2	2 1/4	2 1/2	2 3/4
Bone meal	1·6	.....	1/5	9/40	5/20	11/40
Green vegetables	16	.....	2	2 1/4	2 1/2	2 3/4

The foxes fed upon this ration maintained a healthy condition throughout the summer months. The majority of the foxes shed their fur during the latter part of July which is considered relatively early in the season. At the same time the fur of a large number of the foxes was considered to be very dry in comparison with normal conditions. Also the fur was inclined to matt to a very pronounced extent so that the guard hair and underfur came out at the same time, some of the foxes being quite bare. The evidence was conclusive that the addition of green vegetables to the ration caused the foxes to shed the fur earlier in the season.

TABLE 5.—RICE AND VEGETABLE RATION—FED FROM MAY 29 TO SEPTEMBER 13

Morning meal	Gm/Kw	Cal/Kw	Small Foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Rice cooked	7	24	7/8	63/64	1 3/32	1 13/64
Flour cooked	1	3	1/8	9/64	5/32	11/64
Milk	32	24	4	4 1/2	5	5 1/2
Tripe	8	8	1	1 1/8	1 1/4	1 3/8
Yeast	1/2	.....	1/16	9/128	5/64	11/128

Evening meal	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Rice cooked	7	24	7/8	63/64	1 3/32	1 13/64
Wheat flour cooked	1	3	1/8	9/64	5/32	11/64
Meat	16	22	2	2 1/4	2 1/2	2 3/4
Bone meal	1·6	.....	1/5	9/40	5/20	11/40
Green vegetables	16	.....	2	2 1/4	2 1/2	2 3/4

The great majority of the foxes on this ration maintained what was considered a very healthy condition throughout the summer months. There was no evidence of dryness in the fur as had been observed in the other rations mentioned previously.

In table 6 is given the percentage of fur during the different parts of the summer months. It will be seen from this table that the foxes had shed their underfur by the beginning of August and that after they had completely lost their underfur, a large percentage of last year's guard hairs were still present. Many of those foxes, after losing their entire underfur, looked as well furred as during the winter months. As the new guard hair started to grow the guard hair gradually fell out and those foxes did not show any evidence of bareness during any time of the summer months. The new fur that came in had a better lustre and texture where rice formed the main bulk of the cereal part of the ration, than with any other summer ration fed up to the present time.

TABLE 6.—RESULTS WITH RICE AND GREEN VEGETABLE RATION—SHOWING PERCENTAGE OF GUARD HAIR AND UNDERFUR RETAINED DURING THE SUMMER MONTHS

Fox		June		July				August	
		12	19	3	10	17	31	7	14
		%	%	%	%	%	%	%	%
11	Guard hair	95	75	75	75	85	75	75	50
	Underfur	60	60	55	60	50	10	5	5
1B	Guard hair	95	75	95	75	85	85	60	75
	Underfur	90	75	75	50	50	60	0	0
6C	Guard hair	90	75	65	60	50	50	10	5
	Underfur	55	50	50	50	25	10	5	1
9C	Guard hair	95	85	75	75	60	65	60	50
	Underfur	95	85	65	50	40	50	0	0
47C	Guard hair	65	60	50	50	40	25	25	5
	Underfur	65	60	50	50	40	5	1	1
51C	Guard hair	95	75	75	60	50	75	50	35
	Underfur	50	40	30	20	10	10	5	0
59C	Guard hair	85	75	75	75	75	75	75	75
	Underfur	50	40	50	35	20	10	15	10
5D	Guard hair	95	95	85	65	85	75	65	75
	Underfur	80	95	60	50	50	20	5	0
9D	Guard hair	75	60	60	65	65	35	30	25
	Underfur	85	60	60	65	50	25	0	0
25D	Guard hair	50	50	50	50	50	25	10	10
	Underfur	50	50	50	50	50	25	0	0
27D	Guard hair	75	65	55	50	50	50	25	25
	Underfur	65	65	50	50	40	40	0	0
29D	Guard hair	60	50	50	50	40	50	30	10
	Underfur	40	40	25	25	2	0	0	0
1E	Guard hair	95	85	75	75	75	65	40	25
	Underfur	65	70	55	75	60	50	0	0
11E	Guard hair	95	85	85	85	85	85	65	50
	Underfur	95	75	60	65	65	45	0	0
25E	Guard hair	95	85	85	85	85	75	65	25
	Underfur	75	75	60	50	50	10	10	1
31F	Guard hair	95	75	85	85	85	65	55	50
	Underfur	80	75	50	50	30	25	25	0
32F	Guard hair	95	85	85	75	85	85	75	75
	Underfur	50	75	60	50	30	35	25	0
50F	Guard hair	95	95	85	85	90	85	50	50
	Underfur	95	95	75	85	75	75	20	25
14G	Guard hair	75	75	75	60	85	15	25	10
	Underfur	25	25	15	5	2	0	0	0
6A	Guard hair	65	65	60	50	50	30	15	5
	Underfur	65	65	60	50	40	30	2	0
33A	Guard hair	95	85	95	85	95	85	60	30
	Underfur	50	85	75	50	50	50	25	0
16C	Guard hair	95	85	85	75	85	85	85	35
	Underfur	95	75	60	55	50	40	25	2
19C	Guard hair	.....	75	75	75	60	55	15	15
	Underfur	.....	60	50	50	20	10	5	0
136C	Guard hair	95	95	85	85	85	85	85	75
	Underfur	75	70	75	25	20	20	10	0
232C	Guard hair	.....	.....	85	85	95	85	75	30
	Underfur	.....	.....	75	65	50	60	50	0
8D	Guard hair	90	85	85	75	85	75	75	50
	Underfur	90	85	60	25	15	2	0	0
10D	Guard hair	95	95	85	85	85	50	10	5
	Underfur	80	95	85	50	85	35	0	0
12D	Guard hair	.....	.....	95	85	85	85	75	50
	Underfur	.....	.....	80	75	50	20	5	0
14D	Guard hair	95	95	95	95	85	85	85	55
	Underfur	90	75	85	75	75	60	75	0
16D	Guard hair	95	95	85	75	75	50	50	25
	Underfur	60	75	50	75	30	5	0	0
7E	Guard hair	80	75	75	75	75	65	75	75
	Underfur	80	75	75	50	40	20	15	2
8E	Guard hair	75	75	60	50	65	25	15	25
	Underfur	75	75	60	50	60	25	0	0
13E	Guard hair	95	95	95	95	85	85	5	5
	Underfur	75	75	80	75	50	30	0	0
20E	Guard hair	95	75	65	50	40	25	5	5
	Underfur	90	75	65	50	20	0	0	0
31E	Guard hair	95	95	85	75	50	50	10	5
	Underfur	75	75	75	50	10	0	0	0

TABLE 6—RESULTS WITH RICE AND GREEN VEGETABLE RATION—SHOWING PERCENTAGE OF GUARD HAIR AND UNDERFUR RETAINED DURING THE SUMMER MONTHS.—*Concluded*

Fox	—	June		July				August	
		12	19	3	10	17	31	7	14
		%	%	%	%	%	%	%	%
40E	Guard hair	90	90	85	60	75	55	40	50
	Underfur	90	90	65	50	10	0	0	0
41E	Guard hair	95	95	95	85	85	85	85	50
	Underfur	50	75	50	55	50	40	25	0
42E	Guard hair	75	75	75	50	50	10	5	5
	Underfur	65	75	65	50	25	1	2	0
28F	Guard hair	95	85	75	85	85	85	75	75
	Underfur	50	50	40	30	10	5	2	0
29F	Guard hair	65	50	50	50	60	50	50	30
	Underfur	50	50	15	20	2	5	0	0

INFLUENCE OF EXCESSIVE COOKING OF CEREALS

TABLE 7.—COOKED CEREAL RATION—FED FROM SEPTEMBER 1 TO DECEMBER 31

Ration	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Meat	32	40	4½	5	5½	6
Whole wheat flour cooked	2	7	9/32	5/16	11/32	5/8
Corn meal	2	7	9/32	5/16	11/32	5/8
Rolled oats	2	7	9/32	5/16	11/32	5/8
Rice	2	8	9/32	5/16	11/32	5/8
			cc.	cc.	cc.	cc.
Milk	35	25	140	156	171	187
			oz.	oz.	oz.	oz.
Suet	1	9	9/64	5/32	11/64	3/16

The cereals of this ration were prepared as a porridge in the following manner: the rice was first thoroughly cooked until the grains were completely swollen in an excessive amount of water. While the mixture was still at a boil the other cereals were added and kept at a boil for a few minutes. Sufficient hot water was then added to bring the weight of the porridge to five times the weight of the dry cereals. The porridge and container were immediately placed in a fireless cooker and remained there for twenty hours.

While the foxes fed on this ration developed a good growth of underfur of a desirable colour and texture and the guard hairs did not show any brown shade, the results were most disastrous from a fur standpoint as there was not a favourable development of the guard hairs, which were extremely weak and bent to a very pronounced extent. All the foxes on this ration failed to make a favourable increase in weight during the period it was fed, that is from September 1 to December 31, when, according to our evidence, the foxes should increase 50 per cent in weight in order to obtain favourable results both from a breeding and fur standpoint. In previous years some of the foxes had made a favourable gain in weight with the same ration except that the cereals were only slightly cooked.

The majority of the females failed to raise their litters, although they had successfully raised litters on a similar cereal ration when the cereals had only been slightly cooked. All of the foxes had a very poor coat of fur in comparison with the fur in previous years. Two foxes, fed this ration, were typical cases, and if they had been pelted the furs would have realized less than $50 each. The following year these foxes were fed with others a similar ration with slight

modifications in the cereal ration and were pelted and the furs sold for $260 and $275 respectively, and there was a similar increment in the quality of the fur of the other foxes. The results obtained with the feeding of this ration would indicate that the excessive cooking of the cereals had destroyed some vital constituents that were essential for the development of the foxes during the fall months, both from a breeding and a pelt standpoint.

An attempt was made to carry out an experiment in feeding cereals that had been cooked under thirty pounds steam pressure. As the results were so pronouncedly unfavourable, the experiment was stopped at the end of the third week. It has been our experience that when cereals have been subject to excessive cooking, the porridge will be sloppy when sufficient water is added to bring the weight of the porridge to five times the weight of the dry cereals. On the other hand, with the proper amounting of cooking, according to our results, the porridge is quite firm with the same amount of water. The evidence would indicate that when porridge is overcooked, there is pronounced hydrolysis of the cereals, resulting in a destruction of a great proportion of the vital constituents.

TABLE 8.—HIGH CEREAL AND VEGETABLE RATION—FED FROM SEPTEMBER 1 TO DECEMBER 31

Ration	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Whole wheat flour cooked	3	11¼	27/64	15/32	33/64	9/16
Corn meal cooked	3	11¼	27/64	15/32	33/64	9/16
Rolled oats cooked	3	11¼	27/64	15/32	33/64	9/16
Rice cooked	3	11¼	27/64	15/32	33/64	9/16
Meat	16	20	2¼	2½	2¾	3
			cc.	cc.	cc.	cc.
Milk	52½	37	210	234	256	280
			oz.	oz.	oz.	oz.
Vegetables	12	?	1 11/16	1 7/8	2 1/16	2¼

The cereals in this ration were prepared as outlined in the previous section dealing with the influence of excessive cooking of cereals, except that the porridge remained in the fireless cooker for a period of only two hours. Under this condition there was no evidence of the cereals being overcooked as was the case when the cereals were placed in a fireless cooker for twenty hours or when cooked under steam pressure, the mixture having a firm consistency. The foxes fed this high cereal and vegetable ration made a favourable gain in weight during the months of September and October. While it had, from the examination of the feces, a much higher cereal content than appeared desirable, yet there was a favourable development of the fur as a whole. There was a good growth of guard hairs and only a slight growth of the underfur. The guard hair had favourable qualities regarding both strength and colour during the two months, and the underfur had a very favourable colour and texture. During the months of November and December there was not a continued improvement in the development of the foxes with regard to weight or fur. The majority of the foxes failed to put on a normal weight during these months and there was a lack of continued growth of the guard hairs.

During several years, experimental work with feeding a high cereal and vegetable ration throughout the entire fall months has uniformly given results that would indicate that while such rations have a favourable effect during the months of September and October, yet a high cereal ration is not conducive to good results during the months of November and December. The evidence obtained during several years from feeding a high cereal and vegetable ration during the fall months would indicate that whatever vital constituents of the

food may be present in the cereals, their value is the greatest during the months of September and October, more so than during the summer months or during the months of November and December.

TABLE 9.—HIGH MEAT RATION

——	Gm/Kw	Cal/Kw	Small foxes	Medium foxes	Large foxes	Extra large foxes
			oz.	oz.	oz.	oz.
Whole wheat flour cooked	1	3	9/64	5/32	11/64	3/16
Corn meal cooked	1	3	9/64	5/32	11/64	3/16
Rolled oats cooked	1	3	9/64	5/32	11/64	3/16
Rice cooked	1	4	9/64	5/32	11/64	3/16
Meat	64	80	9	10	11	12
			cc.	cc.	cc.	cc.
Milk	17½	12	70	78	85	93

The cereals in this ration were prepared in the same manner as the cereals referred to in the high cereal and vegetable ration. The foxes fed this ration did not show a favourable development during September and October either with regards to weight or fur qualities. The majority of the foxes did not make a favourable gain in weight, although fed what was considered excessive quantities of meat, especially for September and October. The development of the fur as a whole was most unfavourable. There was a premature growth of the underfur with a lack of development of the guard hairs, which caused the fur to have a very streaky and open appearance. The underfur was neither of a favourable colour nor texture. The guard hair showed a pronounced brown shade, varying in intensity with the different foxes.

During the months of November and December there was a most marked improvement in the manner in which the foxes put on weight. During that time there was a very rapid gain in weight, varying from three-quarters to one pound in a week. Also there was a decided improvement in the development of the fur and the guard hair of some of the foxes that had shown a slight brown shade, developed into a fairly clear black colour. Also there was a good growth of the guard hairs with regard to length, a striking difference from the foxes that were being fed a high cereal and vegetable ration. The experimental work with feeding high meat rations during several years would indicate very conclusively that favourable results cannot be obtained with such rations during the summer and early fall months. On the other hand, they have invariably been conducive to good results during the months of November and December.

DISCUSSION

During the summer months, when the cereal rations were fed, the foxes failed to shed the fur in a normal manner. A large majority developed intestinal disturbances and there was an excessive amount of blood present in the feces. The fur became dry and matted to a very undesirable extent. When green vegetables were added to the cereal ration there was a decided improvement and the foxes shed their fur much earlier in the season, yet at the same time it was inclined to matt. When the main bulk of the cereals was replaced with rice and green vegetables included, the results were more favourable still. The foxes lost their fur relatively early in the season. The fur retained its silky texture without any evidence of matting and the underfur gradually came through the guard hair, leaving the guard hair intact. The results would indicate that it is not desirable to feed cereals such as wheat, cornmeal or rolled

oats during the summer months, but the main bulk of the cereals should be composed of rice which is favourable for tropical countries and that green vegetable matter is necessary during the summer months.

During the fall months when cereals have been included in the rations, these have been conducive to good results during the months of September and October. When the vital constituents of the cereals have been destroyed by excessive cooking, unfavourable results were obtained with such rations during the fall months, which would indicate that it is very necessary to feed certain cereals at least during the months of September and October. High meat rations have invariably produced the most favourable results during the months of November and December.

From the results as a whole the following generalization has been made: It is absolutely necessary that foxes should be fed in step with the season. When the earth is covered with green vegetation foxes require that vegetation or the essentials of it from animals that have recently been eating it; during the fall months, when ripe vegetation is prevalent, foxes require that ripe vegetation. In the late fall months, when the frost has destroyed vegetation and the prey of the foxes is in good condition, foxes require a high meat ration. The results obtained upon the factors controlling reproduction have invariably demonstrated that with females during the gestation period, overfeeding should be rigidly avoided, that is during the end of the winter. When the prey of the foxes is in poor condition and the female and her prey are often snowed in, foxes do not require a large amount of food.

INHERITANCE IN SILVER FOXES

CONSTITUTIONAL VIGOUR

There is very little question that the breeding qualities of silver foxes is an inherent trait that passes from one generation to another. The experience we have had in our experimental work would indicate that these inherent traits do not pass uniformly to all the offspring. As will be shown in the following cases, with some foxes the male offspring are uniformly good breeders and the females very poor breeders and the reverse is true with other foxes. While on the other hand other foxes appear to have the facility to produce offspring that have good fur qualities, yet all of the offspring are uniformly indifferent breeders.

CASE No. 1, FEMALE 14.—This female has raised fourteen pups to maturity, nine males and five females, all of which have been kept for breeding purposes. The males, with one exception only, have all been good vigorous foxes and have been used extensively as polygamous males. The nine males have produced one hundred and twenty-seven pups of which seventy-five per cent were raised to maturity. The five females were kept for breeding purposes on the average for over three years each. Only one of those females raised four pups; none of the others raised a single pup. With this female it will be seen that whilst the male offspring have been consistently good breeders the females have been very poor breeders.

