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DEPARTMENT OF AGRICULTURE
EXPERIMENTAL FARMS SERVICE

DOMINION FOX ILLUSTRATION STATIONS

P.E.I., N.S. and N.B.

PROGRESS REPORT, 1943-1947

PREPARED BY

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

GROUP OF CANADIAN STANDARD
SILVER FOX PELTS

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PERSONNEL

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

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MARITIME FOX ILLUSTRATION STATIONS

NEW BRUNSWICK:

1. *Newcastle*—County—*Northumberland*
   Operator—Lloyd G. Steeves.
   Location of Station—in the Newcastle-Chatham District, one mile north of Newcastle on the highway leading to Chatham on the south bank of the Miramachi River.
2. *Fredericton*—County—*York.*
   Operator—Sheridan Grant.
   Location of Station—one mile from Fredericton on the (Golf Club) road on the east bank of the St. John River.
3. *Salisbury*—County—*Westmoreland.*
   Operator—Leigh A. Colpitts.
   Location of Station—one mile east of Salisbury upon the main road leading into the county.
4. *North Devon*—County—*York.*
   Operator—M. Quartermain & Budovitch Bros.
   Location of Station—situated on the Killarney road, leading from Fredericton to Naskwaak, within the Town limits of North Devon. (Discontinued Contract in 1944).

NOVA SCOTIA:

5. *Bridgetown*—County—*Annapolis.*
   Operator—Spurgeon U. Messinger.
   Location of Station—four miles west of Bridgetown on the Post Road at Centralea.
6. *Meteghan*—County—*Digby.*
   Operator—Mrs. M. J. Robicheau.
   Location of Station—one mile south of Meteghan on the highway to Yarmouth. (Discontinued 1947).
7. *Truro*—County—*Colchester.*
   Operator—C. Homer Barnhill.
   Location of Station—in the village of Debert, 15 miles from Truro and 3 miles north of the Parrsboro-Truro highway. (Discontinued Contract 1940).
8. *Bayfield*—County—*Antigonish.*
   Operator—J. H. Randall.
   Location of Station—on the main road through the Bayfield locality, 4 miles north of Heatherton and 16 miles east of Antigonish. (Discontinued Contract in 1944).

PRINCE EDWARD ISLAND:

9. *O'Leary*—County—*West Prince.*
   Operator—R. Daniel Smallman.
   Location of Station—in western section of Prince County, 4 miles from O'Leary on the main road leading to West Cape.

10. *Montague*—County—*Kings.*
    Operator—Allan A. Mosher.
    Location of Station—half a mile east of the town of Montague on the main road leading to Lower Montague. (Discontinued Contract 1947).

INTRODUCTION

FOX ILLUSTRATION STATIONS were established in 1938 in the three Maritime Provinces, three each being located in Nova Scotia and New Brunswick and two in Prince Edward Island.

These Stations were under the supervision of the late J. C. Jack until 1941 when they were placed under the supervision of the Dominion Experimental Fox Ranch, Summerside, P.E.I. Later the Stations at Truro and Antigonish in Nova Scotia, and at Fredericton, N.B., were discontinued, but the one at Fredericton has since been replaced and a new Station was established at Meteghan, N.S.

Mr. Jack made an interim (unpublished) report of progress in construction and general operation of the eight original Stations in 1940. The present report deals chiefly with the activities of these Stations during the war years, particularly during the 1942-47 period.

The Illustration Stations are placed in localities throughout the Maritime Provinces where there are relatively large numbers of fox ranchers. Annual inspections have been carried out by Dr. C. K. Gunn, Superintendent, Dominion Experimental Fox Ranch, Summerside.

The specific situations of fox ranchers vary somewhat with respect to the availability of different feedstuffs, transportation, refrigeration facilities and other problems peculiar to the district in which the Illustration Stations are located. The size of these Stations, and the number of foxes maintained on each, approximate those of the average small rancher throughout these Provinces.

As the name implies, the Illustration Stations are chiefly testing grounds to demonstrate improved methods of housing, feeding, breeding and parasite control, with the attending improvements of the breeding stock, production, sanitary conditions and particularly to show the increased pelt values accruing from such methods in operation. Through the visits of individual ranchers to the Stations, publications and periodic field days, the findings of the Stations are disseminated.

Better housing methods, employing wire-bottomed pens and covered shed arrangements of the umbrella design, used on the Illustration Stations, have given rise to such obvious improvement in sanitation and in fur colour of foxes maintained in these pens, that they have been widely adopted in the districts in which the Illustration Stations have been placed.

Parasite control on such wire-floored pens has become a minor problem in the raising of foxes, in contrast with the former extensive losses incurred from this source when the animals were reared on earth or board floors formerly common throughout the Maritime Provinces prior to the establishment of the Fox Illustration Stations. One of the main achievements of these Stations has been the marked improvement in the fur quality of Station foxes as a result of the introduction of outstanding sires into these ranches, combined with better selection and breeding methods.

The Supervisor commends the Operators of these Stations for their splendid co-operation during the war years and after its termination when difficulties

arose with respect to scarcity of feedstuffs, labour shortage, restrictions on travel and finally the sudden drop in pelt prices at the close of the war. In spite of these difficulties, the Stations have played an important role in assisting fox ranchers in their respective districts. The nature of assistance rendered is outlined in the report.

The greatly superior quality of pelts produced at the Illustration Stations in contrast to the average valuation of Maritime Provinces fox pelts is of particular interest. This superiority chiefly results from improved methods of selection and breeding, in conjunction with better application of the necessary details related to proper feeding, housing and pelting practices as demonstrated at the Illustration Stations.

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Housing—Pen Structure

The proper type of construction in fox pens is essential in successful fox ranching procedure. The desired type of pen provides for effective parasite control, protection from weathering, cleanliness of the fur, adequate ventilation, general sanitation, exercise for growing fox pups and good breeding results.

Five main types of pens are in use on the Fox Illustration Stations. These are:— (1) soil-bottomed pens, (2) board-floor pens, (3) the single-roof shed, (4) the umbrella combination pens, (5) the double-roof shed.

The modern fox pen should be constructed so that it is economical to build and supplies protection from the weather, good sanitation and proper ventilation. The pen size should be large enough to permit adequate exercise for fox pups and the design should afford convenience for carrying out the operations of cleaning, feeding and the catching of pups where the latter is desired.

Table I shows the distribution of pens of different construction in the Maritime Fox Illustration Stations.

The comparative study of the effects of pen construction upon the results obtained in the different Illustration Stations indicates that further improvements can be made in the housing of foxes. There are three Stations using umbrella-type pens, four with double-roof shed pens, three with single-roof shed pens, two Stations with board-floored pens and two with soil-bottomed pens. As may be seen in Table I, some of the Illustration Stations have more than one type of construction for housing the foxes.

Figure I shows the soil-bottomed pens in which the kennel is enclosed within the confines of the pen. Such pens are excellent for the growth of young pups. In them they appear to exercise better than on wire-bottomed pens. However, the hazard of their becoming infested with lungworm and hookworm from the soil in such pens makes it imperative at present to remove young pup foxes to pens with wire or wooden floors.

Experimental work is in progress at the Dominion Experimental Fox Ranch, Summerside, P.E.I. to evolve methods for destroying parasitic larvae in the soil of earth-floored pens.

Figure 2 shows a board-floored fox pen which represents a first step in improvement over soil-bottomed pens. Its chief merit is in protection from lungworm infestation such as exists in the soil-bottomed pens.

Figure 4 shows an example of an umbrella-type pen. The dimensions of this pen are 20 ft. long by 9 ft. wide. The back 5 ft. is boarded in to offer protection to the foxes and a kennel is joined by a chute through the rear wall of the pen. The roof portion of these pens can be removed during the summer season, so that the growing pups get adequate sunshine. A removable floor is also present in this type of pen for the breeding season and during the early stages of growth of the young pups, to eliminate excessive under-draught during cold spring weather.

The roof and floor are used during the autumn furring season to give shade to the foxes, (Fig. 4). The floor forms a roof between the individual pens, giving them protection from sun and rain comparable to that of a single-pen shed.

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Figure 3 shows a single-roof shed in which the pens are adjacent and open on one side of the shed. Much depends upon the position in which the umbrella and single-shed pen are placed. A study of the direction in which the umbrella and single-pen sheds face with respect to the sunlight, shows that a northern exposure is preferable, (O'Leary, P.E.I.) as compared with pens facing south or east, (Salisbury and Montague) in which direction they require further protection in the form of awnings to prevent bleaching of the fur by direct sunlight during the autumn season.