CASE No. 2, FEMALE 14D.—A grand-daughter of Female 14, that is a daughter of a son of Female 14. This female has raised to maturity four litters of five each, seven males and thirteen females. Three females were raised by her in 1927, three in 1928, four in 1929 and three in 1930. At the time that this report is being compiled, the females born in 1930 have not been used for breeding purposes, although all three are still in the ranch and will be used during the coming season. It would have been a physical possibility for the females that 14D has raised to have produced nineteen litters. As a matter of fact the females have produced eighteen litters and have raised over eighty per cent of the pups that were born. In practically all of the cases where the females failed

to raise their entire litters, it was more the fault of severe experimental conditions, rather than that the females were lacking in breeding qualities. In the only case where one of the females failed to produce her litter, which would have given the full quota of litters, later evidence obtained indicates that it was the fault of the male pup that was mated with her rather than of the female herself, although at that time when she failed to produce, she was a female pup. Of the seven males raised by female 14D, while a number of them were kept for breeding purposes, there was not a single one of them that ever produced a pup. Apart from their breeding qualities, these foxes showed very positive evidence that they were lacking in other respects in constitutional vigour.

CASE No. 3, MALE 51C.—This male in three years produced twenty-nine pups. While a large percentage of these were raised to maturity a number of them died when they were a few months old and all of the foxes from very early ages have been susceptible to worm infestation and showed every evidence of a lack of constitutional vigour, although the majority of them were very well furred. Of the offspring that were kept for breeding purposes four produced offspring and those offspring also showed a marked constitutional weakness and were susceptible to parasitic and other infestation.

RECOMMENDATIONS

Fox breeders should not only keep a record of the breeding qualities of the foxes themselves, but should have a complete record of the breeding qualities of the offspring in order to establish which of their foxes have strong inherent breeding traits.

FUR QUALITIES

If a black Holstein should be crossed with a red Holstein or, as a matter of fact, any other red cow, the black of the offspring would be quite as black as a pure-bred black Holstein, although they would be actually a cross between a red and a black. If yellow corn should be crossed with white corn, the result of the cross would be quite as yellow as a pure-bred yellow corn. Innumerable experiments of a similar nature have been carried on by scientists in different parts of the world and have led to the conclusion that it is impossible to determine the inherent qualities of any individual animal or plant from the actual apparent qualities of the plant or animal, and the only reliable manner in which the actual inherent traits of any individual animal or plant can be determined is by a study of the ancestors and the offspring, that is what the individual came from and what it can produce.

With regard to the fur qualities of silver foxes, the evidence that we have obtained in the Experimental Fox Ranch would indicate that the fundamental truth, which has been well established by scientists, that the appearance of the individual is not conclusive evidence of the inherent traits of the individual, also holds true with silver foxes. In the Experimental Fox Ranch we have had a number of foxes that had very poor fur qualities. As a matter of fact, each year inspectors have considered that these foxes should have been suspended, yet they have produced foxes that have been admired by the same inspectors, and have had what could be considered very good fur qualities. Some of the ancestors of these foxes have been known to have had the reputation of being good foxes. On the other hand, we have had a number of foxes with fairly good fur qualities yet mating these with different foxes they have failed to produce foxes that are up to their own standard of fur qualities.

RECOMMENDATIONS

It has been the general practice of fox breeders in buying breeding stock to make their purchases from the appearance of the foxes without a full study

of their ancestry. It is our conclusion that this is not a reliable method in which to select silver foxes for breeding stock. The Department of Agriculture, the Canadian National Live Stock Records and the Canadian National Silver Fox Breeders' Association have, at a great expense, built up a system of registration of the pedigrees of the silver foxes in Canada. The results that we have obtained would indicate that the reputation of the foundation stock from which the offspring were produced, would be a better guide in purchasing silver foxes than the appearance of the foxes, desirable as that may be.

SILVER COLOURING

The classification of foxes as black, extra dark, dark, dark medium, medium, pale and extra pale, used for registration and in fox shows, being vague and indefinite, was found to be worthless for any critical investigation work. It was necessary that some procedure should be adopted that would give an accurate measure of the amount of silver in the different foxes and the variation, if any, during different seasons. For this purpose we have adopted what we have designated as the silver factor. Records were taken of the extent of the area of the back of the fox showing silver hairs, the extent being expressed in terms of the percentage of the back as a whole from the ears to the base of the tail. Records were also taken of the density or the percentage of silver hairs in the area showing silver hairs. In order to obtain the silver factor, the value given to the silver area was multiplied by the density of silver hairs present in that area and the product divided by one hundred. Thus the silver factor represents the percentage of silver hairs present in the back of the fox. Where the silver is well defined there is very little difficulty in obtaining uniform readings. In many cases, of course, the silver area itself is not well defined and the density of the silver varies greatly within the different regions of the back, but even in those cases, there will not be a variation of more than five per cent from the mean, when three or four readings are carefully taken.

According to the standards that we have adopted for determining the silver factor, foxes in the different classes, as used by the inspectors for registration and those in charge of fox shows, would have the following silver factors respectively:—

Black or extra dark	Under 5
Dark silver	5 to 15
Dark medium	15 to 30
Medium	30 to 45
Pale	45 to 60
Extra pale	65 and over.

In tables No. 10, 11, 12 and 13 the particulars are given regarding the silver area, the density of the silver and the silver factor of the parents and their offspring in a number of cases where inbreeding of varying intensity has been made, and the same data in the cases of outcrosses. In order to ascertain the amount of silver in the offspring in relation to their parents, that is to say, the inheritance of the silver colouring, the mean of the silver factor of the parents was divided into the mean of the silver factor of the offspring and the results multiplied by one hundred. The extent to which this figure varied above or below one hundred gives the increase or decrease of the silver colouring in the offspring. In other words, taking one hundred as the standard of the parents, the amount of the figure shown in the last column of the tables above one hundred represents the percentage increase of the silver colouring and the amount below one hundred the percentage decrease.

TABLE 10.—INHERITANCE OF THE SILVER COLOURING—INBREEDING—FIRST GENERATION

Foxes	Parents				Offspring						
	Silver area	Silver density	Silver factor	Mean silver factor	Foxes	Sex	Silver area	Silver density	Silver factor	Mean silver factor	Ratio of offspring of parents Parents=100
(1) Sire 47C	80	80	64	.....	50F	M	85	80	68	.....	.....
Dam 32E	80	80	64	64	51F	M	80	80	64	.....	.....
					52F	F	95	90	85	.....	.....
					53F	F	75	75	56	68	106
(2) Sire 29D	50	40	20	.....	57F	M	50	30	15	.....	.....
Dam14D	75	65	49	35	58F	M	50	35	17	.....	.....
					59F	F	75	70	52	.....	.....
					60F	F	80	70	56	.....	.....
					61F	F	85	75	64	41	117
(3) Sire 51C	75	75	56	.....	9F	M	0	0	0	.....	.....
Dam 4E	75	75	56	56	10F	M	60	50	30	15	27
(4) Sire 47C	85	85	72	.....	68G	F	75	80	60	.....	.....
Dam 31E	75	75	56	64	69G	F	85	85	70	.....	.....
					70G	F	80	80	64	65	101

No. 1.—47C and 32E was a father and daughter mating, 32E being the offspring of an outcross, there being no relation between her sire and her dam. In the littre produced from this mating, there was an average increase of 6 per cent in the amount of silver with respect to their parents.

No. 2.—29D and 14D was an uncle and niece mating. In the previous generation the matings had been complete outcrosses so that three of the grand-parents of 14D were not related, as far as known, to any of the grand-parents of 29D. Also two of the grand-parents of 29D were in no way related to the grand-parents of 14D. In the litter produced from this mating there was an average increase of 17 per cent in the amount of silver.

No. 3.—51C and 4E was a father and daughter mating, 4E being the offspring of an outcross. There was an average decrease of 73 per cent in the amount of silver in the offspring. There was a known disturbing influence in the development of one of the offspring, 9F, and while he did not show any silver hairs on the back of the body, he was heavily silvered in the face. It is probable that the figures here do not actually represent the inherent silver colouring qualities.

No. 4.—47C and 31E was a father and daughter mating, 31E being the offspring of an outcross. There was an average increase of 1 per cent in the amount of silver in the offspring.

TABLE 11.—INHERITANCE OF THE SILVER COLOURING—INBREEDING—SECOND GENERATION

Foxes	Parents				Offspring						
	Silver area	Silver density	Silver factor	Mean silver factor	Foxes	Sex	Silver area	Silver density	Silver factor	Mean silver factor	Ratio of offspring of parents Parents=100
(1) Sire 9D	75	75	56	.....	5F	M	60	50	30	.....	.....
Dam 22A	60	50	30	44	6F	M	50	50	25	.....	.....
					7F	F	60	60	36	.....	.....
					8F	F	60	50	30	30	68
(2) Sire 25D	50	30	15	.....	44F	M	50	10	5	.....	.....
Dam 41E	60	25	15	15	45F	M	60	20	12	.....	.....
					46F	M	50	25	12	10	66
(3) Sire 5D	55	50	27	.....	1G	M	40	35	14	.....	.....
Dam 10D	60	60	36	32	2G	M	70	65	45	.....	.....
					3G	F	50	50	25	28	87
(4) Sire 9D	75	75	56	.....	25G	M	75	75	56	.....	.....
Dam 40E	70	70	49	53	26G	M	75	70	52	.....	.....
					27G	F	50	55	27	.....	.....
					28G	F	50	50	25	40	76
(5) Sire 29D	50	50	25	.....	45G	F	60	60	36	.....	.....
Dam 41E	75	65	49	37	46G	F	0	0	0	.....	.....
					47G	F	55	55	30	22	59
(6) Sire 50F	85	85	72	.....	64G	M	95	90	85	.....	.....
Dam 30E	75	75	56	64	65G	F	75	80	60	.....	.....
					66G	F	90	85	76	.....	.....
					67G	F	85	85	72	73	114
(7) Sire 29D	50	50	25	.....	81G	M	0	0	0	.....	.....
Dam 61F	75	70	52	39	82G	M	65	65	42	.....	.....
					83G	F	55	55	30	24	61

No. 1.—9D and 22A was a son and mother mating where there had been previous inbreeding, the sire and dam of 9D being first cousins. There was an average decrease of 32 per cent in the amount of silver of the offspring.

No. 2.—25D and 41E was an uncle and niece mating for two generations, two full brothers and one half-brother being mated to three successive generations of females, the sire of 41E being a full brother to 25D and the sire of the dam of 41E being a half-brother to 25D. There was an average decrease of 34 per cent in the amount of silver of the offspring. It may be stated here that in the first generations of inbreeding there was an increase in the amount of silver.

No. 3.—5D and 10D was a half-brother and half-sister mating on the one side and first cousins on the other and in the previous generation in both cases the sire and dam of each were first cousins. There was an average decrease of 23 per cent in the amount of silver in the offspring.

No. 4.—9D and 40E was a mating of cousins where there had been inbreeding to common ancestors for two generations. There was an average decrease of 24 per cent in the amount of silver of the offspring.

No. 5.—29D and 41E was a similar mating to No. 2, where two full brothers and one half-brother had been mated to three successive generations of females. There was an average decrease of 41 per cent in the amount of silver in the offspring.

No. 6.—50F and 30E was a nephew and aunt mating where there had been inbreeding in the previous generations with regard to 50F, but no inbreeding in relation to 30E. There was an average increase of 14 per cent in the amount of silver of the offspring.

No. 7.—29D and 61F was a father and daughter mating where there had been inbreeding in the previous generations with brothers of 29D, that is to say 61F was produced by mating 29D and 14D and the sire of 14D was a half-brother to 29D. There was an average decrease of 39 per cent in the amount of silver of the offspring.

TABLE 12.—INHERITANCE OF THE SILVER COLOURING—INBREEDING—THIRD GENERATION

Foxes	Parents				Offspring						
	Silver area	Silver density	Silver factor	Mean silver factor	Foxes	Sex	Silver area	Silver density	Silver factor	Mean silver factor	Ratio of offspring of parents Parents=100
(1) Sire 27D	50	30	15	.....	24F	M	50	30	15	.....	.....
Dam 13E	75	70	52	33	25F	M	50	30	15	.....	.....
					26F	M	50	20	10	13	39
(2) Sire 11E	65	65	42	.....	14G	F	20	20	4	.....	.....
Dam 18	70	70	49	46	15G	F	50	50	25	.....	.....
					16G	F	65	60	39	.....	.....
					17G	F	75	50	37	26	57
(3) Sire 1D	50	40	20	.....	22G	M	50	30	15	.....	.....
Dam 13E	75	70	52	46	23G	M	35	20	7	.....	.....
					24G	F	50	20	10	11	31
(4) Sire 1E	50	40	20	.....	58G	M	0	0	0	.....	.....
Dam 38F	0	0	0	10	59G	M	0	0	0	.....	.....
					60G	M	0	0	0	.....	.....
					62G	F	20	10	2	.....	.....
					63G	F	0	0	0	4	4

No. 1.—27D and 13E was a father and daughter mating, 13E being the offspring of a one half-brother and a half-sister mating on the side and cousins on the other, there being inbreeding also in the previous generation. There was an average decrease of 61 per cent in the amount of silver of the offspring.

No. 2.—11E and 18 was a grand-son and grand-mother mating where there had been inbreeding in the intermediate generation the foxes being descended from three common ancestors only. There was a decrease of 43 per cent in the amount of silver of the offspring.

No. 3.—1D and 13E was an uncle and niece mating, 13E being inbred for two generations to close relatives of 1D. There was an average decrease of 69 per cent in the amount of silver of the offspring.

No. 4.—1E and 38F was an uncle and niece mating, 38F having been inbred for four generations to ancestors of 1E. There was an average decrease of 96 per cent in the amount of silver in the offspring.

TABLE 13.—INHERITANCE OF THE SILVER COLOURING—OUT-CROSSING

Foxes	Parents				Offspring						
	Silver area	Silver density	Silver factor	Mean silver factor	Foxes	Sex	Silver area	Silver density	Silver factor	Mean silver factor	Ratio of offspring of parents Parents=100
(1) Sire 1B	50	30	15	.....	13F	M	50	20	10	.....	.....
Dam 18	75	70	52	33	14F	F	75	65	49	30	91
(2) Sire 6C	60	50	30	.....	27F	F	50	20	20	.....	.....
Dam 7B	60	50	30	30	28F	F	80	70	56	.....	.....
					29F	F	60	60	36	37	123
(3) Sire 11C	0	0	0	.....	36F	M	75	50	37	.....	.....
Dam 42E	50	20	10	5	37F	M	0	0	0	.....	.....
					38F	F	25	2	1	13	260
(4) Sire 51C	75	75	56	.....	32F	M	75	75	56	.....	.....
Dam 12D	80	75	60	58	33F	M	80	75	60	.....	.....
					35F	F	80	80	64	60	103
(5) Sire 29D	50	40	20	.....	39F	M	75	60	45	.....	.....
Dam 232C	75	75	56	38	40F	F	75	75	56	.....	.....
					41F	F	75	60	45	.....	.....
					42F	F	75	70	52	50	131
(6) Sire 29D	50	40	20	.....	30F	M	65	50	32	.....	.....
Dam 113C	50	30	15	17	31F	M	75	75	56	44	259
(7) Sire 11	55	55	30	.....	9G	M	55	60	33	.....	.....
Dam 14	50	50	25	27	10G	M	15	25	4	.....	.....
					11G	M	5	10	1	.....	.....
					12G	F	55	75	41	.....	.....
					13G	F	50	30	15	19	70
(8) Sire 11	55	55	30	.....	35G	M	50	50	25	.....	.....
Dam 113C	50	40	20	25	36G	M	5	5	5	.....	.....
					37G	F	20	20	4	11	145
(9) Sire 11	55	55	30	.....	75G	M	25	25	6	.....	.....
Dam 14D	75	75	56	43	76G	F	60	70	42	.....	.....
					77G	F	50	50	25	.....	.....
					78G	F	75	75	56	.....	.....
					79G	F	65	65	42	34	79

TABLE 13.—INHERITANCE OF THE SILVER COLOURING—OUT-CROSSING—*Concluded*

Foxes	Parents				Offspring						
	Silver area	Silver density	Silver factor	Mean silver factor	Fozes	Sex	Silver area	Silver density	Silver factor	Mean silver factor	Ratio of offspring of parents Parents=100
(10) Sire 51C	75	75	56	.....	4G	M	60	70	42	.....	.....
Dam 8D	85	85	72	64	5G	M	65	75	49	.....	.....
					6G	M	60	65	39	.....	.....
					7G	F	85	85	72	.....	.....
					8G	F	80	80	64	53	83
(11) Sire 59C	50	10	5	.....	32G	M	50	40	20	.....	.....
Dam 29E	70	70	49	27	33G	F	70	65	45	.....	.....
					34G	F	75	70	52	39	144
(12) Sire 9C	75	65	49	.....	39G	M	80	80	64	.....	.....
Dam 12D	75	70	52	51	40G	M	70	65	45	.....	.....
					41G	M	65	65	42	.....	.....
					42G	F	85	80	68	54	106
(13) Sire 5D	55	50	27	.....	43G	M	75	70	52	.....	.....
Dam 232C	70	70	49	38	44G	F	60	60	36	44	116
(14) Sire 47C	85	85	72	.....	48G	M	75	75	56	.....	.....
Dam 33A	60	50	30	51	49G	F	70	70	49	.....	.....
					50G	F	75	75	56	54	106

No. 1, 1B and 18.—In this particular mating there was a decrease of nine per cent of the silver colouring of the offspring, but it may be stated that in a previous mating all the litter was quite as light as 14F, a product of this mating, and in that case there was a great increase of the silver colouring in the offspring.
No. 2, 6C and 7B.—There was an increase of twenty-three per cent of the silver colouring of the offspring.
No. 3, 11C and 42E.—There was an increase of one hundred and sixty per cent in the silver colouring of the offspring.
No. 4, 51C and 12D.—There was an increase of three per cent of the silver colouring of the offspring.
No. 5, 29D and 232C.—There was an increase of thirty-one per cent of the silver colouring of the offspring.
No. 6, 29D and 113C.—There was an increase of one hundred and fifty-nine per cent of the silver colouring of the offspring.
No. 7, 11 and 14.—Both these were aged foxes. The sire 11 was registered as a dark fox as a two-year old. We have no record of what his colouring was as a pup. At the time that these records were taken he was medium in colour. The dam 14 was quite black as a pup, showing no silver at all and gradually increased in the amount of silver until she became a medium coloured fox. The records of the litter of their offspring were taken when they were pups and the facts show that the pups have more silver than their parents had as pups.
No. 8, 11 and 113C and Nos. 9, 11 and 14D.— These refer to the same sire and, therefore, there would be a greater increase in the amount of silver of the offspring then represented by the figures.
No. 10, 51C and 8D.—Is a case of a pale fox and an extra pale fox being mated together and produced a litter of pale foxes with the exception of 6G which was a light medium.