Figures 5 and 6 show an exterior and interior view of a fox shed with pens on each side of a middle aisle (double-pen shed). This type of fox shed is the most economical to construct and is efficient in providing optimum conditions for foxes to produce good fur, because of the greater control over sunlight and external weather conditions.

The comparative merits of the four different kinds of pens in use at the Maritime Fox Illustration Stations are discussed under the respective headings dealing with fox pens in relation to parasite control, protection from weather, ventilation and the breeding of foxes.

PEN STRUCTURE IN RELATION TO PARASITE CONTROL

A study was made of the different methods of housing foxes at the Illustration Stations in relation to parasite control.

The parasites commonly found on foxes in the Maritime Provinces are:—Fleas, (*Ctenocephalis canis*) and earmites, (*Otodectes cynotis*) known as external parasites; while the internal parasites are:—Round worms (*Toxocara canis*), usually prevalent in pup foxes, hookworm (*Uncinaria stenocephala*), lungworm, (*Crenosoma decoratum*) and coccidia (*Isospora bigemina*), common in adult foxes.

Parasitic infestation can be readily detected in foxes by careful observation of the presence of emaciation and grey nozzles, but more detailed methods are: (1) direct examination of the fur and ears for fleas and earmites, while (2) the detection of internal parasitic worms is made by examination of the feces for worms or parasite eggs.

The factors involved in the relative parasitic infestation at the Illustration Stations are:—Pen structure, dampness of soil in ground pens, height of pens off the ground with respect to reinfestation by fleas, use of fuel oil and anthelmintics and the use of bedding on the wire floors to prevent chafing of the fur.

A comparative study of the relative parasitic infestation on Stations with comparable numbers of foxes gave the following findings:—

Wire- vs. *Soil-Bottomed Pens:*—The evidence of endoparasitic worms (lungworm and hookworm) was significantly greater when the adult foxes were maintained part of the summer season on soil-bottomed pens. This results from fecal contamination of the soil in which the larval forms of the parasitic worms remain present for months after contamination of the soil.

The greater incidence of infestation in soil-bottomed pens, (Meteghan, N.S. and Fredericton, N.B.) was also evident from the general thriftiness of the adult foxes maintained on wire or board floors throughout the year, (Montague, P.E.I., Newcastle, N.B., O'Leary, P.E.I.).

Where the Illustration Station is located on low land with poor drainage, (Bridgetown, N.S. and Salisbury, N.B.) a relatively higher incidence of lungworm and hookworm infestation was prevalent before housing the foxes on wire-floored pens, but these Stations were relatively free from flea and earmite infestation. On the ranches situated on higher land, (Montague, P.E.I., Meteghan, N.S.) the foxes were found to have a higher incidence of external parasites (fleas and earmites) but were free of parasitic lungworm and hookworm infestations.

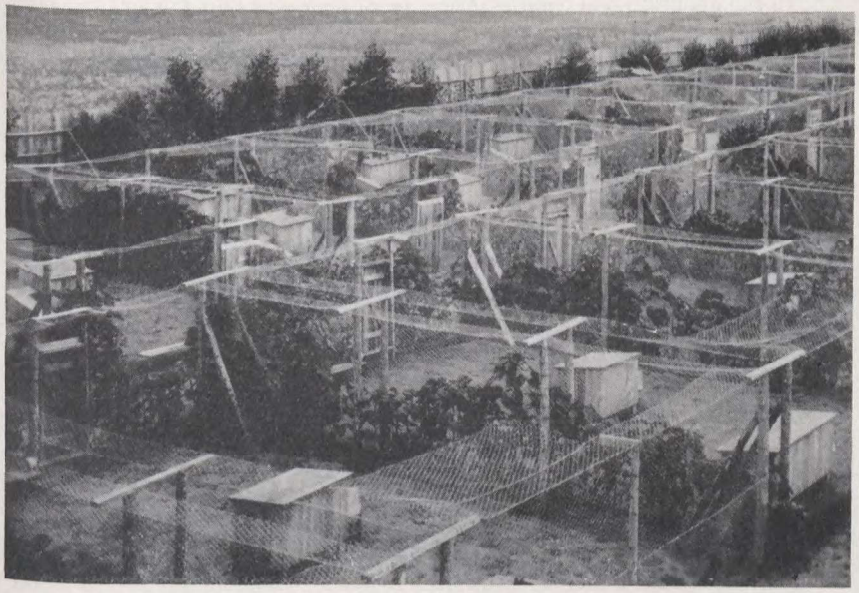

FIG. 1—Soil-Bottom Fox Pen.

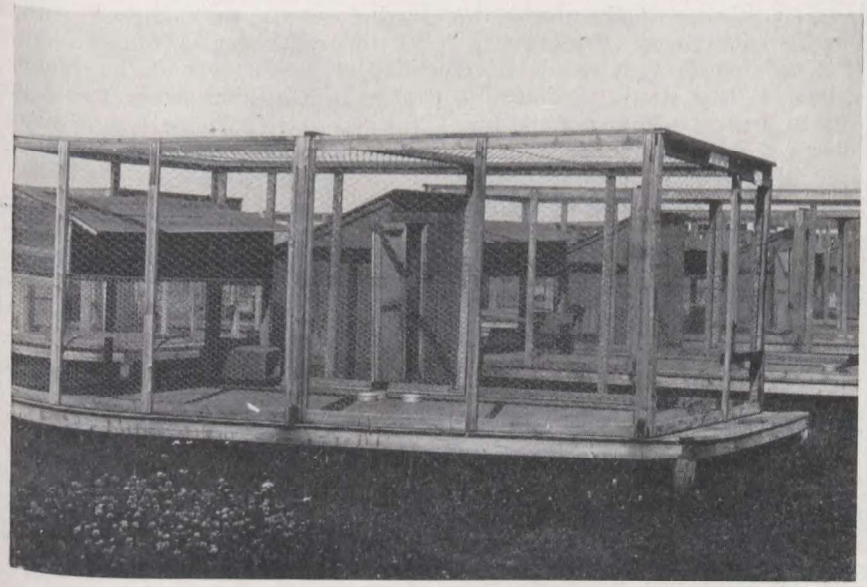

FIG. 2—Wooden-Floor Fox Pen.

Height of the pens above ground was also found to be an important factor in the control of flea infestation. At the Stations where the pens were 3 feet or more above the ground level, reinfestation from droppings on the soil beneath the pens was of rare occurrence, while in the single-shed pens, 1 to 1½ feet from the ground, (Montague, P.E.I., Meteghan, N.S.) greater difficulty was experienced in maintaining the foxes in a condition free from external parasites.

TABLE 1.—TYPES OF FOX PENS IN USE AT THE MARITIME FOX ILLUSTRATION STATIONS

Province	Town	Name of operator	Pens	Sheds
Prince Edward Island	O'Leary	D. Smallman	Umbrella	Double-roof
Prince Edward Island	Montague	A. Mosher	Board-floor	Single-roof
New Brunswick	Salisbury	L. Colpitts	Umbrella	Single-roof
New Brunswick	Fredericton	S. Grant	Soil-floor	Single-roof
New Brunswick	Newcastle	L. G. Steeves	Board-floor	Double-roof
Nova Scotia	Bridgetown	S. U. Messinger	Umbrella	Double-roof
Nova Scotia	Meteghan	M. J. Robicheau	Soil-floor	Double-roof

At Stations where slatted hemlock strips, one inch apart are used in some of the pens, (Fredericton) it was found that the slats, after treatment with fuel oil, appeared greasy and there was also a tendency for feces to cake between the slats, making this type of flooring relatively undesirable compared with wire floors. The higher incidence of parasites and the discolouring effects upon the fur of the foxes housed in such pens do not make wooden-slatted floors economical to use for furring or rearing fox pups.

In a study to determine the relative effect of the practice of placing straw bedding over the rear half of wire-floored fox pens to protect the fur from chafing, (Newcastle, N.B.) during the furring season, as compared with no bedding in such pens, (Bridgetown, N.S.) the experimental results showed: (1) that bedding did prevent excessive chafing of the fur over the hip region of foxes, but (2) that it was necessary to change such bedding every 4 or 5 days in order to prevent staining of the fur. This practice of placing bedding on the wire floors partly defeats the purpose of the wire floors by accumulating feces and spreading parasites to other foxes in the same pen.

Similar findings were noted in other Stations where "one-inch mesh wire" and "one-by-two-inch mesh wire" were used with a view to reducing chafing of the fur. It was found that the finer mesh wire, (Newcastle, N.B., Meteghan, N.S.) tended to collect and hold feces, whereas the coarser mesh wire, (Bridgetown, N.S.), although it caused a somewhat greater amount of chafing of the fur, permitted the feces to drop through the wire, and the pen remained relatively cleaner and eliminated the possibility of significant parasitic reinfestation from fecal deposits in the corners.

Board-floored pens (Fig. 2) are in use on a high percentage of Canadian fox ranches and are used to house adult foxes during the summer season to protect them from lungworm infestation. However, such pens do not eliminate parasitic infestation of ascarid worms.

No. 11 wire mesh of size "one inch by two inch" in rectangular form, which has been galvanized after welding, has been found most efficient to date in remaining clean from feces and causing a minimum of chafing.

As a result of such findings on the Illustration Stations, this type of pen floor, 2½ or 3 ft. from the ground, has been accepted as the standard of construction on many surrounding fox ranches.

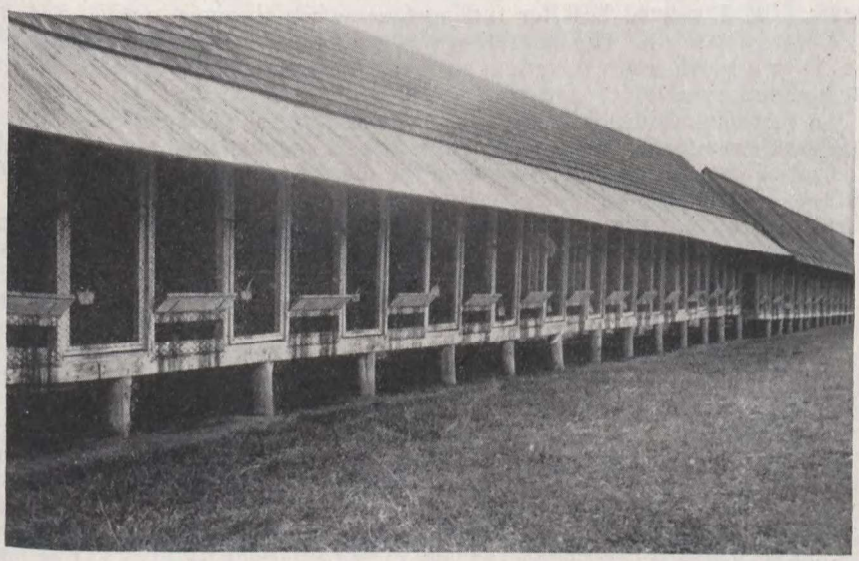

FIG. 3—Single-Roof Fox Shed.

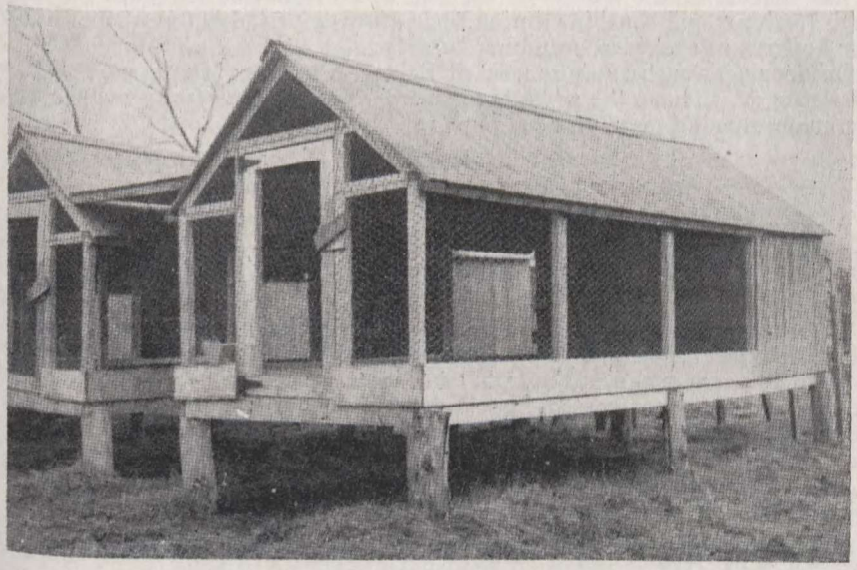

FIG. 4—Umbrella-Type Fox Pen.

PEN STRUCTURE IN RELATION TO THE EFFECTS OF WEATHER

It was found that single pens, Fig. 4, and sheds with one side open to the elements, Fig. 3, proved best for furring foxes when the open side of the shed faced toward the north. The ideal direction for double sheds with a central aisle, Fig. 5, is in a north-south direction, so that each side of the shed gets an equal amount of sunshine.

The factors involved in respect to the retention of good colour in fox fur are chiefly those of sunshine and dampness. Sheds prevent the bleaching (oxidizing) effect of ultra-violet light rays upon the pigment (melanin) of the fur hairs, which takes place especially in moist atmosphere conditions after rain.

A comparative study of the Illustration Stations with double-roofed, Fig. 5, half-roofed, Fig. 3, and open pens, with board or soil bottoms, shows that the double-roofed pens, double shed, with central aisle between the pens, produce the best conditions for furring foxes, by virtue of greater protection from driving rain storms, and control of sunlight entering the sheds. The sunlight can be almost completely shut out at will, by closing the shutters on the sides of the furring sheds. These findings have been repeatedly confirmed at the Stations with double-pen furring sheds (O'Leary, P.E.I., Newcastle, N.B., and Meteghan, N.S.).

Control findings at the Bridgetown and Fredericton Stations showed that it was necessary to cover the front and sides of umbrella pens with bags and factory cotton, in order to provide conditions relatively comparable with those of double-roof furring sheds. During the past year the operator of the Bridgetown Station, realizing the above deficiencies of his umbrella pens, has built a modern double-roof furring shed.

The half-roofed pens at the Montague, P.E.I. Station, Fig. 3, Salisbury and Fredericton Stations were also found to require awnings to give the pens adequate shade during the furring season.

The defects of the double sheds, Fig. 5, are that the fox pups do not get enough fresh air and sunshine during their growing period before their final coat of fur begins to develop in autumn.

Outdoor pens such as those used at Bridgetown, N.S., Montague, P.E.I., and Fredericton, N.B., have the advantage of providing fresh air and sunshine during the summer growing season for fox pups.

PEN STRUCTURE IN RELATION TO VENTILATION

A comparative study of the effect of high pens and low pens on the ventilation of fox pens was made at six of the Illustration Stations. The floor of the pens is 3 to 4 feet off the ground on three Stations and 1½ to 2 feet from the ground level on the other Stations.

Both types of pens have been found to have certain advantages and disadvantages. The high-placed pens are more convenient to clean beneath and reinfestation with fleas cannot take place from litter material in such pens, but on the other hand, unless they are located in a definitely sheltered location, they may be excessively draughty. This condition is detrimental to the health of the foxes in cold weather and was also found by comparison to cause excessive drying of the fur—an undesirable condition. High pens are also difficult to climb into to catch and examine foxes during the breeding season.

High pens are in use at Salisbury, N.B., Newcastle, N.B., and Bridgetown, N.S. While the latter Station, however, is located on rather swampy terrain, it experienced no difficulty from excessive drying of the fox fur. At Bridgetown the under-draught had to be controlled by jute-bag shutters.

Comparative conditions for rearing foxes in low pens of 1½ to 2 feet from the ground are found at Montague, P.E.I., Meteghan, N.S., and O'Leary, P.E.I. Stations.

In foxes at these Stations the fur texture was free from the effects of excessive drying and there was no noticeable under-draught.

From a study of the effects upon the health and drying of the fur in foxes, factory cotton or jute bags were adopted to serve as shutters in the high-constructed fox pens. In lower pens, hinged wooden shutters were adopted to control ventilation.

Adequate ventilation of fox pens is essential, to remove ammonia fumes from the feces, which discolours the fur. However, with the introduction of wire-bottomed pens it became necessary to be able to control excessive, draughty ventilation.

From comparative studies it is found that, depending upon the location, snowfall, shelter and dampness of the climate, pens built 2½ feet from the ground permit adequate clearance for cleaning operations beneath pens, and also enable the rancher to use permanent wooden-hinged shutters to control ventilation.

PEN STRUCTURE IN RELATION TO BREEDING OF FOXES

The relationship of successful breeding of foxes and pen structure depends upon a number of factors. It is difficult to assess the exact part that pen structure itself plays in this role. By studying the results obtained at different Illustration Stations, with some using similar pen structures, certain interesting facts were determined. See Tables 4 and 6.

On Stations where fox pups are reared on wire-bottomed pens they become used to this type of flooring early in life and are found to breed better in such pens than do fox pups reared on board floors or soil-bottomed pens. That is, they are free from parasites and they exercise normally on the wire floors, whereas foxes reared on soil or wooden floors take some time to get used to wire floors and do not take as much exercise when first transferred to wire-bottomed pens.