RECOMMENDATIONS

While in the case of inbreeding, there was undoubtedly an improvement in the general quality of the fur both with regards to density and texture and in the majority of the cases, the silver was much clearer than in the parents, yet there was such an extensive decrease in the amount of silver in the succeeding generations of inbreeding that it reached a point that it was not economical to produce such foxes. On the other hand, with outcrossing there has been a fairly uniformly vast increase in the amount of the silver colouring. We would, therefore, recommend that with dark foxes it would be advisable to outcross as much as possible. On the other hand favourable results can be expected with inbreeding pale foxes fairly close. Our results show that when dark foxes are mated to closely related pale foxes, the average offspring will have less silver than the darker of the two parents. The probability of producing medium silver foxes from dark foxes mated to closely related pale foxes is very remote.

INFLUENCE OF COD LIVER OIL

During three different seasons experiments have been carried out feeding cod liver oil or cod liver meal to foxes in open pens and in covered sheds. In all cases in our experimental work, when cod liver oil or cod liver products were fed to foxes during the summer and fall, they had a marked detrimental effect upon the foxes and particularly upon the fur. As the guard hairs grew they became dry and brittle and developed a pronounced brown shade, and the underfur was inclined to matt. As the season progressed the brown shade became more and more pronounced, especially with foxes in the open pens. While the foxes in the covered shed did not show the unfavourable effects to the same extent as foxes in the open, yet a marked detrimental influence could be observed when cod liver oil or cod liver meal was fed to foxes in covered sheds. The microscopic examination of the hair follicles showed that there was a lock of pigment and the more pronounced the brown shade, the less pigment was present in the follicles. A certain number of females who had a pronounced brown shade and were otherwise under condition were fed one-quarter of an ounce of cod liver oil each day during the latter part of the gestation period. Those females raised their litters. On the other hand we have had a number of cases where the females having a pronounced brown shade lost their litters at birth. The evidence that we have obtained has invariably shown that when cod liver oil or cod liver products and fats have been fed to foxes during the summer and fall months, there has been a lack of production of the black pigment, the foxes showing a pronounced brown shade. Also the foxes have failed to put on weight during the fall months. Cod liver oil is rich in those vitamins that have a similar effect on the animal system as the ultra violet rays. Hence, it would appear that when substances containing those vitamins were fed to foxes there was not a production of the black pigment which would retain the rays of light. That is to say that when the animals were fed substances equivalent to the rays of light the system made no effort to produce the mechanism that would retain the rays of light. Also when cod liver oil and other fats were fed to foxes there was no effort on the part of the foxes to store up the fats in their system and they failed to put on weight.

RECOMMENDATIONS

In the majority of cases where the fur of the foxes has been dry and lacking in life and lustre, because the foxes were out of condition, it has been the policy of the fox breeders to feed oils and fats hoping by this method to counteract the condition. We have extensively investigated this condition and in all cases where foxes, which showed a pronounced dryness of the fur, have

been fed cod liver oil or other oils or fats the condition has been aggravated and we would warn fox breeders against feeding cod liver oil or fats to foxes whose fur was dry and lacking in lustre and proper life. We would also warn fox breeders against feeding cod liver oil in any shape or form to foxes during the summer and fall months. On the other hand, cod liver oil may be fed in small quantities to females during the latter part of the gestation period and during the lactation period.

EXPERIMENTAL WORK IN FEEDING RAW CEREAL PRODUCTS

The preparation of cereals for feeding to silver foxes has been a burning question with fox breeders since the very beginning of the industry. Experience has taught fox breeders that it is not an easy matter to cook cereals properly. As improperly cooked cereals have invariably led to very unfavourable results, the practice of cooking cereals as a porridge has fallen out of vogue and in a large number of ranches in recent years no attempt has been made to cook cereals as a porridge. In recent years there has been a great improvement in the manner in which commercial fox biscuits have been prepared. Still the majority of fox breeders are not satisfied that they have yet found a satisfactory cereal ration for foxes.

Experiments were carried out with a large number of foxes during the summer and fall of 1930 to ascertain to what extent cereals should be fed in the raw state. In the first place it has been found that in order to carry out this successfully, the starchy portion of the cereals must be reduced to a very fine state. On the other hand, bran, cellulose and other roughage portions of cereals can be fed to the foxes in a fairly coarse state. When rice flour and wheat flour were fed to foxes they produced a very pronounced scouring effect upon the foxes and they came through the foxes and appeared in the feces as white spatters. With continued feeding there was a slight improvement. When wheat bran was fed with rice flour and wheat flour there was a complete digestion of the food and there was no sign of any undigested starch in the feces and the foxes passed uniformly dark firm boli of a good consistency. In table 14 is given the degree of fineness of the different raw cereals used in the experimental work. The given quantity of the food was passed through a stack of three sieves No. 20, No. 40 and No. 60. It may be stated here that No. 20, No. 40 and No. 60 sieves have 20, 40 and 60 strands respectively to the lineal inch.

RECOMMENDATIONS

When feeding raw cereals to the foxes it is desirable that at least 50 per cent of the product should pass through a No. 60 sieve and that all of the starchy portion of the food should be reduced to that degree of fineness. The cereals should contain at least ten to fifteen per cent of wheat bran or some other similar roughage.

Rice flour, No. 2, and rice meal, No. 3, were purchased from the Mount Royal Rice Milling Co., Montreal, P.Q.

Oatmeal, No. 6, was purchased from the Quaker Oats Co., Peterboro, Ont.

Cornmeal, No. 7, and corn feed, No. 8, were purchased from the Ontario Oriental Flour Co., St. Thomas, Ont. Cornmeal, No. 7, was designated by this firm as King cornmeal, No. 3, and the corn feed, No. 8, as yellow hominy feed.

TABLE 14—RAW CEREAL PRODUCTS USED IN EXPERIMENTAL WORK—DEGREE OF FINENESS

	No. 2 Rice Meal	No. 3 Rice Flour	No. 6 Oatmeal	No. 7 Cornmeal	No. 8 Corn Feed	No. 16 Whole Wheat Flour
	%	%	%	%	%	%
Retained on No. 20 sieve	8·2	0·0	22·4	0·7	29·8	2·0
Retained on No. 40 sieve	26·6	0·0	43·6	7·7	33·2	16·0
Retained on No. 60 sieve	26·6	0·4	32·1	55·6	27·6	6·0
Passed through No. 60 sieve	38·5	99·5	1·8	35·9	9·3	76·0

RAW RICE RATION

In table 15 is given an outline of the raw rice ration as fed to the foxes. Those foxes shed their fur in a more satisfactory manner and when the fur began to grow in September it had a most favourable silky lustre and texture, and in other respects the foxes appeared to be in good condition. When fed to pups, the pups made a favourable growth and the ration produced what has been considered a most favourable influence with regards to lustre and texture upon the fur of the pups.

Throughout the experimental work there was a most desirable digestion of the ration and there was no evidence of undigested starchy portions of the rations in the feces.

TABLE 15—RICE PRODUCT RATIONS

Summer Rations Fed June 25 to August 26, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Rice flour	6	Small	5¼
Rice meal	1	Medium	6
Wheat bran	1	Large	6¾
Milk	32	Extra large	7½
Tripe	8		
Yeast	½		
Total	48½		
Evening Meal—			
Rice flour	6	Small	3½
Rice meal	1	Medium	4
Wheat bran	1	Large	4½
Meat	16	Extra large	5
Bone	2		
Vegetables	6		
Total	32		

Early Fall Rations Fed August 27, to October 28, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Rice flour	4	Small	6
Corn meal	1	Medium	6¾
Corn feed	1	Large	7½
Rice meal	1	Extra large	8¼
Wheat bran	1		
Milk	32		
Trip	8		
Yeast	½		
Total	48½		
Evening Meal—			
Rice flour	4	Small	7
Corn meal	1	Medium	7⅞
Corn feed	1	Large	8¾
Rice meal	1	Extra large	9⅝
Wheat bran	1		
Wheat germ	2		
Meat	32		
Bone	4		
Vegetables	10		
Total	56		

TABLE 15—RICE PRODUCT RATIONS—*Concluded*

Late Fall Rations Fed October 29, 1930, to January 6, 1931

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Rice flour	6	Small	6
Oatmeal	3	Medium	6¾
Cornmeal	3	Large	7½
Wheat bran	2	Extra large	8¼
Wheat germ	2		
Tripe	8		
Milk	24		
Potassium iodide solution			
Total	48		
Evening Meal—			
Meat	40	Small	5¼
Wheat bran or vegetables	2	Medium	6
Potassium iodide solution		Large	6½
		Extra large	7¼

COMBINED RAW CEREAL RATION

In table 16 is given an outline of the combined raw cereal ration as fed to the foxes during the summer and fall months. The foxes maintained a healthy condition and there was a good development of the fur as to length and texture, but while in many cases the lustre was very good, it was not as uniformly good as with those foxes on the raw rice ration. The pups that were fed a similar ration made a favourable gain in weight and a good development of the fur.

Throughout the experimental work there was a most desirable digestion of the ration and there was no evidence of undigested starchy portions of the ration in the feces.

TABLE 16—COMBINED RAW CEREALS

Summer Rations Fed June 25 to August 26, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Rice flour	3	Small	5¼
Rice meal	1	Medium	6
Wheat flour	3	Large	6¾
Bran wheat	1	Extra large	7½
Milk	32		
Tripe	8		
Yeast	½		
Total	48½		
Evening Meal—			
Rice flour	3	Small	3½
Rice meal	1	Medium	4
Wheat flour	3	Large	4½
Wheat bran	1	Extra large	5
Meat	16		
Bone	2		
Vegetables	6		
Total	32		

Early Fall Rations Fed August 27 to October 29, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Rice flour	2	Small	6
Wheat flour	2	Medium	6¾
Corn meal	1	Large	7½
Corn feed	1	Extra large	8¼
Rice meal	1		
Wheat bran	1		
Milk	32		
Tripe	8		
Yeast	½		
Total	48½		

TABLE 16—COMBINED RAW CEREALS—*Concluded*

Early Fall Rations Fed August 27 to October 29, 1930.—Concluded

Evening Meal—	
Rice flour	2
Wheat flour	2
Corn meal	1
Corn feed	1
Rice meal	1
Wheat bran	1
Wheat germ	2½
Meat	32
Bone	4
Vegetables	10
Total	56

Amount Fed—	
Small	7
Medium	7⅞
Large	8¾
Extra large	9⅝

Late Fall Rations Fed October 29, 1930, to January 6, 1931

Morning Meal—	gm/KW
Rice flour	3
Wheat flour	3
Oatmeal	3
Corn meal	3
Wheat bran	2
Wheat germ	2
Tripe	8
Milk	24
Total	48
Potassium iodide solution.	

Amount Fed—	oz.
Small	6
Medium	6¾
Large	7½
Extra large	8¼

Evening Meal—	
Meat	40
Wheat bran or vegetables	2
Potassium iodide solution	

Small	5¼
Medium	6
Large	6½
Extra large	7¼

RAW WHEAT RATION

In table 17 is given an outline of the wheat ration that was fed during the summer and fall months. During the summer months the foxes were not considered to be in as good condition as the foxes fed the rice ration and the combined raw cereal ration. The fur was relatively dry and lacking in lustre. The pups fed a similar ration made a fairly good gain in weight and while they had a good growth of fur, the finish and texture was not as favourable as with the raw rice products.

The digestion in this ration was a vast improvement on the commercial fox biscuits, although we do not recommend this ration for a summer feeding for foxes, and would warn fox breeders against feeding wheat products extensively during the summer months either in the raw or cooked state.

TABLE 17—WHEAT PRODUCTS RAW CEREALS

Summer Rations Fed June 25 to August 26, 1930

Morning Meal—	gm/KW
Wheat flour	6
Wheat bran	2
Milk	32
Tripe	8
Yeast	½
Total	48½

Amount Fed—	
Small	5¼
Medium	6
Large	6¾
Extra large	7½

Evening Meal—	
Wheat flour	6
Wheat bran	2
Meat	16
Bone	2
Vegetables	6
Total	32

Small	3½
Medium	4
Large	4½
Extra large	5

TABLE 17—WHEAT PRODUCTS RAW CEREALS—*Concluded*

Early Fall Rations Fed August 27 to October 28, 1930

Morning Meal—	gm/KW	*Amount Fed*	oz.
Wheat flour	4	Small	6
Wheat bran	2	Medium	6¾
Corn meal	1	Large	7½
Corn feed	1	Extra large	8¼
Milk	32		
Tripe	8		
Yeast	½		
Total	48½		
Evening Meal—			
Wheat flour	4	Small	7
Wheat bran	2	Medium	7⅞
Corn meal	1	Large	8¾
Corn feed	1	Extra large	9⅝
Wheat germ	2		
Meat	32		
Bone	4		
Vegetables	10		
Total	56		

Late Fall Rations Fed October 29, 1930, to January 6, 1931

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Wheat flour	6	Small	6
Oatmeal	3	Medium	6¾
Corn meal	3	Large	7½
Wheat bran	2	Extra large	8¼
Wheat germ	2		
Tripe	8		
Milk	24		
Potassium iodide solution			
Total	48		
Evening Meal—			
Meat	40	Small	5½
Wheat bran or vegetables	2	Medium	6
Potassium iodide solution		Large	6½
		Extra large	7¼
Total	42		

COOKED CEREAL RATION

An outline of the cooked cereal ration as fed to the foxes during the summer and fall months is given in table 18. Wheat bran was added to this ration which was a modification that had not been carried out in previous years. There was a vast improvement in the manner in which the cereals were digested and there was no evidence of any undigested portions of the cereal part of the ration, even when relatively large amounts of cereals were fed to the foxes. The foxes fed this ration made a good gain in weight and there was a good development of the fur with regard to length and texture. This ration was a great improvement on the cooked cereal rations that were fed previously without the addition of bran.

TABLE 18—COOKED CEREAL RATION

Summer Rations Fed June 25 to August 26, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Porridge	40	Small	8¾
Milk	32	Medium	10
Tripe	8	Large	11½
Yeast	½	Extra large	12½
Total	80½		
Evening Meal—			
Cooked porridge	40	Small	7
Meat	16	Medium	8
Bone	2	Large	9
Vegetables	6	Extra large	10
Total	64		

TABLE 18—COOKED CEREAL RATION—*Concluded*

Early Fall Rations Fed August 27 to October 28, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Porridge	40	Small	10
Milk	32	Medium	11¼
Tripe	8	Large	12½
Yeast	½	Extra large	13¾
Total	80½		
Evening Meal—			
Cooked porridge	40	Small	11
Meat	32	Medium	11⅜
Bone	4	Large	13¾
Vegetables	12	Extra large	15⅛
Total	88		

Late Fall Rations Fed October 29, 1930, to January 6, 1931

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Porridge	60	Small	12
Tripe	8	Medium	13½
Milk	24	Large	15
Potassium iodide solution		Extra large	16½
Total	92		
Evening Meal—			
Meat	40	Small	5¼
Wheat bran or vegetables	2	Medium	6
Potassium iodide solution		Large	6½
		Extra large	7¼

FROZEN RABBIT RATION

When the raising of silver foxes in captivity was in its early stages, the offals and the waste cuts from different parts of the carcasses of animals killed at the leading abattoirs was a drug on the market. In recent years a greater percentage of the offal meat, etc., has been consumed by the human population and the meat requirements of the silver fox industry has been increasing by leaps and bounds. This has caused an acute shortage of meats that were available to fox breeders, with an increase in prices. Therefore, there has been a wide search to find out if the present meat supply for silver foxes could be supplemented by meat from other sources.

Frozen rabbits have for a long time been exported from Australia and New Zealand to English and European centres for human consumption. It has been considered by many that these frozen rabbits from New Zealand and Australia would help to meet the acute demand for meat that at present exists in the silver fox industry. In table 19 is given the outline of frozen rabbit rations fed to some foxes and pups during the summer and fall months. The adult foxes maintained what was considered a healthy condition during the summer months and there appeared to be a favourable growth of fur up until the month of September. After that period the foxes on the frozen rabbit ration appeared to be on the down grade. Many of them produced a very pronounced brown shade. When a similar ration was fed to the pups there was not a very favourable development of the fox as regards weight. While there was a favourable development of the underfur and of the guard hair during the summer months the development during November and December was not satisfactory.