If the wire-bottomed pens are situated in a draughty location in cold weather, this condition is detrimental to the health of the foxes and retards their coming in "heat".

Other factors, such as diet, fecundity of the strain of foxes, and freedom from parasitic infestation are also important in determining successful breeding.

Examination of Table 4 shows a wide variation in average ranch reproduction per vixen maintained in the Stations. The most important factor involved in this variation in production was the shortage of certain essential ingredients in the fox rations, particularly during the last two years of the period covered by this report. Horsemeat and tripe were particularly difficult to obtain in some Maritime localities during that period.

At the Stations in Newcastle and Bridgetown these ingredients were relatively more available. In the Newcastle district, fresh-killed meats were cheap and plentiful, while at the Bridgetown Station the operator has a cold storage plant and was able to purchase larger supplies of meat when it was available, and, therefore, had a relatively constant supply of this essential ingredient.

Hence, in the period 1944 to 1946 inclusive, the factor of pen construction played only a minor role in comparative breeding results at the different Stations. The variation in the 1947 season, however, cannot be completely attributed to a shortage of meats, except to a certain extent at the Salisbury Station, where some difficulty was still found in procuring large shipments of frozen rabbits, tripe and fish. The latter shortage was caused by the fact that previously discarded types of fish and tripe were directed into channels of human consumption for the European recovery program.

NEW TYPE FOX PENS AND SHEDS

Figures 7 and 8 show all-metal pens, constructed of 2" by 1" mesh wire with angle-iron supports. These pens have the qualities of durability and good appearance, as well as serving the other known requirements of the regular wire-floored fox pen. The type shown in Fig. 8 is found to be the most serviceable where snowdrifts occur on the fox ranch. In this pen the snow does not reach the floor level and it is more convenient to keep the ground beneath it in clean condition. At the present time these pens are being tested at the Dominion Experimental Fox Ranch at Summerside, P.E.I., as well as another new type of pen which is connected to the regular fox furring shed, as shown in Figures 9 and 10. The latter outdoor pens are connected by chutes to inside shed pens. The fox pens, therefore, can be shut indoors or outside at will by means of a board in the chute of each pen.

Such an arrangement overcomes the main defect of double-roof fox sheds, namely, that the growing fox pups do not get adequate sunshine, fresh air and exercise. During the furring season, when sunlight is detrimental to fur colour, the foxes can be maintained within the shed during the daytime and allowed to run in the outside pen during the night without detrimental effect upon the colour of their fur, in this way giving them the advantage of outdoor exercise and fresh air.

Recommendations in regard to the construction of a modern fox shed should ensure protection from weather, good ventilation and sanitation.

Individual pens should be large enough to permit adequate exercise for fox pups and the design should afford convenience for carrying out cleaning, feeding and the rearing of pups where the latter is desired. Good quality materials should be used as these will outlast cheaper ones, reducing future repair costs of furring sheds, and thus be more economical over a period of years.

Sanitation is an important factor to consider in construction of furring sheds. Wire floors are a great aid in this respect. Where wire floors are used they should be constructed of heavy-gauge wire which has been galvanized after it has been welded. In conjunction with this type of flooring, the cross beams and side boards of the pens should be bevelled so that the droppings fall through the flooring quite readily without any obstruction. Some fox ranchers make a board-run, 2 feet wide, across the middle of their pens. They feel that this board runway causes the foxes to exercise more and to maintain better condition. However, there is a danger here that the foxes will lie on these board floors and defeat the original purpose of the wire flooring. If heavy strands of wire (No. 9 soft wire) are placed beneath the wire flooring, they hold it up an inch from the cross beams of the floor and greatly assist in giving the floor resiliency so that the normal activity of the foxes causes all fecal material to fall through. Wire flooring in this way practically eliminates the possibility of infection from bacterial or parasitic organisms of fecal origin, and gives rise to better ventilation and a cooler shed in hot weather. Smooth wire should be selected to eliminate chafing of the fur.

Lining the insides of the shed pens with galvanized iron to a height of 2½ feet from the floor has been found beneficial. This eliminates the chewing of wooden structures and further reduces chafing and injury through the wire partitions. The remainder of the partition between fox pens is usually constructed of fine mesh wire 3 feet wide with boards above that. The wire portion of this partition should be of chain link of ½- to ¾-inch mesh wire, so that the foxes cannot get their paws or tongues through it, otherwise these will be bitten off by animals in adjacent pens. Wire partitions between the pens are found preferable to solid board partitions because they offer better ventilation and the added visibility has a quieting effect upon the foxes.

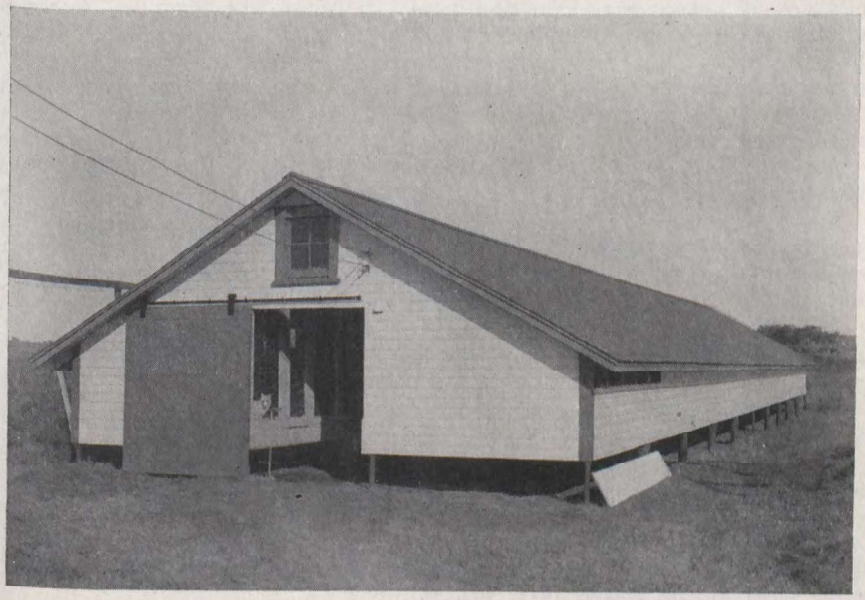

FIG. 5—Double-Roof Fox Shed.

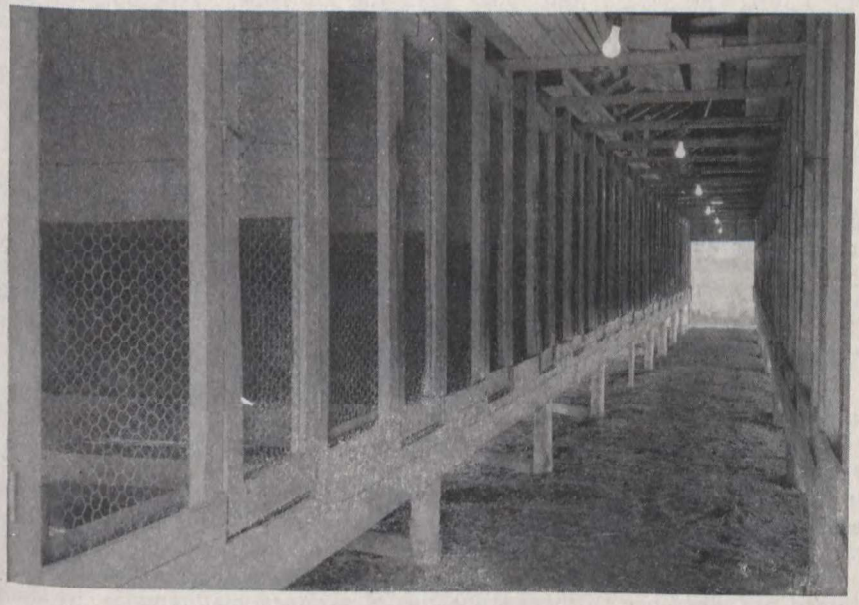

FIG. 6—Interior of Double-Roof Fox Shed, Showing Individual Fox Pens.

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Proper ventilation in a shed is essential to the production of good fur texture. If the furring shed is placed on high dry ground, especially in dry windy climates, and exposed to the wind, the fur on the foxes will become too dry. Therefore, it is advisable to build a fox shed in a north-south direction unless the prevailing winds would indicate otherwise. However, good results can be obtained in a shed 3 to 4 feet off the ground if hinged wooden shutters or factory cotton are used to protect the foxes from rain, snow and excessive under-draught, as was the case at the Bridgetown Station. The latter type of structure offers considerably greater ease in cleaning beneath the pens than is the case in low set buildings.

Size of the individual pens in a furring shed is important because this can affect the general well-being of the fox pups. A proper-sized pen reduces fur chewing, fighting and quarrelling for the feed. It gives rise to better fur and body condition.

A good average size for individual pens in a furring shed is 5 by 8 feet. A wire-bottomed pen of these dimensions will house 2 or 3 fox pups. This allows plenty of room for exercise and prevents overcrowding.

Where shelves are used on wire-bottomed pens, they should also be made with wire or slats and be so constructed as to be removable.

The correlation of good fur colour and shed construction shows that relatively dark sheds, without windows, are found to produce the best coloured fur in foxes. However, roof ventilators should be installed every 25 feet along the roof in hot climates. Hinged shutters two feet wide on each side are found most convenient to control ventilation and were built into the plan of the new furring shed at the Bridgetown Station.

The double-row shed with pens on each side of a central aisle produces the best conditions for furring foxes and at the same time is the most economical to construct. In this type of shed it is convenient to have a board-floored aisle 4½ or 5 feet wide and 1 foot lower than the fox pens. This built-in aisle is wide enough to work in without crowding, and it greatly facilitates the work entailed in catching and examining foxes.

Comparison of the housing methods in the Illustration Stations with those in surrounding fox ranches demonstrates the advantages to be obtained by proper sanitary maintenance of foxes under such conditions, in the following respects:—

(1) Many ground pens are still in use throughout the Maritime Provinces and the foxes are consistently found to be heavily parasitized, thus giving rise to poor condition, poor growth in the pups, thinly-furred pelts, and low breeding production. These defects have been mainly overcome in the Illustration Stations as a result of raised wire-floored pen construction. Although most of the more progressive fox ranchers in the different districts have changed to this method of rearing their foxes, it has not been completely adopted.

(2) Many ranchers have not used the principle of wire-floored pens to the fullest advantage. Wrong-sized mesh wire, the improper use of straw bedding on the wire floors to prevent chafing of the fur, improper direction of pens and sheds (not north-south) and failure to control excessive ventilation in their fox houses have also caused stained, excessively-dry pelts and in some cases poor breeding results. In relation to the part played by these details of pen construction and use of bedding, the Illustration Stations have set a good example in most cases for surrounding fox ranches, and from the results they have obtained by adherence to these principles of sanitary maintenance, in the production of growthy pups, relative freedom from parasites and clear coloured, densely-furred pelts, are demonstrating to surrounding ranchers the value of such attention to the details of proper housing methods for foxes.

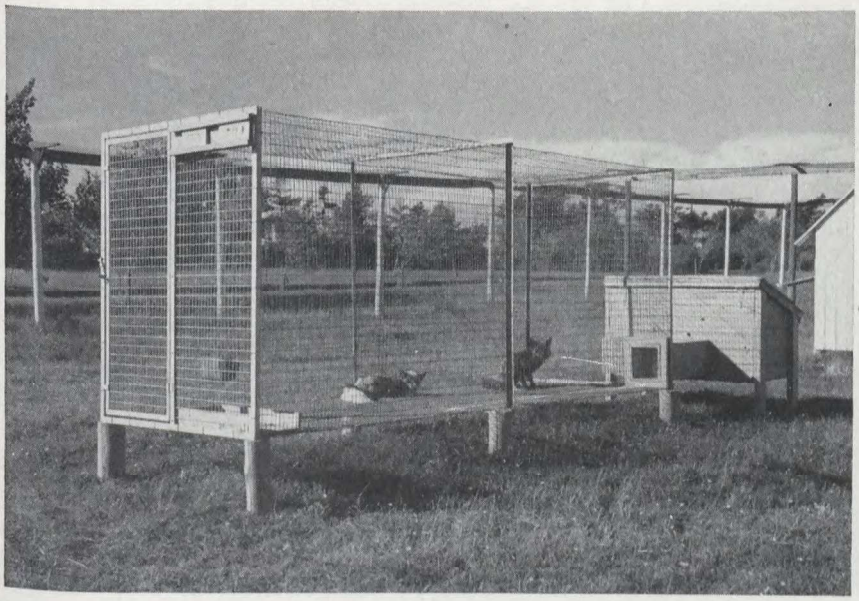


FIG. 7—All Metal Fox Pen of Low Construction.

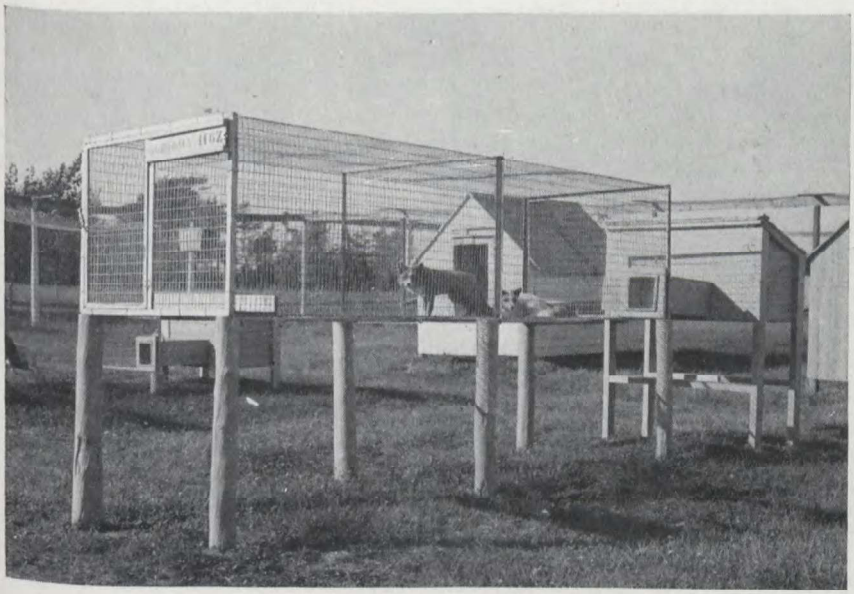


FIG. 8—All Metal Fox Pen of High Construction.

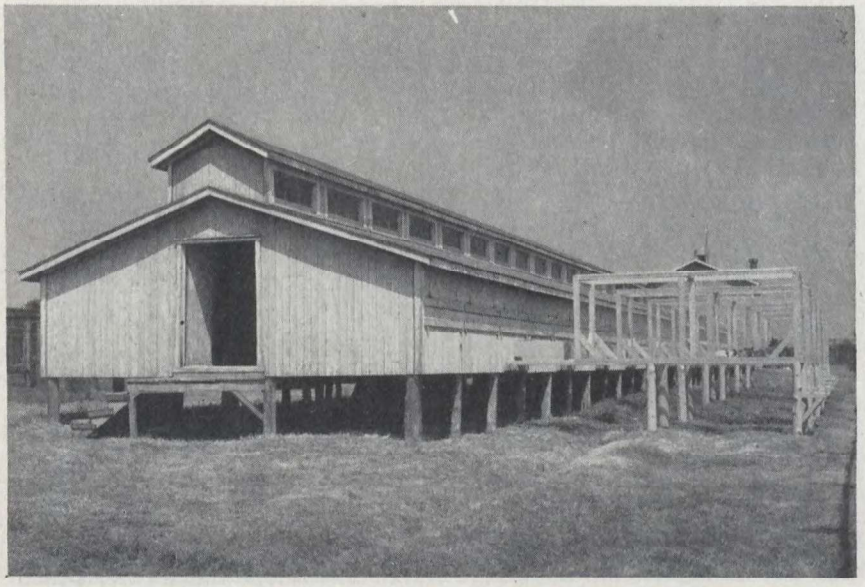


FIG. 9—Outdoor-Runway Pens Attached to Fox Furring Shed by Individual Chutes.