TABLE 19—FROZEN RABBIT RATION

Summer Rations Fed June 25 to August 26, 1930

Morning Meal—	gm/KW	*Amount Fed*	oz.
Porridge	40	Small	$8\frac{3}{4}$
Milk	32	Medium	10
Tripe	8	Large	$11\frac{1}{4}$
Yeast	$\frac{1}{2}$	Extra large	$12\frac{1}{2}$
Total	$80\frac{1}{2}$		
Evening Meal—			
Porridge	40	Small	7
Frozen rabbit	16	Medium	8
Bone	2	Large	9
Vegetables	6	Extra large	10
Total	64		

Early Fall Rations Fed August 27 to October 28, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Porridge	40	Small	10
Milk	32	Medium	$11\frac{1}{4}$
Tripe	8	Large	$12\frac{1}{2}$
Yeast	$\frac{1}{2}$	Extra large	$13\frac{3}{4}$
Total	$80\frac{1}{2}$		
Evening Meal—			
Frozen rabbit	48	Small	7
Vegetables	8	Medium	$7\frac{7}{8}$
		Large	$8\frac{3}{4}$
Total	56	Extra large	$9\frac{5}{8}$

Late Fall Rations Fed October 29, 1930, to January 6, 1931

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Porridge	60	Small	12
Tripe	8	Medium	$13\frac{1}{2}$
Milk	24	Large	15
Potassium iodide solution	1 cc.	Extra large	$16\frac{1}{2}$
Evening Meal—			
Frozen rabbits	40	Small	5
		Medium	$5\frac{5}{8}$
		Large	$6\frac{1}{4}$
		Extra large	$6\frac{7}{8}$

SWIFT MEAT RATION

In table 20 is given an outline of the Swift meat ration as fed to a number of adult foxes and pups during the summer and fall months. This ration produced fairly favourable results during the summer months and the pups made a satisfactory gain in weight, but the results were far from satisfactory during the late fall months.

RECOMMENDATIONS

This meat may be fed occasionally to foxes during the summer months and for this purpose a reserve supply may be kept on hand to feed to the foxes when fresh meat is not available, but the results obtained up to the present time would indicate that it does not duplicate a good quality of freshly killed meat. The Swift meat was purchased from The Canadian Swift Company, Toronto, and is placed upon the market by this firm as Swift's Silver Fur Food.

TABLE 20—SWIFT MEAT RATION

Summer Rations Fed June 25 to August 26, 1930

Morning Meal—	gm/KW	*Amount Fed—*	oz.
Porridge	40	Small	$8\frac{3}{4}$
Milk	32	Medium	10
Tripe	8	Large	$11\frac{1}{4}$
Yeast	$\frac{1}{2}$	Extra large	$12\frac{1}{2}$
Total	$80\frac{1}{2}$		
Evening Meal—			
Meat	60	Small	3
Bone	2	Medium	$3\frac{1}{2}$
Vegetables	4	Large	$3\frac{3}{4}$
		Extra large	$4\frac{1}{4}$
Total	66		

Early Fall Rations Fed August 27 to October 28, 1930

Morning Meal—	gm/KW	*Amount Fed—*	oz.
Porridge	40	Small	10
Milk	32	Medium	$11\frac{1}{4}$
Tripe	8	Large	$12\frac{1}{2}$
Yeast	$\frac{1}{2}$	Extra large	$13\frac{3}{4}$
Total	$80\frac{1}{2}$		
Evening Meal—			
Swift's meat	60	Small	7
Vegetables	10	Medium	$7\frac{7}{8}$
Total	70		

Late Fall Rations Fed October 29, 1930, to January 6, 1931

Morning Meal—	gm/KW	*Amount Fed—*	oz.
Porridge	60	Small	12
Tripe	8	Medium	$13\frac{1}{3}$
Milk	24	Large	15
Potassium iodide solution	1 cc.	Extra large	$16\frac{1}{2}$
Evening Meal—			
Swift's meat	40	Small	5
		Medium	$5\frac{5}{8}$
		Large	$6\frac{1}{4}$
		Extra large	$6\frac{7}{8}$

PURINA CHOW RATION

In table 21 is given an outline of the ration of purina chow ration as fed to a number of foxes. The foxes on this ration maintained a healthy condition throughout the summer months and the pups made a more rapid growth until they were four months old than on any other ration. In some respects it appeared to force the development of the foxes a little too fast and a percentage of the foxes developed a slight brown shade, which was very pronounced in some cases in the silver. According to our observations this ration had a most favourable development upon the length and strength of the guard hairs and would be conducive to producing a pelt of a good commercial value, when fed in moderate amounts.

RECOMMENDATIONS

Purina Fox Chow appears to be a very good food for supplementing the ordinary rations that are fed throughout the silver fox industry, but it is very questionable if it can be fed as the entire food supply or the entire cereal content of the ration, as it appears to be a very strong food and will be liable to force the foxes a little overprime. On the other hand, according to the evidence that we have obtained, it appears to enhance the development of both the weight and fur. Purina Fox Chow was purchased from the Purina Mills, St. Louis, Missouri, through their local agents.

TABLE 21—PURINA CHOW RATION

Summer Rations Fed June 25 to August 26, 1930

Morning Meal—	gm/KW	*Amount Fed*	oz.
Purina chow	8	Small	5¼
Milk	32	Medium	6
Tripe	8	Large	6¾
Yeast	½	Extra large	7½
Total	48½		
Evening Meal—			
Purina Chow	8	Small	3½
Meat	16	Medium	4
Bone	2	Large	4½
Vegetables	6	Extra large	5
Total	32		

Early Fall Rations Fed August 27 to October 28, 1930

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Purina Chow	12	Small	6
Milk	48	Medium	6¾
Tripe	12	Large	7½
Yeast	1¼	Extra large	8¼
Evening Meal—			
Purina Chow	12	Small	7
Meat	48	Medium	7⅞
Bone	6	Large	8¾
Vegetables	18	Extra large	9⅝
Total	84		

Late Fall Rations Fed October 29, 1930, to January 6, 1931

Morning Meal—	gm/KW	*Amount Fed*—	oz.
Purina Chow	12	Small	6
Tripe	8	Medium	6¾
Milk	24	Large	7½
Potassium iodide solution	1 cc.	Extra large	8¼
Evening Meal—			
Meat	40	Small	5¼
Wheat bran or vegetables	2	Medium	6
		Large	6½
		Extra large	7¼

FLOTATION OF WORM EGGS IN SALT SOLUTIONS

During the experimental work involving the examination of feces for the presence of worm eggs, different methods have been tried for separating the worm eggs from the feces. Centrifuging the feces in water, besides involving a great deal of work, was not satisfactory on account of the fact that only a very small sample of the feces could be used, and the time involved made it impossible to carry out a routine examination of the feces of all the foxes in the ranch. Experiments were carried out using glycerine as the suspension medium. This also was not satisfactory as only small samples of the feces could be used and also the cost of the glycerine was an inhibitory factor. Satisfactory results were obtained using common salt solution as suspension media, but it was necessary to ascertain the particular specific gravity or concentration of the salt solution which would give the best results for hook worm, lung worm and round worm eggs separately and collectively. Samples were obtained from foxes that were known to be infested with those worms and an equivalent amount of the feces used for making the tests with the different concentrations of salt solution. The method generally adopted was to place the feces in a one-half pint milk bottle, and mix thoroughly with the particular salt solution. The samples were allowed to stand for sixteen to twenty-four hours and the eggs, which had floated

to the surface, removed by a loop to a microscopic slide. In table 22 are given the number of eggs of the different worms that have floated to the surface of the salt solutions of different concentrations during different intervals of time. The concentration refers to the weight of the salt in the hundred parts by weight of water. A salt solution of specific gravity of 1·15 would have a concentration of twenty ounces of sodium chloride or common salt in one hundred ounces of water if avoirdupois weights should be used, or twenty grams of salt in one hundred cc. of water with metric weights.

TABLE 22—FLOTATION OF WORM EGGS IN SALT SOLUTION

Time period	Concentration	Specific gravity	Hook worm eggs	Lung worm eggs	Roundworm eggs
	%				
17 hours	13	1·10	2,432	1	9
18 hours	16½	1·125	1,224	36	111
21 hours	20	1·15	1,349	324	201
23 hours	23	1·175	595	390	224
24 hours	26	1·20	Not counted	400	Not counted

CONCLUSIONS

(1) Further experiments that we have carried out would indicate that time was also an important factor as well as concentration of the salt solution on the relative number of eggs that float to the surface.

(2) Twenty per cent solution of salt of specific gravity of 1·15 is suitable for a routine examination of feces for hook worm eggs, lung worm eggs and round worm eggs.

(3) The examination can satisfactorily be made in one half pint milk bottles, using samples of feces of between one and two ounces in weight.

(4) The expense of the material used is negligible.

(5) The solutions, after being mixed, should be allowed to stand from sixteen to twenty-four hours before being examined.

PHYSIOLOGICAL EFFECT OF VERMICIDES

This investigation was undertaken to obtain definite information on the following factors:—

(1) The effect of the vermicide on the alimentary tract.

(2) Whether it would be more beneficial to feed immediately after the administration of the vermicide or to postpone the feeding.

(3) If different media would have a beneficial effect when administered at the same time as the vermicide.

(4) If the injurious effect of the vermicide could be counteracted by feeding some constituents for a given period before the vermicides were administered.

In this experimental work, unless otherwise stated, the foxes were fasted for 24 hours before the administering of the vermicide, that is to say, the foxes were fed the morning meal on the previous day, the evening meal was eliminated and the following morning the vermicide was administered. The foxes were killed on the third day after administration of the vermicide. Experimental work has already been reported on carbon tetrachloride. As it has been found that tetrachlorethylene, from a practical standpoint, was safer, more efficient and less injurious, the experimental work was confined mostly to this compound. The tetrachlorethylene used in this work was supplied by Parke Davis & Co. of Walkerville, Ont., through their local agents, in one cc (16 mm) capsules. The capsules are distributed by this firm under the trade name of "Nema Capsules".

TABLE 23—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED EIGHT HOURS AFTER THE ADMINISTRATION OF VEXMICIDE

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
166	13D	1 cc. tetracalorethylene.....	Slight	None	Slight in jejunum only
167	9E	1 cc. tetrachlorethylene.....	Slight	Slight	None
170	4F	2 cc. tetrachlorethylene.....	Dull red	Bright red	Roseate throughout

TABLE 24—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED ONE HOUR AFTER THE ADMINISTRATION OF VERMICIDE

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
175	11C	2 cc. tetrachlorethylene.....	Very slight	Slight	None
177	24F	2 cc. tetrachlorethylene.....	Slight	Slight	Pink throughout

TABLE 25—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED EIGHT HOURS AFTER THE ADMINISTRATION OF VERMICIDE WITH CASTOR OIL

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
161	43C	1 cc. tetrachlorethylene plus 15 cc. castor oil.	None	Slight	Slight
165	15D	1 cc. tetrachlorethylene plus 15 cc. castor oil.	Dull red	Bright red	Red throughout
168	26E	1 cc. tetrachlorethylene plus 15 cc. castor oil.	None	Bright	Dull red
171	5F	2 cc. tetrachlorethylene plus 50 cc. castor oil.	Dull red	Bright red	Roseate throughout

TABLE 26—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED ONE HOUR AFTER THE ADMINISTRATION OF VERMICIDE WITH CASTOR OIL

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
173	20D	2 cc. tetrachlorethylene plus 50 cc. castor oil.	Dull red	Roseate	Roseate
178	25F	2 cc. tetrachlorethylene plus 50 cc. castor oil.	Dull red	Roseate	Roseate

TABLE 27—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED EIGHT HOURS AFTER THE ADMINISTRATION OF VERMICIDE WITH PARAFFIN OIL

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
162	13	1 cc. tetrachlorethylene plus 15 cc. paraffin oil.	Dull red	None	None
164	6E	1 cc. tetrachlorethylene plus 15 cc. paraffin oil.	Dull red	Red	Slight
169	39E	1 cc. tetrachlorethylene plus 15 cc. paraffin oil.	Bright red	Dull red	Dull red
172	6F	2 cc. tetrachlorethylene.....	Slight	Bright red	Roseate throughout

TABLE 28—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED ONE HOUR AFTER THE ADMINISTRATION OF VERMICIDE WITH PARAFFIN OIL

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
174	12E	2 cc. tetrachlorethylene plus 50 cc. paraffin oil.	Slight	Roseate	Roseate
179	26F	2 cc. tetrachlorethylene plus 50 cc. paraffin oil.	Streaked	Streaked	Streaked

TABLE 29—CONTROL EXPERIMENTS ON THE EFFECT OF THE MEDIA

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
186	36F	50 cc. castor oil.....	Slight	Slight	Slight
187	37F	50 cc. paraffin oil.....	None	None	None

TABLE 30—BONE MEAL FED FOR SIX DAYS PREVIOUS TO ADMINISTRATION—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED ONE HOUR AFTER THE ADMINISTRATION OF VERMICIDE

P.M. No.	Fox No.	Dosage	Condition of the Alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
183	44F	2 cc. tetrachlorethylene.....	Dull red throughout	Slight	Slight
184	45F	2 cc. tetrachlorethylene plus 50 cc. castor oil.	Dull red throughout	Roseate	Slight throughout
185	46F	2 cc. tetrachlorethylene plus 50 cc. paraffin oil.	None	Streaked	Pink in jejunum only
188	23F	1 cc. tetrachlorethylene.....	Dull red	Streaked	Pink throughout
189	57F	1 cc. tetrachlorethylene.....	None	Slight	Slight
190	58F	1 cc. tetrachlorethylene.....	None	Slight	None

TABLE 31.—COD LIVER OIL FED FOR SIX DAYS PREVIOUS TO ADMINISTRATION—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED ONE HOUR AFTER THE ADMINISTRATION OF VERMICIDE

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
191	35F	1 cc. tetrachlorethylene	Dull red in small area	Dark red streaks	None
192	52F	1 cc. tetrachlorethylene	Slight	Roseate streaks	Slight

TABLE 32—BONE MEAL FED FOR SIX DAYS PREVIOUS TO ADMINISTRATION—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED ONE HOUR AFTER ADMINISTRATION OF VERMICIDE

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
196	14E	1 gram colloidal iodine	Dull red	Slight	None
197	14B	1 gram colloidal iodine	Slight	Slight	None
198	24E	1 gram colloidal iodine plus 25 cc. paraffin oil.	Slight	Slight	Slight

TABLE 33—COD LIVER OIL FED FOR SIX DAYS PREVIOUS TO ADMINISTRATION—FOXES FASTED TWENTY-FOUR HOURS BEFORE AND FED ONE HOUR AFTER THE ADMINISTRATION OF VERMICIDE

P.M. No.	Fox No.	Dosage	Condition of the alimentary tract		
			Stomach	Duodenum	Intestines
			Inflammation present	Inflammation present	Inflammation present
193	33F	1 gram colloidal iodine	Slight	Roseate	Slight in jejunum.
194	51F	1 gram colloidal iodine	Slight	Superficial	Slight in jejunum
195	10F	1 gram colloidal iodine plus 25 cc. paraffin oil.	None	Roseate streaks	None

It will be seen from table 23 that when 1 cc tetrachlorethylene was administered and the foxes fed eight hours after the administration, there was only very slight inflammation which was of a superficial character and would probably not have an injurious effect on the foxes. On the other hand, when the dosage was increased to 2 cc there was a very pronounced inflammation throughout the alimentary tract.

From table 24 it will be observed that when the foxes were fed one hour after the administration, there was a marked reduction in the inflammatory conditions.

When castor oil was administered at the same time as tetrachlorethylene, there was a pronounced increase in the degree and extent of the inflammation of the alimentary tract, the inflammation being more pronounced in the duodenum and intestines, and still more pronounced when the amount of castor oil was increased from 15 cc to 50 cc.

When paraffin oil was administered with tetrachlorethylene the inflammation was much less pronounced than in the case with castor oil. On the other hand,

while there was very little difference between the conditions with paraffin oil and with those when tetrachlorethylene was administered by itself, the results would indicate that there is not much, if any, benefit in using the paraffin oil when administering this vermicide.

Control experiments were carried out administering the castor oil and paraffin oil as will be seen from table 29. While paraffin oil did not have any inflammatory effect on the alimentary canal, there was a decided inflammatory condition after administering castor oil, which is in accordance with our previous experience. This experimental work together with our previous experience, would indicate that it is not advisable to administer castor oil at the same time as tetrachlorethylene.

When cod liver oil was fed previous to the administration it will be seen from table 31 that there was a pronounced increase of the inflammatory condition in the duodenum, and it would appear that cod liver oil had a similar effect as castor oil and, therefore, any benefit that might be obtained from the use of cod liver oil could not be expected when the cod liver oil is fed before the administration. On the other hand, other results we have obtained would indicate that there might be an advantage in feeding the cod liver oil after the administration for a period of ten days.

When bone meal was fed before the administration, there was a slight improvement in the general condition of the alimentary canal. It will also be seen from table 32 that when colloidal iodine was administered and bone meal was fed previous to the administration, the results were more favourable than when cod liver oil was fed.

In all cases where tetrachlorethylene was administered post mortem examination failed to reveal the presence of any worms. This confirms our previous experience with this vermicide and would indicate that it was practically one hundred per cent efficient.

RECOMMENDATIONS

The results of this experimental work indicate that tetrachlorethylene can safely be used as a vermicide for silver foxes, when proper precautions are taken. We would recommend that the foxes should be fasted for 24 hours previous to the administration and that not more than one cc (16 cm) should be administered at one time. As there does not appear to be any advantage in using castor oil or paraffin oil, the tetrachlorethylene should be administered by itself. We would also recommend that the foxes should be fed one or two hours after tetrachlorethylene has been administered and that it would be advisable that the diet should contain a certain amount of ground green bone or bone meal for at least one week before the administration. In fact it has always been our recommendation that bone meal should be included in the daily ration of silver foxes throughout the year.

CONTROL OF LUNG WORM INFESTATION

During the seasons 1926 and 1927 a certain number of the pups at this Ranch became infested with lung worms, more particularly between two and five months of age. These pups were kept in pens with soil bottoms. We have observed in visiting ranches in different parts of the Dominion that the ranches on light sandy or gravel soil were very rarely troubled with lung worm infestation. On the other hand, in ranches on heavy clay soil, lung worm infestation was very common. The soil at the Experimental Fox Ranch is of a heavy clay nature and experiments were under taken to ascertain to what extent impervious floors would control lung worm infestation.

Ten pens with wooden floors were constructed in August, 1928; the floors were made from 1¼-inch tongued and grooved spruce and were raised one to two

feet from the ground, each floor having an area of seventeen feet by nine feet. The timber was laid as closely as possible and was well saturated with oil two or three times before being used. Two sections of the Hall Redi-Made Pens were used for the upper part of the pens. These sections were clamped on the board floors with iron ells, which raised the frame of the pen about one-half an inch from the floors.

Fourteen pups, the majority being known to be infested with lung worms, were placed in these pens the first week of September. In table 34 is given the extent to which the respiration was affected, that is to say where there was absence of a slight or a pronounced wheeze. In the readings XX stands for a pronounced wheeze; X a slight wheeze and—no audible abnormality in the respiratory organs. At first the readings were taken with a stethescope, but it was found that by placing the ear against the chest that the readings could be taken just as well as with a stethescope.

TABLE 34—SOUNDINGS OF PUPS FOR 1928

1928, week ending	4F	18F	19F	20F	23F	30F	31F	48F	55F	57F	58F	59F	60F	61F
June 30			X	X										
July 7			X	X	X			X		X	X	X	X	X
14			X	X	X			X		X	X	X	X	X
21			X	X	X			X		X	X	X	X	X
28		X	X	X	X			X		XX	XX	XX	XX	XX
Aug. 4		X	XX	XX	XX			XX	X	XX	XX	XX	XX	XX
11		X	XX	XX	XX			XX	X	XX	XX	XX	XX	XX
18		XX	XX	XX	XX			XX	XX	XX	XX	X	XX	XX
25		XX	XX	XX	XX			XX	XX	X	XX	X		X
Sept. 1		XX	XX	XX	XX			XX	XX	X	XX	X		X
Foxes placed on board floors during this interval.														
8		XX	XX	X	XX			XX	X	XX	X			
15		XX	XX		XX				XX					
22		XX	XX	X	XX	XX		XX	XX	X	X	X		
29		XX	X	XX	XX	XX	XX	XX	XX	X	X	X	X	
Oct. 6		X	X	XX	X	X	XX	XX	XX	XX	X			
22				X	X	X	X	XX		X	X	X		
29					X	X		XX						
Nov. 6					X	XX		XX		X				
13				X				XX			X			
19				X	X	X		XX			X			
26						X		XX						
Dec. 3				X	X			XX						
11				X				XX						
17				X			X	X						
Jan. 9				X				XX						
17				X				XX						
23								XX						
Feb. 6								XX						
20								XX						
Mar. 13								XX						

It will be seen from the readings in table 34 that the majority of the foxes lost the wheeze within two months after being placed on the board floors and the respiration of all the foxes became normal with one exception after being on the board floors for four months.

Fox 4F was one that did not show any respiratory trouble during its life time. He was placed in pens with board floors with 23F and 48F, both of which showed a pronounced wheeze. The following foxes were pelted at the end of December: 4F, 23F, 57F, 58F. In the post mortem examination of these foxes five to eight lung worms were found in each case, but the lung tissues appeared to be in a normal condition. We have since made post mortem examinations of

foxes that have been on board floors for twelve months and in those cases the post mortem examination did not show the presence of any lung worms.

Up to the present time beneficial results with placing foxes on board floors, have only been obtained when this has been done during the warm months. In table 35 are given the readings of fox pups that had a pronounced wheeze which were placed on board floors during the fourth week of September. It will be seen from these readings that there was practically no improvement in the respiratory trouble. 52F was pelted on January 13 and the post mortem examination showed that the fox was infested with a multitude of lung worms.

TABLE 35—SOUNDINGS OF PUPS PLACED ON BOARD FLOORS IN SEPTEMBER

1928, week ending	40F	42F	41F	52F	53F
June 30					
July 7					
14					X
21					
28					
Aug. 4			X		
11					
18					
25				X	
Sept. 1	XX		X	XX	
8	XX		XX	XX	
15			X		
22	XX	X	XX	X	
Foxes placed on board floor during this interval.					
29	XX		XX	XX	XX
Oct. 6	XX	XX	XX	XX	XX
22	XX	XX	XX	XX	X
29	X	X	XX	XX	XX
Nov. 6	XX	X	XX	XX	XX
13	X	XX		XX	XX
19	X	XX		XX	XX
26	XX	XX		XX	XX
Dec. 3	XX	XX	XX	XX	XX
11	XX	XX	X	XX	XX
17	XX	XX		XX	XX
Jan. 9	XX	XX			XX
17	XX	XX			XX
23	X	XX			X
Feb. 6	XX	X			XX
10	X	X			
Mar. 13	XX	X			

During the seasons 1929 and 1930 over seventy-five pups were raised to maturity each year on board floors. None of these pups, as long as they were on the board floors, showed any signs of a wheeze or any respiratory trouble whatever, and with the pups that were pelted directly from the board floors, the post mortem examination failed to reveal the presence of any lung worms in the trachea or the bronchial tubes.

RECOMMENDATIONS

In fox ranches on heavy clay soil, we would recommend that the foxes be placed on board floors before they are five weeks old, and that they should be kept on these board floors until growth has been completed. It is most advisable and necessary that the floors should be raised about two feet from the ground, that they should be well saturated with a light fuel oil, and every precaution should be taken to counteract external parasitic infestation which is liable to occur in the dry places of the ranch and more particularly in pens with wooden floors, and the fox pups should be treated at least once a month, both for ear mites with glycerine and iodine solution and for fleas with some efficient flea powder, such as Buhach, Pulvex, Gallant's, etc.

CONTROL OF BLADDER WORM INFESTATION

From a breeding standpoint, bladder worm infestation is one of the most insidious conditions with which fox breeders have to contend. When the bladder of the female fox becomes heavily infested with these worms, a very pronounced inflammatory condition arises, which spreads to all of the sexual organs and results in a marked swelling of the vulva, which can be readily observed. These worms also cause a pronounced haemorrhage from the walls of the bladder and blood is freely passed in the urine, and, with the female foxes, the vulva becomes incrustated with blood.

While a pronounced worm infestation can be readily detected in the female foxes, it is not so easy to detect in a male fox. Up to the present time, while the male fox is still alive, we have not yet been able to observe any marked effect on the sexual organs although the males have been observed to pass bloody urine from time to time. When the bladder worm infestation occurs during the breeding season, while the majority of the females come in heat and mate, the greater number of these fail to become pregnant. Undoubtedly, the infestation of the bladder not only causes a pronounced swelling of the vulva, but affects the sexual organs as a whole, and undermines the breeding qualities of the fox.

TABLE 36—VULVA READINGS OF FEMALES INFESTED WITH BLADDER WORMS

Date	Condition	31E	40E	12G	19G	20G	70G	71G	72G	73G	74G
June 25..	Vulva swollen	Not	0	XX	?	0	X	X	XX	XXX	X
	Blood present	Obs.	0	?	0	0	X	X	XX	XXX	X
July 2..	Vulva swollen	0	0	XX	XX	0	?	X	X	XX	0
	Blood present	0	0	X	X	0	?	X	X	XX	0
16..	Vulva swollen	0	X	X	X	X	?	XXX	XX	XX	X
	Blood present	0	X	X	X	X	?	0	X	X	X
30..	Vulva swollen	X	X	X	X	0	X	XX	XX	X	X
	Blood present	X	X	X	X	X	X	0	X	X	X
Aug. 6..	Vulva Swollen	X	X	XX	0	X	X	XXXX	X	X	0
	Blood present	X	X	?	0	X	X	X	X	X	0
	Foxes placed in pens with board floors during this interval.										
13..	Vulva swollen	0	X	X	X	0	0	XX	X	0	0
	Blood present	X	X	0	0	0	0	0	X	0	0
20..	Vulva swollen	0	0	0	X	0	0	X	0	X	0
	Blood present	0	0	0	X	0	0	0	0	0	0
27..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	0	0	0	?	0	0
Sept. 3..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	?	0	0	X	0	0
10..	Vulva swollen	0	0	0	0	0	0	X	?	0	0
	Blood present	0	0	0	0	0	0	XX	?	0	0
17..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	0	0	0	0	0	0
24..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	0	0	0	0	0	0
Oct. 1..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	0	0	0	0	0	0
8..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	0	0	0	0	0	0
15..	Vulva swollen	0	0	0	0	0	0	X	0	0	0
	Blood present	0	0	0	0	0	0	X	0	0	0
29..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	0	0	0	0	0	0
Nov. 6..	Vulva swollen	0	0	0	0	0	0	0	0	0	0
	Blood present	0	0	0	0	0	0	0	0	0	0
Dec. 6..	Vulva swollen	.....	.....	.....	.....	0	.....	.....	.....	.....	.....
	Blood present	.....	.....	.....	.....	0	.....	.....	.....	.....	.....
18..	Vulva swollen	0	0	0	0	.....	0	0	.....	.....	Not
	Blood present	0	0	0	0	.....	0	0	.....	.....	obs.
Jan. 9..	Vulva swollen	0	0	0	0	.....	0	.....	.....	.....	Not
	Blood present	0	0	0	0	.....	0	.....	.....	.....	obs.

In table 36 are given the readings of the vulvae of ten females that showed a marked swelling, and the blood being incrustated on them. XXX, XX and X denote the relative swelling of the vulva, and also the relative amount of blood that was incrustated on it, and was being passed at that time. It will be observed that these foxes were in pens with soil bottoms. It will be noticed that after they were placed on the board floors, there was a marked improvement in the condition of the vulva; and while the condition appeared to clear up, as far as could be observed with the live foxes, four of the females were pelted at the end of the year, and the post-mortem examination showed that there were some bladder worms present. It may be mentioned here that in the pups that were raised from these females that were kept on board floors, the vulvae of the female pups remained normal throughout their history, and with those that were pelted, the post-mortem examination showed that there was an absence of bladder worms.

RECOMMENDATIONS

(1) It is advisable that the vulvae of all the foxes in the ranch should be examined two or three times each year, during the summer months, to ascertain if there is any swelling and if blood should be incrustating on them.

(2) Such females as show any swelling of the vulva, and also have blood incrustating on the vulva, should be placed on board floors.

(3) Any male foxes that are observed passing blood in the urine should be placed on board floors.

PHYSIOLOGICAL EFFECT OF APHRODISIACS—YOHIMBINE HYDROCHLORIDE

Case No. 1, Female 14.—Born in 1921 and raised a litter of four pups in 1922. During the next three years there was no evidence that she had become pregnant or had given birth to pups, although she came in heat in each of the three seasons and was seen to mate in two of them. In 1926 this female was given $\frac{1}{26}$ grain of Yohimbine Hydrochloride daily for a period of ten days, from January 19 to January 29. She mated February 19 and whelped on April 13, giving birth to four males, all of which were raised to maturity and have proven consistent breeders, as shown by the following record:—

23D.—In 1927 sired a litter of five, but as he was a black fox, he was not used any further for breeding purposes.

25D.—In 1927 did not mate with any female, but in 1928 sired three litters.

27D.—In 1927 sired a litter and one in 1928.

29D.—Was by far the best of the males both in fur qualities and conformation. In 1927 sired one litter, in 1928 four litters, in 1929 four litters and in 1930 five litters.

None of these males were given any Yohimbine at any time in their history.

Female 14, in 1927 and 1928, was not given any Yohimbine Hydrochloride. In 1927 she gave birth to only one pup. In 1928 she mated and did not become pregnant. In 1929 she was given $\frac{1}{26}$ grain of Yohimbine Hydrochloride daily from January 11 to January 30. She mated on February 27 and whelped on April 20, giving birth to five pups, all of which were raised to maturity and were well furred foxes. In 1930 this female was again given Yohimbine Hydrochloride as previously and produced four pups.

Case No. 2, Male 9C.—Born in 1925 and was placed in a pen with a female during the breeding season of 1926 but there was no evidence that the female came in heat. This male in 1927 and 1928 was placed in pens at different times with four or five females each year that were known to be in heat, but he was

entirely indifferent and did not make any attempt to mate with them. This male in 1929 was given 1/26 grain Yohimbine Hydrochloride daily for a period of twenty days, from January 11 to January 30. He mated with three females on March 6, 9 and 18 respectively. He had no difficulty in mating with the females and locked with them within a few minutes after being placed in the pen. All of these three females produced litters, two of which raised all their pups to maturity. In 1930 this male was not given any Yohimbine Hydrochloride and he mated with two females, both of which produced and raised litters.

During the early part of the breeding season of 1926 there were a number of females which were not considered to be in a good condition. While some of them had made a favourable gain in weight, the majority of them were light in weight. Yohimbine was given to these females. Those females that had made a favourable gain in weight came in heat, mated and produced pups, but with those females that were light in weight there was no evidence whatever of them even coming in heat. In 1929 twenty females, some of which were on the border line between poor and good condition and others that were pronouncedly under condition, were given 1/26 grain of Yohimbine Hydrochloride daily for a period of twenty days; twelve of these produced and raised litters but all of these were considered as border line foxes, and not in really poor condition; seven of the other eight females that did not produce litters were notoriously out of condition and under weight.

Seven female pups, which had been heavily infested with lung worms during the period of their growth were each given 1/26 grain of Yohimbine Hydrochloride daily for a period of twenty days; three of these raised litters, the other four that did not raise pups had a very pronounced wheeze throughout the breeding season.

During different breeding seasons Yohimbine Hydrochloride was given after the first of March to females that had not shown any evidence of coming in heat. There was not a single case where any of those ever came in heat or produced pups. Up to the present time there have been no beneficial results obtained except in giving Yohimbine early in the breeding season.

The evidence that we have obtained up to the present time would indicate that the proper feeding of the foxes is the best aphrodisiac, and if the females have been properly fed and are in good condition, they will readily come in heat. At the same time the evidence that we have obtained would indicate that under certain conditions, with foxes that are on the border line of good and poor conditions, beneficial results can be obtained by a proper administration of Yohimbine. But on the other hand, if the foxes are in poor condition, it is absolutely useless to obtain or expect any results from feeding Yohimbine or any other specific aphrodisiac.

The Yohimbine Hydrochloride used in this experimental work was obtained from Merck & Co., Ltd., 412 St. Sulpice St., Montreal, P.Q., in the form of tablets put up in tubes, each tube containing ten tablets, each tablet containing 1/13 grain Yohimbine Hydrochloride. One half of each tablet was given to the respective foxes daily, the tablet being powdered and sprinkled on the meat that was being fed.

POLYGAMOUS MATING

For a number of years practically all the breeding at the Experimental Fox Ranch has been carried out by polygamous mating. It may help a large number of breeders, especially those who have only had a few years' experience, to give particulars regarding the manner in which the mating has been carried out, at the same time to give fox breeders in general the benefit of the experience gained after several years of polygamous mating.

In the first place, the select and first class males in the ranch can be used to the maximum extent. Also as to a great extent the fox that will act as a polygamous male has a good constitutional vigour and, therefore, there will be a greater percentage of stronger and more vigorous pups. Experience has demonstrated very conclusively that polygamous mating, when properly carried out is less burdensome and has less strain on those in charge of the foxes. Every season in the average ranch there are a number of females that either do not come in heat or do not mate until late in the season. A great percentage of those females probably will not come in heat so that in practically all ranches where the foxes are ranched in pairs the breeders are giving their thought and attention to non-producing foxes and to that extent the producing foxes are failing to have their proper attention. When foxes are left in pairs a large percentage of the matings are not observed and it is a common error to surmise that the females may be pregnant by their size, when the apparent size may be entirely due to depth of fur. As there is no progressive development in the size of the fox that is not pregnant, a query arises in the mind of the breeders and like every other unanswerable query, these cases occupy the thought and attention of the breeders. It is no " child's play " to take charge of fox ranches during the breeding season, as there are so many incidents that tax the resources of the most experienced breeders. When the facts are known with any amount of certainty, there is less strain on the breeders, but it is the uncertainties that harass the mind. In table 37 are given the data showing how the matings are carried out at the Experimenal Fox Ranch.