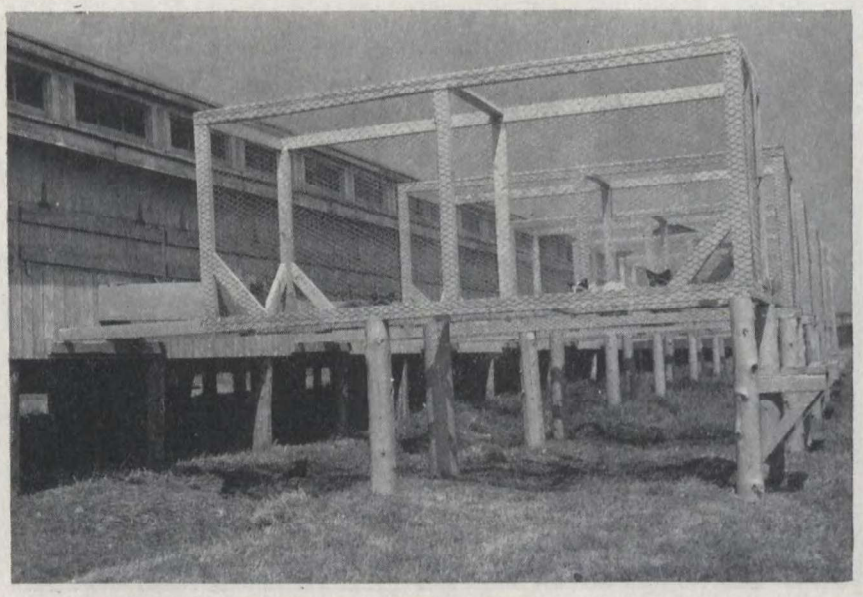


FIG. 10—Outdoor-Runway Pens, Showing Chute with Board Stoppers to Lock Foxes Inside or Outside.

Nutrition

The Maritime Fox Illustration Stations serve as an excellent testing ground to determine the comparative results obtained by the feeding of different rations to foxes maintained under comparable housing conditions, parasite control, management and with the same feeding procedures.

Comparative tests with different feed ingredients and feeding practices have been, however, limited to particular Stations or selected groups of Stations during the past four years because of shortages of certain dietary ingredients of fox rations during that period in some localities. Such shortages necessitate a flexible feeding schedule, so that the operator could take advantage of available feedstuffs in the particular locality and carry on during the war years to meet the requirements of fox ranching procedure to maximum advantage in the production of good pelts and also to obtain good reproduction on his fox ranch.

The overall picture, however, serves to demonstrate that good production and outstanding fur pelts can be produced by a number of different but wholesome fox rations. These diets vary widely in the selection and proportions of ingredients comprising the different fox rations used at the Illustration Stations.

Nutrition in relation to the preservation of feedstuffs

Different Illustration Stations employ different methods of storing fresh meats during the warm seasons of the year. At the Bridgetown Station a refrigeration plant with a capacity of 500 cubic feet has been in operation for five years, while at the Montague, P.E.I., Illustration Station, an ice house of 600 cubic feet capacity is used for meat storage. The Newcastle, N.B., Station uses practically all fresh-killed meats and has no adequate facilities for prolonged storage of large supplies of meats.

The other three Stations are mainly dependent upon local storage plants in their districts, and chiefly use frozen meat supplies purchased from the meat packing companies. The Salisbury, N.B. Station uses car-lot shipments of frozen and fresh meat for its ranches since there are no adequate cold storage facilities to hold over large quantities of feed.

The beneficial effects of available cold storage facilities have been made self-evident by comparison of the degree of food poisoning which occurs at Stations where refrigeration facilities are not available to the operators.

Sharp outbreaks of food (infection) poisoning have occurred at all Illustration Stations without refrigeration facilities during periods of excessively hot weather. The cause of the trouble was traced to spoiled or improperly handled meats. These outbreaks ranged from sickness and death, with one or two foxes, to a major outbreak of paratyphoid infection at the Salisbury Station, where one-third of the total number of foxes at the ranch died before the infection could be controlled. The latter infection was identified and treated by the Provincial Animal Pathologist in New Brunswick.

Only one case of food poisoning was traced to mouldy cereal feed. The most commonly offending feed was tripe. The old practice of keeping a frozen block of tripe or liver beneath a sack for three or four days until it is used up has been eliminated from the procedure of the Illustration Stations because of the frequent outbreaks of food poisoning resulting from this practice. Tripe or glandular meats, by the third or fourth day, were in a relatively decomposed condition and unfit for fox feed, it was found.

A comparative study, showing from 5 to 33 per cent mortality among Illustration Station foxes over a period of 5 years, clearly demonstrates the economy and convenience in fox ranching procedure of proper means for storing meats during the warm season of the year.

TABLE 2.—FOX DIETS—USED AT SIX STATIONS

Seasons	Horse	Tripe	Fish	Eggs	Jubilee	Rabbits	Cereals	Lip Meat	Liver	Hexite	Cubes	Lungs	Melts	Milk	Bread-meat	Water	Cooked Vege-tables	Cod liver oil	Purina
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%			
Bridgetown																			
Breeding	71·6						8·2				4·1								
Gestation	71·2		16·1				7·7				5·0								
Growing	58·2		13·5				6·1				22·2								
Furring	41·1		15·4				5·7				37·8								
Newcastle																			
Breeding	64·28														23·62		12·10		
Gestation	61·0														26·0		13·0		
Growing	57·49														28·34		14·17		
Furring	57·0														28·44		14·56		
Salisbury																			
Breeding	51·8	3·8	32·4	4·7	0·7	1·9	4·7	2·34											
Gestation	27·25	12·26	28·57	2·32	4·67		3·08	1·91	11·3	6·32									
Growing	14·0	7·0	42·8	2·5	6·2		25·0	2·5											
Furring	19·3	25·8	8·4	1·9			23·7					19·0	1·6						
Fredericton																			
Breeding	71·6	17·28					11·12												
Gestation	37·2	14·4	11·4				28·8							7·2				1·0	
Growing		42·1	29·0				24·0							3·9				1·0	
Furring	16·6						83·4												
O'Leary																			
Breeding	46·6	3·0	32·4								17·8								10·0
Gestation	39·5	3·8			9·9						11·6					25·2			
Growing					17·0		31·7									51·3			
Furring																			100·0
Montague																			
Breeding	72·7						27·3												
Growing	50·0						50·0												
Meteghan																			
Furring	73·5						23·1										3·4		

Growing Season—June, July, August. Furring Season—September, October, November.
Breeding Season—December, January, February. Gestation Season—March, April, May.

TABLE 3.—ILLUSTRATION STATION BUILDINGS, EQUIPMENT AND STOCK (SIX STATIONS)

Illustration Stations	Average number foxes on station	Other fur bearers	Size of farm	Fox ranching buildings	Equipment
Bridgetown	26	30 mink (breeding stock)	200 ac.	PENS—Umbrella Type— 7 —Box Type —12 FURRING SHEDS. 1 with 14 pens 6 x 8 1 with 14 pens 6 x 6 1 with 24 pens 6 x 6 REFRIGERATION BUILDING. 12 x 20.	—Butcher's equipment for slaughtering purposes. —Electric meat grinding equipment. —Refrigeration unit 480 cu. ft. capacity. —Carpenter's bench equipment.
Meteghan	29	20 mink (breeding stock)	2 ac.	PENS—Box Type—20 FURRING SHED with 50 pens 5 x 6. PELTING SHED, 40 x 18, 2 floors.	—Electric meat grinding equipment. —Carpenter's bench equipment. —Ice box 75 cu. ft. capacity.
Fredericton	16	None	3 ac.	PENS—Box Type—35 size 6 x 8. FURRING SHED with 30 pens 6 x 8. FEED HOUSE, 15 x 12.	—Electric meat grinding equipment. —Ice box 100 cu. ft. capacity.
Salisbury	30	None	160 ac. farm	PENS—Box Type—190 sizes 8 x 15 and 8 x 18 Umbrella Type—10 size 6 x 15 FURRING SHED with 135 pens sizes 4 x 8 and 6 x 8.	—Electric meat grinding equipment. —Butcher's equipment for slaughtering purposes. —Carpenter's bench equipment.
Montague	30	None	2 ac.	PENS—16 size 8 x 12 FURRING SHED with 15 pens size 6 x 10 FEED HOUSE, 15 x 20, 2 story.	—Electric meat grinding equipment. —Ice house, capacity 600 cu. ft. —Carpenter's bench equipment.
O'Leary	16	None	314 ac. farm	PENS—Umbrella Type—10 FURRING SHEDS—2 1 with 16 pens 6 x 6½ 1 with 14 pens 8 x 10.	—Electric meat grinding equipment. —Butcher's equipment for slaughtering purposes —Carpenter's bench equipment.
New Castle	27	None	75 ac.	PENS—Umbrella Type—6 —Box Type —40 size 15 x 5. FURRING SHEDS—125 x 8 pens 4 x 8 60 x 20 pens 6 x 8.	—Butcher's equipment for slaughtering purposes. —Electric meat grinder. —Carpenter's bench equipment.

The cost of construction and maintenance, (Bridgetown or Montague), may be reduced to a minimum by construction of a plant adequate to accommodate more meat than required by the owner. For a small storage fee the operators of these Stations are able to accommodate neighbouring fox ranchers. This factor has been an added advantage of the Illustration Station to the particular district and has clearly demonstrated the advantages of proper handling of fox meats in these localities.

NUTRITION IN RELATION TO PREPARATION OF FEEDSTUFFS TO FORM FOX RATIONS

A study of the effects of grinding the ingredients in fox rations and mixing them together into a hamburg consistency, (Bridgetown and Montague) as compared with feeding the foxes whole fish, chunk meat and cubes, was made at Salisbury Station to determine if there was a significant difference in (1) growth of pup foxes, (2) development of fur or (3) breeding results.

The diets consisted of almost the same quantities of similar ingredients fed to the foxes, except that some herring was used in place of fishblox at one Station.

The feeding trials were carried out during the summer, autumn and winter seasons.

The findings indicated that mixed feeds had an advantage over the feeding of chunk meat and whole fish in the resulting production of greater uniformity in growth, fur quality and breeding results.

Growth of pup foxes on chunk meats and whole fish was excellent in some litters, but in others which did not eat the crude diet so well, pups were stunted in growth and lagged behind the average size of the foxes on the ranch.

Fur quality showed similar wide variation and in those foxes which did appear advanced in fur development in the autumn months, many were deficient in dense underfur. They had the appearance of animals which had subsisted on meats and had not consumed adequate cereals in their rations. This discrimination, or self-selection, of feeds by the fox pups is eliminated in mixed feeds, and the uniformity of ration is thought to account for the greater uniformity in furring results of the foxes fed the mixed feeds in the control stations. The percentages of outstanding animals at these Stations and the control ranch are partly a result of the feeding methods used.

Breeding results were not so adversely affected by the mixed or unmixed rations, because the production was relatively good on all Stations at which the experiment was conducted, as shown in Table 4. In respect to the methods of supplying the feed to the foxes, the extra work entailed in grinding and mixing fox feed was shown to pay dividends in the greater uniformity of growth in pup foxes and in production of more uniform fur development. This uniformity facilitates the task of pelting foxes when they have reached the prime state. That is, less selection was found necessary at pelting time among the different litters, particularly in pup foxes, to obtain numbers of foxes ready for pelting at the same time. However, where very large numbers of foxes are maintained, as at Salisbury Station, the amount of detailed labour and handling of feed are important considerations. The feeding of chunk meat, whole fish and cubes for cereal, greatly minimizes the labour factor, which was in a state of acute shortage at the Salisbury Station during the war years, Table 8.

NUTRITION IN RELATION TO THE DISTRIBUTION OF FEED TO FOXES

Although this was not an active project, work was carried out to improve the feed receptacles in the umbrella-type fox pens. Previous trial tests and observations at the Dominion Experimental Fox Ranch and at outside ranches with

different feeding and watering devices led to the following types being recommended for use at the Illustration Stations.

1. A pail-type device suspended from the roof of the pen by a wire approximately one foot from the front of the pen. This type of watering device eliminates spilled water and torn wire. It has the defect of being unsuitable for small pups and the water becomes stagnant unless the pail is cleaned regularly.
2. The second type of watering device is one in which the watering pan, with a lip from it, projects through a board into the fox pen. From this small projection of 2 by 3 inches the fox drinks. The main reservoir pan of 6 by 8 inches by 3 inches in depth rests on a shelf. This watering device can be placed low in a fox pen for the convenience of young fox pups and it can also be readily filled without going into the fox pen. The sides of the reservoir pan are bevelled to counteract the effects of ice formation in it.

Some difficulty was experienced with loss of feed and chewing of the feeding boards at the Illustration Stations, which led to the introduction of a metal-covered feeding trough. This is constructed of a 4-inch board covered with galvanized metal. The arrangement is such that two 4-inch metal-covered boards, with the pen wire between them, form a feeding trough. The outside board of the trough is hinged so that it can be let down and thoroughly cleaned. This type of feeder was thought to be expensive to construct by the operators of the Stations but its superior and longer service has been found to compensate for the relatively greater initial cost.

At Stations using cereal feed in cube form, during the autumn season the operators soldered metal lips on the outer metal covering of the trough to retain the cube feed to better advantage. Such troughs are then found to serve well both for wet-mixed feeds and dry-cubed cereal feeds.

NUTRITION IN RELATION TO INGREDIENTS IN FOX RATIONS

Although the basic constituents of fox rations in the form of carbohydrates, fat, protein, mineral salts and vitamins may be all present in the diet, changes can be made in the relative quantities and sources of these nutrients which play an important role upon the growth of pup foxes and the development of desirable fur colour, density and texture.

Experimental feeding work at the Dominion Experimental Fox Ranch at Summerside, P.E.I., had shown that the addition of from 15 to 30 per cent fish to a ration for pup foxes, after they reached 12 weeks of age, gave superior growth results to similar control rations without the fish supplement. Recently it has been proved that fish protein contains an unidentified growth factor, which is also present in meat proteins to a lesser extent. See A. R. Robbley et al, Journal of Biological Chemistry, Vol. 173, p. 117, March, 1948.

To test the value of fish supplement under field conditions, fish was added to the rations at Illustration Stations, where this product was readily available. It is difficult to get a continuous supply of fish at the Newcastle Station, where, however, there is a plentiful supply of fresh horsemeat and offal meats.

Comparative feeding of fish was carried out at Bridgetown, using whitefish, cod and haddock, in the proportion of 15 per cent of the ration by weight, ground and mixed in the feed. At Salisbury, 30 per cent by weight of fish (frozen herring) was used three times weekly, where the fish was fed in the whole state.

Comparative estimates by examination and weight showed that the fox pups receiving the fish-supplemented ration grew slightly faster than foxes on the control ranch at Newcastle, and considerably faster than the Montague, P.E.I. and O'Leary, P.E.I. Stations, which were not feeding fish and did not have the

TABLE 4.—ILLUSTRATION STATION RANCH PRODUCTION—SEVEN STATIONS

Station	1943		1944		1945		1946		1947		Percentage of vixens mated in station	Average 5 Years production			
												Station		Ranch	
	Average per vixen	Average per ranch	Average per vixen	Average per ranch	Average per vixen	Average per ranch	Average per vixen	Average per ranch	Average per vixen	Average per ranch		Average per vixen	Average per ranch	Average per vixen	Average per ranch
NEW BRUNSWICK															
Salisbury	.....	3·8	.....	4·15	4·5	3·85	3·75	3·0	4·3	3·9	88	4·1	3·7	3·0	2·5
Fredericton	.....	.....	.....	.....	.....	.....	.....	3·8	.....	3·15	.....	.....	3·4*	.....	2·9
Newcastle	4·28	3·8	4·62	3·6	4·2	2·3	3·00	2·55	4·6	3·05	75	3·9	2·9	2·93	2·84
NOVA SCOTIA															
Bridgetown	.....	4·0	1·9	1·2	2·47	2·35	4·17	3·75	4·64	4·15	92	3·7	3·2	3·2	2·2
Meteghan	.....	.....	.....	.....	.....	.....	.....	.....	.....	5·05	100	.....	5·05*	.....	.....
PRINCE EDWARD ISLAND															
Montague	3·9	2·3	3·4	3·25	4·1	3·25	3·3	2·12	2·7	2·7	85	3·5	2·7	2·5	2·0
O'Leary	2·9	2·3	.....	3·75	2·95	2·95	3·95	3·95	2·1	1·6	92	2·9	2·4	2·6	2·1

* Stations at Fredericton and Meteghan have been in operation 2 and 1 years, respectively.

excellent cheap supply of fresh horsemeat and offal meats available at Newcastle. Offal meats comprise liver, spleen, heart, lungs and tripe—the glandular meats—which are an excellent addition to the muscle meat in pup-fox rations. The Island Stations were feeding frozen storage horsemeat and there was a marked difference in size of the foxes at the Bridgetown and Salisbury Stations by contrast with the foxes not receiving fish in their pup-growing ration. At midsummer the fish-fed pup foxes showed greater skeletal growth, possibly resulting from the extra calcium supplied in the fish bones.

HIGH MEAT RATION

A radical meat test ration was tried to determine its effects upon mating and reproduction in foxes at the Bridgetown Station. A control with a relatively balanced ration was simultaneously conducted under similar housing and management conditions at the Newcastle Station.

A diet of 100 per cent beef and horsemeat was fed to the Station foxes at the Bridgetown Station during the months of December, January and February. During the months of March and April the diet comprised beef 35 per cent, tripe 30 per cent, fish 25 per cent and cereal mixture 10 per cent.

Considerable difficulty arose in the breeding of the vixens on the high meat ration. Only 11 of the 18 vixens became pregnant. Three vixens did not mate and 4 of those mated did not become pregnant. The average pup production was 1·18 while the average vixen litter size was 1·9. Two pups died before the age of four weeks. The previous year's average production at this Station was 4·0, and the general average for a four-year period, exclusive of the year in which the experimental feeding trial was conducted, was 3·2 pups per litter ranch average.