TABLE 37—PARTICULARS OF DAILY MATINGS—MOVEMENT FROM PEN TO PEN

Male	Mondays, Wednesdays, Fridays A.M. Saturdays		Tuesdays, Thursdays, Fridays P.M. Sundays	
	1st period	2nd period	1st period	2nd period
75G	*DS 18 to 87*		*DS 18 to 88*	
47C	1M to 1	.....	1M to 2	1M to 2M
10G	12M to 12	.....	12M to 13	12M to 14
51C	3M to 3	.....	3M to 4	
5G	.....	.....	4M to 5	
59C	.....	.....	5M to 6	
4G	11M to 11	.....	.....	
48G	15M to 15	.....	15M to 16	
1D	22M to 22	.....	22M to 23	
5E	24M to 24	.....	24M to 25	
6G	.....	.....	25M to 26	
6C	31M to 31	.....	31M to 32	
31F	33M to 33	.....	33M to 34	33M to 34M
9G	.....	.....	35M to 36	
9C	41M to 41	.....	41M to 42	41M to 42M
1G	43M to 43	.....	43M to 44	
30F	.....	.....	45M to 46	
90F	51M to 51	.....	51M to 52	51M to 52M
5D	54M to 54	.....	54M to 55	
30G	.....	.....	55M to 56	
64G	61M to 61	.....	.....	
29D	62M to 62	*62M to 74*	62M to 63	*62M to 75*
11	64M to 64	*64M to 63M*	64M to 65	
35G	.....	.....	65M to 66	

It will be seen from this table that the females are divided into two general groups. The males run with the one group of females on Mondays, Wednesdays, Friday mornings and Saturdays, and with the other group on Tuesdays, Thursdays, Friday afternoons and Sundays, so that each female in the ranch has a male running with her four times each week. The males are placed with the female one hour after they are fed in the morning and they are left with the female for about one hour during which period the foxes are kept under observa-

tion. In cases where the males are running with more than one female on the same day, the males are removed to another pen for one hour.

In the Experimental Fox Ranch the pens occupied by the males are connected with the female pens with a chute. It has been found more convenient to have these chutes at the back of the pen and not at the front. In cases where the chutes are at the front of the pens, when the chute is open, a certain number of foxes remain at the back of the pen and it is necessary to go into the pen to make the male jump through. Where the chutes are at the back of the pen, when the person walks to the back of the pen the males come forward. If the slide is open, if the person walks a few paces forward the male goes to the back of the pen and jumps through the chute without it being necessary for the person to go into the pen. The slide is placed into the chute as soon as the fox has passed through. Also before the males are placed in the female pens, a slide is placed in the chute of the female kennel. This makes it easier for the male to return to his own pen, as they are very liable to run into the female kennel if they are left open. In tables 38, 39 and 40 are given the breeding records of three different males. Space will not permit the complete record, although we have other foxes that have mated with four and five females in one single year.

TABLE 38—BREEDING RECORD OF 29D

Females mated in the year 1928 and Particulars of their progeny.

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 22....	Research Lady 14D.....	65	M.S.	100963	GRS 14D..	2	3	5
23....	113C.....	34	M.S.	139953	113C	2	0	2
Mar. 18....	Research Lady 16D.....	64	P.S.	100965	GRS 16D	2	2	4
April 1....	232C.....	44	M.S.	36103	232C	1	4	5

Females mated in the year 1929 and particulars of their progeny

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 14....	Research Lady 60F.....	75	P.S.	175645	GRS 60F	3	2	5
20....	Research Lady 59F.....	74	P.S.	175644	GRS 59F	1	2	3
21....	Research Lady 41E.....	52	M.S.	139029	GRS 41E	0	3	3
27....	Research Lady 8E.....	11	D.S.	138998	GRS 8E	.....	.....	.....
Mar. 6....	Research Lady 61F.....	76	M.S.	100974	GRS 61F	2	2	4

Females mated in the year 1930 and particulars of their progeny

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 16....	Research Lady 60F.....	75	P.S.	175645	GRS 60F	3	1	4
23....	Research Lady 7E.....	33	M.S.	138997	GRS 7E	1	1	2
27....	Research Lady 31E.....	63	M.S.	139020	GRS 31E	2	2	4
28....	Research Lady 30E.....	62	M.S.	139019	GRS 30E	2	3	5
Mar. 1....	Research Lady 59F.....	74	P.S.	175644	GRS 59F	6	0	6

TABLE 39—BREEDING RECORD OF 5E

Females mated in the year 1929 and particulars of their progeny

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 15....	Research Lady 22D.....	Ex. 2	D.S.	100970	GRS 22D	.....	.....	.....
22....	Research Lady 42E.....	25	Ex. D.	139030	GRS 42E	3	0	3
Mar. 14....	Research Lady 15E.....	55	M.S.	139005	GRS 15E	3	2	5
21....	Research Lady 16E.....	55M	M.S.	139006	GRS 16E	2	0	2

Females mated in the year 1930 and particulars of their progeny.

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 11....	Research Lady 42E.....	25	Ex. D.	139030	GRS 42E	1	2	3
13....	Research Lady 40E.....	24	M.S.	139028	GRS 40E	5	0	5
Mar. 13....	Research Lady 22E.....	23	P.S.	139011	GRS 22E	.....	.....	.....
25....	Research Lady 37G.....	36	D.S.	263608	GRS 37G	4	0	4

TABLE 40—BREEDING RECORD OF 47C

Females mated in the year 1928 and particulars of their progeny

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 14....	33A.....	53	D.S.	11297	33A	0	2	2
Mar. 8....	Research Lady 32E.....	54	P.S.	139021	GRS 32E	3	2	5

Females mated in the year 1929 and particulars of their progeny

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 27....	Research Lady 31E.....	63	M.S.	139020	GRS 31E	0	3	3
Mar. 13....	33A.....	53	D.S.	11297	33A	2	2	4

Females mated in the year 1930 and particulars of their progeny

Date	Name	Pen No.	Colour	Registration No.	Tattoo No.	Male	Female	Total
Feb. 10....	Research Lady 10D.....	1	M.S.	100959	GRS 10D	1	1	2
11....	Research Lady 22A.....	2	M.S.	69952	GRS 22A	4	1	5
13....	Research Lady 13E.....	14	M.S.	139003	GRS 13E	.....	.....	.....
17....	Research Lady 52D.....	13	M.S.	100979	GRS 52D	.....	.....	.....
20....	33A	53	D.S.	11297	33A	2	0	2

RECOMMENDATIONS

(1) The chute between the male and female pen should be placed at the back of the pen, preferably two or three feet from the ground and the female should not be allowed to go into the male pen.

(2) Males that are intended to be used for polygamous mating should not be wedded to one female and preferably should be kept in pens by themselves throughout the entire season. It is absolutely necessary that they should be in pens separated from any females for at least one month before the breeding season.

(3) When the females are being mated to males that have not been running with them, they should not be placed in pens where the males have been running with other females. The males will look upon such females as intruders and may attack them. On the other hand, the majority of males will readily mate with females if they are taken to the females' pens.

(4) It should not be assumed that females are in heat by the action of the females themselves. Many females will stand with their tails up two or three days before they actually come in heat. As far as our experience goes, the only actual way to tell that a female is in heat is by the actions of the males only that have been running with them. When males have been running with the females continually they will not mount the females until they are actually in heat. On the other hand, if a strange male is placed in the pen he will mate with her if she will stand whether she is actually in heat or otherwise.

(5) When using another male to mate with the females and not the male that has been running with them, it is not advisable, though it should be thought that the female is in heat, to place the male that is intended to mate with her in a pen until the male that has been running with her has actually started to mount her.

(6) When placing males in strange pens, it is advisable to shut the females inside the kennel until the males have become familiar with the pens.

(7) Only vigorous males should be allowed to run with the females and as it is not convenient to have a separate suitable mating pen for each male, it is advisable to carry the male to the female pen.

(8) An aged male used for polygamous mating should be kept in a pen by himself and should not be allowed to run with any female. The females should be brought to his pen when they are actually in heat and ready to mate.

(9) It is not advisable to attempt to mate foxes in adjacent pens that have not been running with each other. There is liable to be an antagonism develop between foxes in adjacent pens whether they are males or females.

(10) We do not recommend small fox breeders to mate a large number of females with a small number of males unless there is a reserve supply of males. For ten females it is necessary to have at least six or seven males and on the average it is always necessary to have at least one male for every two females, even though a large percentage of the males mate with three or four females. During these last three years in the Experimental Fox Ranch seventy per cent of the matings have been by males that have mated on the average with four females a year. Yet with keeping one male for every two females it has taxed our resources to properly mate the females that come in heat late in the year. From our experience, it is easier, and more successful results are obtained by mating a male with four females four days in succession, than mating a male with four females during a period of two months. It would be, therefore, a good policy for the fox breeders to mate up

the polygamous males that they have used at the beginning of the season with as many females as possible early in the season and to keep some males in reserve for use only during the latter part of the breeding season.

TEMPERATURE OF FOX NESTS

The proper construction of nests and kennels has been a question to which we have given a great deal of thought and attention. Unfortunately, the general type of kennels and nests that are in use throughout the fox industry do not duplicate the conditions of a burrow in the ground, as they are too susceptible to the variation in temperature of the outside climatic conditions. It has been our policy to take the maximum and minimum temperature readings of a certain number of the different types of fox pens for these last three seasons. In Table No. 41 are given the maximum and minimum temperatures of three different types of nests together with the outside temperature taken during the breeding season of 1928.

TABLE 41.—MAXIMUM AND MINIMUM TEMPERATURE OF DIFFERENT TYPES OF NESTS—Breeding Season 1928

Date	Outside in shade	Single walled	Single walled	Barrel	Barrel	Barrel	Double walled	Double walled	Double walled	Double walled	Double walled
	Female Pen	18 13	10D 1	33A 53	22A 2	14D 65	4D 14	13E 25	113C 34	42E 44	41E 52
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
April 14	Max. 46	62	.....	60	.....	.....	62	.....	.....	.....	.....
	Min. 29	40	.....	40	.....	.....	46	.....	.....	.....	.....
" 16	Max. 53	70	.....	68	.....	.....	70	.....	.....	.....	.....
	Min. 24	36	.....	36	.....	.....	40	.....	.....	.....	.....
" 17	Max. 33	56	.....	52	.....	.....	58	.....	.....	.....	.....
	Min. 23	34	.....	34	.....	.....	39	.....	.....	.....	.....
" 18	Max. 37	50	.....	48	.....	.....	54	.....	.....	.....	.....
	Min. 24	36	.....	36	.....	.....	40	.....	.....	.....	.....
" 19	Max. 41	54	.....	54	.....	.....	59	.....	.....	.....	.....
	Min. 27	38	.....	36	.....	.....	40	.....	.....	.....	.....
" 20	Max. 38	60	.....	48	.....	.....	62	.....	.....	.....	.....
	Min. 23	38	.....	32	.....	.....	42	.....	.....	.....	.....
" 22	Max. Not observed	56	.....	52	.....	.....	62	.....	.....	.....	.....
	Min. Not observed	36	.....	36	.....	.....	41	.....	.....	.....	.....
" 23	Max. 49	68	.....	58	.....	.....	70	.....	.....	.....	.....
	Min. 25	42	.....	38	.....	.....	45	.....	.....	.....	.....
" 24	Max. 39	52	.....	.....	.....	.....	56	.....	.....	.....	.....
	Min. 30	42	.....	.....	.....	.....	46	.....	.....	.....	.....
" 25	Max. 41	60	60	56	64	.....	64	62	66	.....	.....
	Min. 29	42	42	36	46	.....	44	45	50	.....	.....
" 26	Max. 45	58	58	.....	64	.....	64	56	62	.....	.....
	Min. 29	44	42	.....	43	.....	48	46	52	.....	.....
" 28	Max. 51	62	66	60	74	68	62	70	64	68	69
	Min. 22	30	42	34	44	42	28	40	34	44	44
" 29	Max. 53	56	64	56	64	63	66	62	68	65	67
	Min. 35	40	46	42	51	50	38	48	42	49	50
" 30	Max. 59	66	72	64	77	70	72	70	74	72	72
	Min. 37	42	50	44	54	51	52	52	58	54	54
May 1	Max. 50	60	70	59	75	64	67	66	70	67	66
	Min. 38	42	50	44	56	52	51	52	58	55	54

" 2	Max. 61	70	76	67	78	72	74	72	72	74	73
	Min. 42	46	54	58	54	56	58	56	51	58	58
" 3	Max. 59	64	70	64	70	70	68	69	65	72	72
	Min. 32	38	46	40	48	49	38	49	44	53	50
" 4	Max. 40	50	58	52	59	57	52	58	52	62	60
	Min. 34	38	46	40	47	50	38	48	43	51	50
" 5	Max. 42	48	56	53	63	58	50	58	50	62	58
	Min. 30	34	44	43	48	46	36	48	39	50	48
" 6	Max. 52	67	72	68	77	70	68	70	69	74	72
	Min. 36	40	48	44	54	51	42	44	45	54	54
" 7	Max. 55	60	70	61	72	68	62	62	62	70	70
	Min. 34	40	48	44	54	51	42	44	45	53	54
" 8	Max. 50	64	69	64	75	68	64	64	64	71	70
	Min. 31	34	44	40	49	47	36	40	40	51	50
" 9	Max. 61	70	76	70	82	73	70	72	70	75	73
	Min. 36	40	50	44	54	44	42	44	45	55	54
" 10	Max. 64	72	78	70	82	71	.....	70	70	75	74
	Min. 38	44	53	46	56	48	48	48	48	56	59
" 11	Max. 66	74	80	74	83	73	78	72	75	77	79
	Min. 44	49	60	54	61	53	52	64	55	64	64
" 12	Max. 69	76	83	76	86	75	78	76	76	75	76
	Min. 41	46	55	50	60	50	48	50	52	58	50
" 13	Max. 48	60	60	59	64	56	60	56	69	68	63
	Min. 36	42	44	45	56	44	44	42	52	55	50
" 14	Max. 43	53	66	51	61	51	57	48	66	64	61
	Min. 31	46	52	40	49	40	46	37	52	52	50
" 15	Max. 43	52	54	52	58	53	58	47	60	59	59
	Min. 32	44	46	40	51	40	44	37	52	50	48
" 16	Max. 52	66	68	65	75	62	67	62	72	70	71
	Min. 30	44	44	38	50	40	38	36	53	50	51
" 17	Max. 57	72	74	69	80	68	72	68	77	69	70
	Min. 35	38	50	40	53	42	40	40	52	41	42
" 18	Max. 52	64	66	60	72	60	65	62	71	69	68
	Min. 38	44	56	48	54	48	46	46	57	41	52

Single walled nests referred to in the table were made from a single wall nest enclosed in a separate partition in the kennel. The barrels were also enclosed in a separate partition and sawdust placed on all sides around them except at the top so that the top of the barrel could be opened for observation and for taking the readings. The double walled nests were made with two separate boxes built one inside the other which left an air space of two inches on all sides. A small partition was built inside of the nests and the thermometers were placed at the back of this partition at a height of about six inches from the top of the nest. It will be noticed from the readings given in table 41 that there was a great fluctuation in the temperatures of the nests varying between twenty and thirty degrees. This we believe is greater than should be under natural conditions and does not duplicate the conditions of a burrow in the ground. In all of the cases referred to in table No. 41 the pups were raised to maturity and there were no fatalities during the nursing period that could be ascribed to the temperature of the nests.

In table No. 42 are given the temperatures of an unsatisfactory type of nest in which no insulation was used, it being simply a large nest placed inside the kennel.

TABLE 42—TEMPERATURES OF INFERIOR NESTS

Date	Outside temperature	60F No. 75 Large nest, single walled	42F No. 80 Large nest, single walled	18 No. 13 Small nest, single walled
	°F.	°F.	°F.	°F.
April 12	Max. 28	54	56	57
	Min. 17	25	28	22
13	Max. 27	50	53	46
	Min. 17	28	29	22
14	Max.	48	44	40
	Min.	34	32	32
15	Max. 30	50	52	46
	Min. 20	36	36	30
16	Max. 34	56	54	50
	Min. 24	32	32	28

Of the fourteen pups that were born in those nests, six were lost during the first and second weeks and the development of the survivors that were raised to maturity, from a fur standpoint, was the most unsatisfactory that we have had in the Experimental Fox Ranch.

It will be seen from the readings in table No. 41 that during the cold weather in April the temperature of the nest went down too low. Also during the latter part of the breeding season as the warm weather approached the temperature of the nest became too high. On May 11 and 12, when the maximum outside temperature went to sixty-six and sixty-nine degrees respectively, the maximum temperature of some of the nests was over eighty degrees. According to our observations when the maximum temperature of the nest is over seventy-five the pups became uncomfortably hot and invariably their growth is injured. It will be also observed that the temperature rose to a greater extent in the nests with the single walled partition than in those with double walled partitions.

RECOMMENDATIONS

(1) We recommend that all nests used should be made of a double wall, leaving an air space of at least two inches on all sides.

(2) The nest should be so constructed so that the temperature range would be between a maximum of sixty-five degrees and a minimum of forty-five degrees.

(3) The kennels should be so constructed that they may be properly ventilated so that the pups born late in the season will not be subject to too high a temperature.

TABLE 43—ANALYSIS OF VIXEN'S MILK

Fox No.	26	26	8
Days after parturition	28	35	28
	%	%	%
Total solids	22·81	20·94	18·02
Ash	1·204	0·942	0·919
Fat (ether extract)	12·03	10·9	7·91
Total N	1·466	1·325	1·114
Total protein (N x 6·38)	9·36	8·46	7·14

MAXIMUM AND MINIMUM TEMPERATURES AT THE RANCH

In table 44 are given the maximum and minimum temperature readings for the years 1929 and 1930 of thermometers in the shade, in the covered shed and exposed on the top of one of the pens.

These readings are self-explanatory, but it will be observed that in the covered shed the temperature did not go low as either of the thermometers outside during the winter months and the maximum temperatures in the covered shed were slightly higher than those in the shade outside, and the same is true with regard to the minimum temperatures during the summer months. It will be further noted that there was a difference of between fifteen to thirty degrees between the maximum temperature in the covered shed and exposed thermometers in the ranch during the summer months.

TABLE 44—MAXIMUM AND MINIMUM TEMPERATURES AT (IN DEGREES FAHRENHEIT) EXPERIMENTAL FOX RANCH, SUMMERSIDE

Date 1929	January						February					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	30	23	32	26	36	26
2	35	14	38	18	38	12	29	13	32	18	36	15
3	37	7	38	10	40	8	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	.....	.....	24	11	29	15	32	13
5	25	−7	28	−4	28	−7	18	1	23	6	30	0
6	.....	.....	.....	.....	.....	.....	33	9	.....	.....	.....	.....
7	45	−4	48	0	46	−2	32	8	34	9	40	7
8	26	−3	30	2	30	−4	35	17	38	16	40	22
9	10	−3	12	−2	14	−6	33	22	36	26	44	20
10	15	0	20	6	18	−2	.....	.....	.....	.....	.....	.....
11	33	1	34	9	37	8	34	11	34	16	.....	.....
12	20	6	27	13	28	1	20	6	28	12	.....	.....
13	.....	.....	.....	.....	.....	.....	30	−6	24	0	48	−5
14	.....	.....	.....	.....	.....	.....	8	−8	18	0	26	−12
15	23	−15	26	−12	26	−14	10	1	16	2	30	4
16	−2	−12	2	−10	3	−12	17	1	24	9	32	0
17	8	−5	14	−2	14	−12	.....	.....	.....	.....	.....	.....
18	33	−1	36	2	34	8	38	8	31	16	48	9
19	36	27	38	31	40	26	34	15	34	18	42	17
20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21	41	−1	44	4	45	0	22	−10	26	−2	33	−10
22	3	−1	10	2	8	0	16	2	18	0	24	14
23	13	3	20	6	24	4	28	2	28	8	38	6
24	14	5	18	8	23	5	17	3	26	2	32	3
25	21	2	26	12	28	6	.....	.....	.....	.....	.....	.....
26	19	11	28	13	32	8	19	1	30	6	26	4
27	.....	.....	.....	.....	.....	.....	18	6	28	9	42	6
28	20	11	24	15	29	13	30	14	30	18	.....	.....
29	28	13	30	16	32	18	.....	.....	.....	.....	.....	.....
20	31	27	34	30	37	28	.....	.....	.....	.....	.....	.....
31	31	21	34	26	36	22	.....	.....	.....	.....	.....	.....
Average	24	4	28	8	29	5	25	7	28	11	26	7

Date 1929	March						April					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	32	12	36	16	40	12	.....	.....	.....	.....	.....	.....
2	29	13	38	18	54	14	44	22	48	26	68	22
3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4	43	18	43	24	68	22	33	21	42	26	66	28
5	40	30	38	32	48	35	40	30	38	32	58	37
6	39	30	40	34	50	34	41	22	46	28	64	30
7	30	14	34	18	40	18	.....	.....	.....	.....	.....	.....
8	35	14	34	18	48	22	38	24	40	30	65	34
9	16	1	25	5	30	4	37	26	372	30	68	36
10	.....	.....	.....	.....	.....	.....	42	23	50	28	78	34
11	21	−1	30	4	34	−1	27	18	36	24	53	20
12	7	−7	20	−2	27	−8	38	17	40	24	58	20
13	29	8	32	8	44	15	27	17	36	22	56	28
14	24	2	32	8	44	4	.....	.....	.....	.....	.....	.....
15	31	13	38	16	68	22	30	20	40	26	56	30
16	45	20	32	22	53	31	34	23	46	30	58	26
17	.....	.....	.....	.....	.....	.....	43	31	46	32	74	42
18	44	10	34	17	52	18	42	34	44	36	62	46
19	29	14	33	19	46	21	44	32	44	35	63	42
20	38	28	41	26	54	36	43	29	42	32	58	40
21	43	29	44	32	58	34	.....	.....	.....	.....	.....	.....
22	38	29	44	32	60	36	39	22	48	28	66	28
23	39	20	46	26	61	20	34	26	38	30	58	38
24	.....	.....	.....	.....	.....	.....	34	26	44	30	56	34
25	32	11	32	16	.....	.....	44	27	50	32	70	34
26	35	24	34	22	56	14	52	37	50	36	74	48
27	40	22	42	28	56	28	50	33	50	38	72	42
28	32	17	42	23	52	17	.....	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	58	31	58	35	82	40
30	44	16	42	24	58	35	47	31	48	34	64	44
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	33	15	36	19	50	20	39	26	44	30	64	

TABLE 44—MAXIMUM AND MINIMUM TEMPERATURES AT (IN DEGREES FAHRENHEIT) EXPERIMENTAL FOX RANCH, SUMMERSIDE

Date 1929	May						June					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	41	30	40	34	60	42	50	37	60	44	84	54
2	47	38	46	40	66	48	.....	.....	.....	.....	.....	.....
3	58	37	60	42	86	49	.....	.....	.....	.....	.....	.....
4	61	37	60	40	82	48	57	35	64	40	94	48
5	.....	.....	.....	.....	.....	.....	62	40	64	46	100	52
6	60	34	58	38	80	46	66	46	68	50	108	60
7	57	38	56	41	82	47	63	48	60	52	90	64
8	45	37	46	40	62	50	70	45	68	48	95	60
9	50	32	50	36	76	42	.....	.....	.....	.....	.....	.....
10	49	28	46	34	76	36	74	43	70	48	116	56
11	55	34	54	42	86	42	71	46	68	50	100	60
12	.....	.....	.....	.....	.....	.....	76	50	74	54	116	66
13	66	38	66	42	94	50	79	43	76	50	110	62
14	48	30	50	32	78	42	49	43	52	48	76	62
15	52	35	52	40	86	50	63	44	66	50	100	58
16	49	35	48	38	69	46	.....	.....	.....	.....	.....	.....
17	60	37	60	40	83	50	77	53	76	58	110	70
18	55	36	58	40	78	50	81	49	82	54	116	62
19	.....	.....	.....	.....	.....	.....	59	39	64	42	104	52
20	46	27	57	32	76	44	58	40	66	47	88	52
21	48	35	56	36	88	49	65	35	56	40	92	48
22	48	32	44	36	68	46	68	49	72	52	102	64
23	48	33	50	38	80	43	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	78	56	80	58	108	76
25	60	35	62	40	85	48	76	61	72	66	103	80
26	.....	.....	.....	.....	.....	.....	83	60	80	62	116	80
27	58	36	66	40	93	45	76	53	76	56	106	70
28	63	44	60	48	88	58	77	46	70	50	114	62
29	74	46	77	51	116	60	77	54	109	73	74	56
30	72	38	72	44	122	54	.....	.....	.....	.....	.....	.....
31	48	36	50	42	86	52	.....	.....	.....	.....	.....	.....
Average	55	35	56	83	48	69	47	71	52	52	101	61

Date 1929	July						August					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	77	53	76	56	96	52
2	72	51	74	64	108	70	80	56	78	59	90	56
3	63	43	65	48	88	60	69	49	68	52	92	44
4	67	47	64	50	96	68	.....	.....	.....	.....	.....	.....
5	70	52	66	54	98	72	77	53	74	56	92	52
6	62	54	62	58	86	76	65	54	62	56	70	54
7	.....	.....	.....	.....	.....	.....	70	51	68	54	78	50
8	78	55	75	58	112	76	68	49	68	52	88	44
9	73	51	68	54	108	70	78	77	58	90	90	52
10	73	50	72	52	110	72	78	55	78	58	86	52
11	70	56	65	100	77	.....	.....	.....	.....	.....	.....	.....
12	76	73	73	56	108	74	82	57	82	60	96	54
13	82	56	80	58	118	78	75	60	73	63	94	58
14	.....	.....	.....	.....	.....	.....	74	59	76	64	100	55
15	77	48	74	52	110	70	85	59	80	62	102	56
16	72	55	72	58	118	76	79	63	78	66	92	60
17	84	58	82	60	126	80	79	51	78	52	92	46
18	84	56	80	60	120	80	.....	.....	.....	.....	.....	.....
19	78	57	76	60	112	80	78	55	74	58	94	52
20	80	43	75	58	114	80	69	59	70	54	88	50
21	.....	.....	.....	.....	.....	.....	62	47	64	50	80	42
22	76	47	73	50	112	68	64	46	66	50	84	41
23	84	56	81	60	124	80	69	46	72	48	100	40
24	76	57	74	58	108	80	76	57	70	60	86	56
25	67	51	72	54	112	74	.....	.....	.....	.....	.....	.....
26	72	51	72	55	118	70	70	54	72	56	84	50
27	77	56	75	60	114	80	79	56	76	60	90	56
28	.....	.....	.....	.....	.....	.....	76	56	78	60	84	54
29	78	59	74	61	94	56	72	50	71	54	80	46
30	76	57	74	60	80	56	69	46	66	50	86	40
31	82	54	80	56	106	48	.....	.....	.....	.....	.....	.....
Average	75	54	73	57	108	72	74	53	73	57	89	51

TABLE 44—MAXIMUM AND MINIMUM TEMPERATURES AT (IN DEGREES FAHRENHEIT) EXPERIMENTAL FOX RANCH, SUMMERSIDE

Date 1929	September						October					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	51	37	54	40	64	30
2	.....	.....	.....	.....	.....	.....	56	35	54	50	64	32
3	72	43	68	48	93	36	60	43	62	44	62	42
4	58	43	58	47	71	38	67	52	68	54	68	49
5	64	43	64	46	80	36	54	40	54	42	56	40
6	63	51	64	54	80	48	.....	.....	.....	.....	.....	.....
7	71	60	68	60	78	58	56	35	58	40	62	30
8	.....	.....	.....	.....	.....	.....	59	40	58	44	66	36
9	80	49	74	52	90	42	50	29	52	32	54	26
10	70	50	72	54	90	44	44	29	44	32	62	28
11	69	58	68	60	77	54	40	29	42	32	50	20
12	67	43	68	46	74	38	46	31	38	36	61	24
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	73	49	70	54	82	48	52	37	54	42	58	32
15	.....	.....	.....	.....	.....	.....	55	36	54	52	68	32
16	72	46	70	50	74	41	52	39	56	42	54	34
17	69	53	70	56	82	52	.....	.....	.....	.....	.....	.....
18	74	61	74	62	78	60	53	38	54	40	56	36
19	62	46	64	50	64	42	45	35	44	38	50	33
20	62	38	62	42	63	36	.....	.....	.....	.....	.....	.....
21	52	40	54	43	66	36	53	32	54	38	56	28
22	.....	.....	.....	.....	.....	.....	60	44	60	48	68	42
23	61	36	60	42	82	30	64	42	66	46	70	10
24	.....	.....	.....	.....	.....	.....	56	48	48	.....	.....	.....
25	67	48	66	52	78	46	.....	.....	.....	.....	.....	.....
26	70	53	68	56	78	52	.....	.....	.....	.....	.....	.....
27	62	44	62	47	69	41	.....	.....	.....	.....	.....	.....
28	53	36	54	40	62	30	.....	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
30	57	42	58	45	80	38	.....	.....	.....	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	66	47	65	50	77	43	54	38	55	51	61	33

Date 1929	November						December					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....	32	12	34	16	36	12
3	.....	.....	.....	.....	.....	.....	29	20	31	24	34	20
4	52	26	52	30	58	26	.....	.....	.....	.....	.....	.....
5	48	36	48	40	54	36	27	7	26	13	28	6
6	.....	.....	.....	.....	.....	.....	22	8	26	12	26	10
7	40	29	42	34	50	26	16	5	20	12	20	4
8	44	26	45	30	50	26	.....	.....	.....	.....	.....	.....
9	36	26	36	30	42	19	23	8	26	14	26	10
10	.....	.....	.....	.....	.....	.....	31	5	28	10	30	9
11	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	42	26	46	28	52	16	10	3	14	8	16	2
13	45	32	45	36	54	28	14	2	18	12	18	−2
14	43	35	45	40	48	34	29	14	32	16	30	14
15	41	36	44	40	42	36	.....	.....	.....	.....	.....	.....
16	.....	.....	.....	.....	.....	.....	39	−1	34	6	40	0
17	.....	.....	.....	.....	.....	.....	12	−2	14	−4	12	−8
18	40	21	42	20	48	16	.....	.....	.....	.....	.....	.....
19	42	26	45	28	44	26	28	11	31	14	.....	.....
20	.....	.....	.....	.....	.....	.....	28	21	32	24	.....	.....
21	.....	.....	.....	.....	.....	.....	35	12	38	22	36	10
22	32	13	34	18	36	8	.....	.....	.....	.....	.....	.....
23	28	13	30	16	32	12	21	0	22	6	23	−1
24	.....	.....	.....	.....	.....	.....	23	7	26	10	26	10
25	31	10	32	15	34	4	.....	.....	.....	.....	.....	.....
26	33	5	32	10	.....	.....	20	4	26	12	30	0
27	.....	.....	.....	.....	.....	.....	33	2	34	12	34	−4
28	38	10	38	12	40	6	31	20	32	22	33	20
29	37	13	39	18	44	10	.....	.....	.....	.....	.....	.....
30	23	5	26	10	27	4	36	23	34	28	.....	.....
31	.....	.....	.....	.....	.....	.....	23	13	28	21	.....	.....
Average	39	22	40	25	44	20	26	9	28	14	28	6

TABLE 44—MAXIMUM AND MINIMUM TEMPERATURES AT (IN DEGREES FAHRENHEIT) EXPERIMENTAL FOX RANCH, SUMMERSIDE

Date 1930	January						February					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	7	2	12	9	11	−2
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	40	30	40	34	43	30	24	−3	26	8	28	−6
4	33	20	36	24	.....	.....	13	−7	18	0	21	−12
5	.....	.....	.....	.....	.....	.....	20	−5	20	0	26	−4
6	20	−6	24	2	.....	.....	35	−8	28	−4	30	−6
7	35	15	37	16	38	−14	1	−8	7	−3	8	−9
8	.....	.....	.....	.....	.....	.....	16	−9	20	−3	20	0
9	40	26	43	30	46	26	.....	.....	.....	.....	.....	.....
10	.....	.....	.....	.....	.....	.....	23	−2	24	−2	28	−8
11	25	−4	32	3	.....	.....	35	4	32	18	34	8
12	.....	.....	.....	.....	.....	.....	22	−3	22	8	28	−4
13	.....	.....	.....	.....	.....	.....	24	−1	20	4	30	−6
14	31	10	32	15	34	4	38	12	40	16	40	20
15	.....	.....	.....	.....	.....	.....	40	3	41	8	41	−2
16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
17	1	−15	.....	.....	.....	.....	28	−11	30	−8	27	−12
18	5	−7	10	2	18	−12	12	−10	12	−7	14	−6
19	.....	.....	.....	.....	.....	.....	31	10	28	10	28	4
20	34	0	32	6	36	0	33	11	32	18	32	10
21	12	−3	16	6	21	−6	35	14	36	18	38	16
22	22	7	22	9	23	8	32	7	38	18	40	0
23	19	9	20	14	20	2	.....	.....	.....	.....	.....	.....
24	17	−8	14	0	20	−13	39	18	44	16	42	16
25	19	1	18	8	21	−4	38	24	32	30	40	22
26	.....	.....	.....	.....	.....	.....	40	13	42	18	48	14
27	30	−11	24	−4	28	−11	28	3	30	10	26	0
28	15	−3	18	−2	20	−6	22	6	36	12	30	4
29	30	15	30	14	32	18	.....	.....	.....	.....	.....	.....
30	24	−6	30	−4	26	−12	.....	.....	.....	.....	.....	.....
31	12	−1	12	2	25	−2	.....	.....	.....	.....	.....	.....
Average	23	4	26	9	28	0·5	27	3	28	8	30	2

Date 1930	March						April					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	31	9	40	14	36	4	41	24	34	30	56	18
2	.....	.....	.....	.....	.....	.....	43	30	51	32	60	28
3	39	21	38	20	43	22	39	28	42	30	40	27
4	32	4	35	10	30	2	34	27	35	30	40	24
5	17	3	31	10	26	−7	32	25	40	30	42	22
6	32	15	38	18	34	10	.....	.....	.....	.....	.....	.....
7	33	24	34	28	34	23	51	24	60	28	76	20
8	32	27	34	30	32	26	50	32	46	32	46	36
9	.....	.....	.....	.....	.....	.....	45	27	50	26	52	32
10	43	25	46	28	46	26	44	26	50	32	58	26
11	38	22	48	28	48	20	.....	.....	.....	.....	.....	.....
12	40	27	54	30	74	26	38	25	52	28	48	16
13	45	29	54	34	56	30	.....	.....	.....	.....	.....	.....
14	31	26	36	30	34	26	57	27	56	30	72	20
15	30	8	34	14	40	10	47	24	48	27	53	22
16	.....	.....	.....	.....	.....	.....	34	10	38	18	46	4
17	17	5	24	12	22	0	.....	.....	.....	.....	.....	.....
18	24	13	33	12	33	5	.....	.....	.....	.....	.....	.....
19	37	24	36	12	45	24	.....	.....	.....	.....	.....	.....
20	42	12	38	11	42	12	.....	.....	.....	.....	.....	.....
21	32	14	36	18	37	13	.....	.....	.....	.....	.....	.....
22	36	4	38	11	43	5	53	23	52	28	55	16
23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	28	6	40	10	34	8	46	19	58	24	62	18
25	35	19	46	24	42	12	38	24	38	28	46	22
26	42	27	46	30	58	24	47	27	46	32	55	24
27	34	31	36	34	37	28	.....	.....	.....	.....	.....	.....
28	37	25	42	30	42	22	55	23	54	23	67	17
29	35	26	38	30	40	24	49	25	54	30	72	28
30	.....	.....	.....	.....	.....	.....	51	28	58	34	74	24
31	42	24	48	28	53	18	.....	.....	.....	.....	.....	.....
Average	34	18	39	21	41	16	45	25	48	29	56	22

TABLE 44—MAXIMUM AND MINIMUM TEMPERATURES AT (IN DEGREES FAHRENHEIT) EXPERIMENTAL FOX RANCH, SUMMERSIDE

Date 1930	May						June					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	63	30	62	38	74	30	.....	.....	.....	.....	.....	.....
2	70	41	68	44	84	30	63	45	61	44	74	37
3	66	44	62	46	80	40	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	58	30	64	36	64	30	.....	.....	.....	.....	.....	.....
6	45	30	60	38	54	24	84	38	80	44	102	30
7	60	40	58	40	68	34	82	53	80	54	92	48
8	64	30	62	38	76	30	.....	.....	.....	.....	.....	.....
9	56	35	68	40	82	28	76	56	74	58	82	52
10	.....	.....	.....	.....	.....	.....	82	56	80	58	94	50
11	.....	.....	.....	.....	.....	.....	79	53	78	56	102	45
12	.....	.....	.....	.....	.....	.....	84	57	80	58	102	50
13	60	28	58	30	74	24	81	54	78	56	88	48
14	63	30	62	32	72	24	86	52	76	55	92	46
15	58	30	60	34	70	24	.....	.....	.....	.....	.....	.....
16	60	32	62	36	70	25	86	56	80	58	96	50
17	64	42	62	46	72	38	84	57	80	60	96	50
18	.....	.....	.....	.....	.....	.....	78	53	72	58	84	46
19	67	37	67	40	79	30	84	58	76	62	90	52
20	52	30	58	36	70	22	80	63	72	66	88	57
21	.....	.....	.....	.....	.....	.....	82	58	78	61	90	50
22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	50	29	56	34	64	26	78	56	72	58	86	50
24	.....	.....	.....	.....	.....	.....	84	57	76	60	100	50
25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	63	30	69	33	82	23	77	58	90	52	76	60
27	.....	.....	.....	.....	.....	.....	85	55	78	60	100	46
28	.....	.....	.....	.....	.....	.....	85	63	80	66	94	56
29	56	35	58	40	68	30	.....	.....	.....	.....	.....	.....
30	63	34	64	42	70	26	.....	.....	.....	.....	.....	.....
31	59	42	64	42	70	26	.....	.....	.....	.....	.....	.....
Average	60	34	62	38	72	28	81	55	77	57	91	49

Date 1930	July						August					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	81	56	78	60	86	46
2	.....	.....	.....	.....	.....	.....	77	54	74	58	90	40
3	83	55	80	58	88	48	.....	.....	.....	.....	.....	.....
4	82	54	72	57	94	58	84	59	82	62	94	50
5	69	50	66	53	86	40	82	61	78	63	94	52
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	80	49	74	54	106	38	75	48	72	52	96	36
8	71	58	70	60	74	52	69	45	70	48	84	32
9	78	54	70	60	86	46	76	56	74	58	84	48
10	74	53	70	56	98	44	.....	.....	.....	.....	.....	.....
11	81	56	75	60	92	48	76	54	72	56	76	46
12	69	55	68	58	68	48	72	50	70	52	81	40
13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	82	55	82	58	100	48	75	50	74	53	81	38
15	79	59	76	61	84	52	79	51	73	55	84	42
16	76	51	68	55	76	40	77	56	72	60	79	48
17	79	55	76	58	92	48	.....	.....	.....	.....	.....	.....
18	79	55	76	58	94	42	74	54	74	58	81	46
19	82	61	74	64	92	53	79	53	74	56	88	46
20	.....	.....	.....	.....	.....	.....	63	52	66	54	74	44
21	82	57	78	60	90	48	66	48	66	51	84	34
22	.....	.....	.....	.....	.....	.....	68	50	70	54	86	38
23	.....	.....	.....	.....	.....	.....	69	52	70	56	80	42
24	80	54	80	58	98	44	.....	.....	.....	.....	.....	.....
25	85	58	82	62	98	48	74	54	74	58	86	46
26	81	54	76	56	86	46	78	59	72	62	82	50
27	.....	.....	.....	.....	.....	.....	75	55	74	60	83	46
28	78	55	78	60	94	44	83	52	80	56	86	40
29	81	56	78	60	92	48	82	58	82	62	92	48
30	78	59	74	62	84	50	79	58	78	62	84	50
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	79	55	75	59	90	47	76	57	74	57	85	44

TABLE 44—MAXIMUM AND MINIMUM TEMPERATURES AT (IN DEGREES FAHRENHEIT) EXPERIMENTAL FOX RANCH, SUMMERSIDE

Date 1930	September						October					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	62	42	60	46	72	28
2	84	56	82	60	92	46	58	39	62	42	66	26
3	80	61	74	62	90	50	56	40	60	44	74	26
4	73	55	66	53	88	43	55	41	58	44	58	30
5	70	46	68	49	78	34	.....	.....	.....	.....	.....	.....
6	69	51	68	55	76	44	53	44	55	47	60	30
7	.....	.....	.....	.....	.....	.....	48	44	50	46	44	35
8	72	45	70	50	76	32	51	39	54	43	54	32
9	64	40	62	42	66	28	57	38	61	42	74	32
10	.....	.....	.....	.....	.....	.....	58	42	58	46	74	37
11	.....	.....	.....	.....	.....	.....	53	41	54	44	62	36
12	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	.....	.....	.....	.....	.....	.....	71	48	70	52	86	43
14	.....	.....	.....	.....	.....	.....	74	50	74	54	82	48
15	59	39	61	44	75	27	74	45	74	47	86	44
16	68	55	68	58	71	46	.....	.....	.....	.....	.....	.....
17	76	56	.....	.....	46	31	52	47	54	49	54	46
18	73	56	75	60	80	45	52	47	54	50	56	46
19	72	48	70	50	78	38	.....	.....	.....	.....	.....	.....
20	62	46	63	48	70	36	55	32	56	38	58	32
21	.....	.....	.....	.....	.....	.....	47	28	46	32	56	28
22	69	45	68	49	78	34	.....	.....	.....	.....	.....	.....
23	68	48	66	46	69	34	41	28	42	32	50	26
24	57	42	58	46	58	34	50	30	50	36	59	28
25	59	48	60	50	65	37	50	35	52	39	66	36
26	56	45	58	49	51	33	.....	.....	.....	.....	.....	.....
27	62	43	62	48	72	30	42	35	44	39	47	38
28	.....	.....	.....	.....	.....	.....	41	29	43	33	48	27
29	68	46	66	50	76	33	.....	.....	.....	.....	.....	.....
30	62	39	60	44	68	26	.....	.....	.....	.....	.....	.....
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	68	48	76	51	73	36	55	40	56	43	63	34

Date 1930	November						December					
	In shade		Covered shed		Exposed		In shade		Covered shed		Exposed	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
1	.....	.....	.....	.....	.....	.....	45	11	46	16	57	22
2	.....	.....	.....	.....	.....	.....	36	16	43	24	.....	.....
3	46	27	46	32	64	26	16	4	24	11	.....	.....
4	42	29	44	36	55	28	.....	.....	.....	.....	.....	.....
5	46	33	48	38	60	33	27	11	30	14	48	12
6	.....	.....	.....	.....	.....	.....	31	12	29	20	.....	.....
7	54	22	56	26	68	29	.....	.....	.....	.....	.....	.....
8	32	23	34	27	42	28	33	24	34	23	47	21
9	.....	.....	.....	.....	.....	.....	32	26	34	30	50	38
10	.....	.....	.....	.....	.....	.....	32	26	34	30	49	37
11	44	23	46	28	52	31	28	16	30	20	47	28
12	32	20	34	24	46	20	25	18	32	22	46	31
13	39	32	42	34	52	38	30	25	34	28	45	39
14	44	39	46	42	54	44	.....	.....	.....	.....	.....	.....
15	50	28	52	32	65	34	29	8	.....	.....	.....	.....
16	.....	.....	.....	.....	.....	.....	18	2	33	9	.....	.....
17	39	26	44	30	54	28	12	3	16	10	47	18
18	39	29	42	35	56	34	.....	.....	.....	.....	.....	.....
19	39	27	44	32	54	33	.....	.....	.....	.....	.....	.....
20	.....	.....	.....	.....	.....	.....	31	13	34	16	50	26
21	42	23	50	27	60	26	.....	.....	.....	.....	.....	.....
22	42	30	45	35	58	36	37	22	36	28	54	35
23	.....	.....	.....	.....	.....	.....	30	20	36	26	50	31
24	45	30	47	36	59	36	29	19	32	26	46	37
25	47	33	50	37	61	39	.....	.....	.....	.....	.....	.....
26	55	35	56	38	72	44	26	11	32	18	.....	.....
27	38	28	41	32	52	35	30	17	.....	.....	46	25
28	31	14	33	24	.....	.....	.....	.....	.....	.....	.....	.....
29	24	8	30	15	.....	.....	25	15	32	23	44	31
30	.....	.....	.....	.....	.....	.....	29	6	29	18	55	19
31	.....	.....	.....	.....	.....	.....	28	10	32	18	54	22
Average	41	27	44	31	57	33	29	15	33	21	49	28

RATE OF DIGESTION OF FOOD STUFFS

There is a great diversity of opinion among fox breeders regarding the time taken for different food stuffs to digest, and hence what would be the most advisable time interval between meals. Fox breeders appear to be divided into two groups on this question; the greater percentage of fox breeders have always made a practice of feeding their foxes twice daily, generally in the morning between seven and eight and in the evening between four and five, a time interval of nine hours between meals during the day and fifteen hours during the night. Fox breeders have contended, on account of the keen appetite of the foxes at each meal, that the previous meal had been digested before the subsequent meal was fed. The other group of fox breeders have adopted the method of feeding only one meal each day. Whether foxes are fed once or twice daily, they are always more on the alert at feeding time than at any other time of the day. When foxes are fed only one meal a day, naturally they are not expecting food except at the particular time of the meal and are observed to be lying down the greater part of the day, appearing to be quite contented. On this account fox breeders who have been feeding only one meal a day have assumed that the food was still being digested and that it took twenty-four hours or more to digest the ordinary rations fed to foxes.

TABLE 45—RATE OF DIGESTION OF BEEF

P.M. Number	Fox Number	Amount eaten	Digestion period	Residue in stomach	Percentage digested
		oz. beef	hours	oz.	%
233	59G	8	1½	8	None
234	60G	8	1½	8	None
248	82G	6	1	5	17
249	16G	6	2	5½	8
237	22D	6	3	3	50
238	10D	6	3	3	50
239	86G	6	6	4	33
240	84G	6	7	1	83
241	85G	6	8	Trace	99
244	22G	6	9	Trace	99
245	23G	6	9	Trace	99
246	24G	6	9	1	83
231	1B	6	17	None	100
232	6A	6	17	None	100

TABLE 46—RATE OF DIGESTION OF BISCUITS

P.M. Number	Fox Number	Amount eaten	Digestion period	Residue in stomach	Percentage digested
		oz. biscuits	hours	oz.	%
259	25D	1½	5	None	.....
260	1E	1½	5	1	33
267	32F	1½	7	1	33
261	25E	1½	9	⅔	55
257	25G	1½	16	None	100
258	26G	1½	16	None	100
268	58G	1½	16	None	100
269	48F	1½	16	None	100
270	53F	1½	16	None	100
271	8E	1½	16	None	100

Foxes that have been set aside for pelting were used for this experimental work. In general the foxes were fasted for one meal the previous evening and then fed between seven and eight o'clock the following morning and then killed

after different time intervals. The interval between the time of feeding and the time of killing was taken as the digestion period. As this experimental work was carried out during the extreme cold weather in order to insure the foxes eating the biscuits, they were mixed with a certain proportion of meat. For simplicity this has not been placed in the tables, but the calculations were made on that basis.

DISCUSSION

It will be seen from the results given in table 45 that meat is practically all digested between seven and eight hours with the average foxes, if not more than six ounces are fed at the one meal. When eight ounces were fed, it has invariably been found that the stomach was packed with meat and the digestion has been delayed. In the cases given in table 45 where eight ounces of meat were fed, there has been practically no digestion after an hour and a half.

With regard to the rate of digestion of biscuits, it will be observed that the digestion was much slower, probably taking between thirteen and fourteen hours to complete.

In some of the experiments charcoal was incorporated into the food so as to have a means of checking the passage of the particular meal in the intestinal tract. As it was necessary to feed a considerable bulk of charcoal, different dyes were tried in some cases. When soluble dyes, such as methylene blue were added, it was found, even when the foxes were killed after a time interval of only one hour, that the dye was distributed in the fatty tissues in the different parts of the body, but the greater portion of the dye was found in the rectum. Also there was no evidence of the presence of the dye in the intestinal tract, except for one or two inches in the upper part of the duodenum. This would show that the dye was absorbed directly into the blood stream from the stomach and was either immediately deposited in the fatty tissues throughout the body or else eliminated into the rectum. I may be mentioned here that the action of Epsom salts, when administered to foxes, would be very similar to the soluble dye; that is the salts are directly absorbed into the blood stream from the stomach and then poured directly into the rectum without having passed through the main portion of the intestinal tract. Hence, Epsom salts would not be of much value in expelling worms from the intestinal tract after an anthelmintic has been administered. With both the meat and the biscuits, in none of the experiments was there any evidence of any food stuffs in the lower part of the intestinal tract, in fact the food stuff was only found in the stomach and in the first five or six inches of the duodenum. This would confirm our previous experience that the food is digested in the upper portion of the intestinal tract and there is no food passing through the main portion of the intestinal tract unless a certain amount of undigested roughage has been added to produce a scouring effect on the intestines.

RECOMMENDATIONS

Fox breeders are recommended to avoid feeding excessive amounts of food at one meal as the stomach becomes gorged and slows down the rate of digestion. Also, according to our evidence, this tends to lead to an inflammatory condition of the stomach. We would recommend fox breeders to feed two meals daily and while the meat is digested more rapidly than the cereals, from our experience in the ranch, it would appear to be immaterial whether the meat should be fed at the evening meal or at the morning meal. While there is no doubt that it would be most desirable that the stomach should be empty before the next meal is fed, as fox breeders are aware, foxes have a keener appetite for meat than for cereals. Therefore, if the cereals should be fed at the meal where there has been the longest fast, it will insure this food being eaten so that it is

very questionable whether there would be any greater advantage feeding the meat at the morning meal in preferenee to the evening meal, which appears to be the general practice.

TABLE 47—RAW CEREAL RATIONS—AS RECOMMENDED BY THE EXPERIMENTAL FOX RANCH

Summer Rations Fed from June 1 to August 31

	120 foxes	60 foxes	30 foxes	
	lb.	lb.	lb.	
Morning Meal—				
Rice flour	6	3	1½	
Rice meal	1	½	¼	
Wheat bran	1	½	¼	
Milk	32	16	8	
Tripe	8	4	2	
Yeast	½	¼	⅛	
				Amount Fed to each Fox—
				Small foxes.....6 ounces.
				Large foxes.....7½ "
Evening Meal—				
Rice flour	6	3	1½	
Rice meal	1	½	¼	
Wheat bran	1	½	¼	
Ground meat	16	8	4	
Bone	2	1	½	
Vegetables	6	3	1½	
				Small foxes.....4 ounces.
				Large foxes.....4½ "

Early Fall Rations Fed from September 1 to October 31

—	120 foxes	60 foxes	30 foxes	
	lb.	lb.	lb.	
Morning Meal—				
Rice flour	2	1	½	
Wheat flour	2	1	½	
Corn meal	2	1	½	
Rice meal	1	½	¼	
Wheat bran	1	½	¼	
Milk	32	16	8	
	oz.	oz.	oz.	
Yeast	8	4	2	
				Amount Fed to each Fox—
				Small foxes.....6 ounces.
				Large foxes.....7½ "
Evening Meal—	lb.	lb.	lb.	
Rice flour	2	1	½	
Wheat flour	2	1	½	
Corn meal	2	1	½	
Rice meal	1	½	¼	
Wheat bran	1	½	¼	
Wheat germ	2	1	½	
Ground meat	32	16	8	
Bone	4	2	1	
Vegetables	10	5	2½	
				Small foxes.....6 ounces.
				Large foxes.....7½ "

TABLE 47—RAW CEREAT RATIONS—*Concluded*

Late Fall Rations Fed from November 1 to January 15.

——	120 foxes	60 foxes	30 foxes	
	lb.	lb.	lb.	
Morning Meal—				
Rice flour	3	1½	¾	
Wheat flour	3	1½	¾	
Oatmeal	3	1½	¾	
Corn meal	3	1½	¾	
Wheat bran	2	1	½	
Tripe	8	4	2	
Milk	24	12	6	
	oz.	oz.	oz.	
Weak Potassium iodide solution.	4	2	1	*Amount Fed to each Fox.*— Small foxes.....6 ounces. Large foxes.....7½ "
Evening Meal—				
Ground meat	40	20	10	
Wheat bran	2	1	½	Small foxes.....6 ounces. Large foxes.....7½ "