At the control Station a diet of 60 per cent horsemeat and tripe, 25 per cent cereal, with 15 per cent cooked vegetables, was fed in a mixed ration of hamburger consistency. Here, the foxes came in "heat" without difficulty. Nineteen out of 20 vixens mated, had pups with an average production of 4·6 and a ranch average of 3·6 for the corresponding mating season, while the average ranch production for a corresponding four-year period was 2·93 per vixen kept at the Station.

Thus, the advantage of a balanced ration containing cereals and vegetables as well as meats, as recommended by the Dominion Experimental Fox Ranch, Summerside, P.E.I., was clearly demonstrated in relation to normal mating processes and production of good litter size.

Pelting Operations

PELTING OPERATIONS IN RELATION TO PREPARATION OF FOXES FOR PELTING

The chief preparatory operations with respect to getting ready for pelting are those made in (1) diet and (2) housing of foxes.

In the diet of foxes during the furring season, certain dietary ingredients can cause off-coloured or brownish-coloured fur which is undesirable and lowers the commercial value of the pelt. Considerable experimental work has been carried out on such factors at the Dominion Experimental Fox Ranch, Summerside, P.E.I. There it was found that oily fish, cod liver oil, fishmeal, bonmeal and food ingredients causing biotin deficiency in foxes were the cause of undesirable colour changes and excessive dryness of fox fur. However, in certain coastal areas of Nova Scotia (Meteghan) it was found that ocean whitefish, which are not fatty in nature, were being fed as the main source of animal protein to foxes which were pelting out with good colour. This led to a study of the relative effects upon fox fur colour of ocean whitefish, cod, pollock, haddock and ling, in fox rations during the furring season.

At Bridgetown Station where such fish are available, 15 per cent fish was added to the ration fed during the furring season, which otherwise consisted of 40 per cent horsemeat and tripe, 37½ per cent cereals, and the remainder finely-ground vegetables.

A control ration containing no fish during the furring season was fed at the Newcastle Station. Here the diet consisted of meats, 60 per cent, cereals 25 per cent and cooked vegetables 15 per cent.

Examination of the fur at this Station showed it to be advanced in primeness compared with that of the foxes fed fish at the Bridgetown Station, but there was no marked superiority of colour as compared with the foxes which received fish. At both Stations the housing conditions, although not identical, were made approximately the same by placing awnings over the umbrella pens at the Bridgetown Station. Both strains of foxes have common ancestral heredity and the management at each ranch was comparable.

This experimental procedure has been repeated with confirmation of the findings that ocean whitefish fed during the furring season do not cause an appreciable discoloration of fox fur. The feeding of fish in the diet throughout the whole year has now become a regular practice at the Bridgetown and Salisbury Stations.

During the autumn season, it has been found after feeding varying amounts of meats in proportion to cereals that red meats tend to stimulate the development of the guard fur. If this practice is carried too far the resultant pelt is flat because of poor development of the underfur. The latter is stimulated by the more fattening carbohydrate portion, or cereal in the ration. It has been found good practice, once the guard fur is developing nicely, to gradually increase the cereal portion of the ration so that the fox puts on weight and the underfur develops, giving it a dense coat of fur and preventing the pelt from becoming flat.

A comparative test was carried out at the Fredericton Station with a high ratio of cereal to meat in the ration, as compared with the average proportions of such at the Bridgetown and Newcastle Stations.

Here, it was evident that the proportion of cereal to meat was too high on the cereal side. Some of the foxes were well furred. However, they were too fat and were lacking in strength of fur as a result of the poorer growth of guard fur.

The maximum cereal content in a ration which gave the best average growth of guard and underfur was found to be between 27 per cent and 37 per cent of the total furring ration. This is for foxes already in good muscular condition at the beginning of the furring season, such as were found at the Bridgetown Station at the beginning of the autumn season. These foxes received 37 per cent cereal, 5½ per cent vegetables, 15 per cent fish (ocean whitefish) and 42 per cent meats. These observations in regard to the condition of the foxes at this Station were confirmed by the large number of prizes won by the Bridgetown Station at the Nova Scotia Provincial Live Fox Show. For example, the prizes won for the 1947 season are as follows:

Grand Champion Fox of Show.
Reserve Grand Champion of Fox Show.
Champion Standard Silver Male Pup.
Reserve Standard Silver Male Pup.
Champion Standard Silver Female Pup.
Reserve Champion Standard Silver Female Pup.
Champion White-Marked Male Pup.
Champion Standard Platinum Female Pup.
Reserve Standard Silver Adult Male.

Total—8 firsts, 9 seconds, 4 thirds and 1 fourth.

Housing of foxes also plays an important role in preparing foxes for pelting so that they produce clean, undamaged and not discoloured pelts.

TABLE 5.—STATISTICAL SUMMARY OF MARITIME FUR FARMS

1945

Province	Number farms	Capital value	Personnel		Animals born	Animal deaths	Animals pelted	Animals sold		Pelts sold		Animals on fur farms	
			Number	Wages				Number	Value	Number	Value	Number	Value
		$		$					$		$		$
Prince Edward Island	567	1,561,201	126	80,403	24,279	1,699	20,552	1,208	113,220	19,960	669,177	14,358	914,216
Nova Scotia	380	672,406	49	24,886	16,316	1,595	12,769	1,066	48,304	11,990	307,657	9,762	441,229
New Brunswick	426	925,233	100	71,014	22,656	2,054	19,021	962	62,196	16,845	460,070	13,494	651,438
Total	1,373	3,158,840	275	176,303	63,251	5,348	52,342	3,236	223,720	48,795	1,436,844	37,614	2,006,883

Average Sale Price of Maritime Fox Pelts—$29.44.

CHAFING OF FUR

With the advent of wire floors in the pens at the Illustration Stations, it was soon discovered by the operators that the hips, in particular, of the pelts were often worn or chafed on the wire floors.

Comparative trials were made to determine whether or not wire floors should be partly bedded with straw during the furring season.

Accordingly, at the Newcastle Station, the rear half of the pens was bedded with straw during the 1944 furring season. Control findings were checked at the Montague Station where the same kind and size (1") mesh wire was used on the pen floors.

Comparative examination of the fur toward the end of the furring season showed that the foxes on the bare wire floors had become more chafed, but their fur was cleaner than that in the bedded pens. In the latter there was evidence of urine and fecal staining on the belly side of the pelts which was, taking all factors into account, a greater detraction from the value of the pelts than the chafing by the bare wire of the Montague Station pelts.

Consultation with expert fur graders regarding this matter, confirmed the fact that staining of the belly side of the pelts lessened the value of pelts more than a slight amount of chafing of the clear-coloured fur from bare-wire pens.

The mesh should be large enough to allow all feces to drop through and yet be small enough to enable the foxes to run about on it quite freely. The "after-galvanizing" prevents the fox fur from catching between the cross wire and also makes it smooth for the feet of the foxes.

ADAPTATION OF UMBRELLA FOX PEN

The umbrella fox pens during the furring season are modified to give conditions similar to a half-roofed shed. The wooden floor is removed and used for roofing the space between the two pens (Fig. 4), while the wire pen portion is roofed in during this season to further reduce the exposure of the fur to the sunlight.

The modifications of the original construction of these pens were not found to be adequate to produce ideal furring conditions, or even to approach those of a double-roofed shed. Therefore, at the Bridgetown Station it was decided to use awnings to further supplement the shading in these pens during the autumn season. Although such awnings, made of jute bagging and factory cotton, were found to greatly increase the efficiency of the original Illustration Station pens, yet they are ugly in appearance and are really only a temporary substitute for a modern double-roof furring shed.

The relatively high prices received for fox pelts at the Illustration Stations, after selection from the fox population of the best animals for breeding stock and the sale of foundation animals to surrounding fox ranchers (Table 7) for improvement of their herds, have amply demonstrated the value of the methods used at the Illustration Stations over those of the average Maritime fox rancher.

PELTING OPERATIONS IN RELATION TO METHODS OF PROCEDURE

This is not an active project at the Illustration Stations because of the difficulties of supervising the work at the Stations during that season when at the Dominion Experimental Station Ranch, Summerside, P.E.I., checking of the fur and pelting operations are also in progress.

The recommendations for checking of primeness in the Illustration Station foxes are (1) examination of the general density of fur, especially the underfur; (2) examination of the development of fur, particularly on the back of the foxes;

(3) examination for clear-coloured leather at the nape of the neck, which will indicate that the whole pelt is prime if the priming process has reached that area of the skin which is the last to become prime.

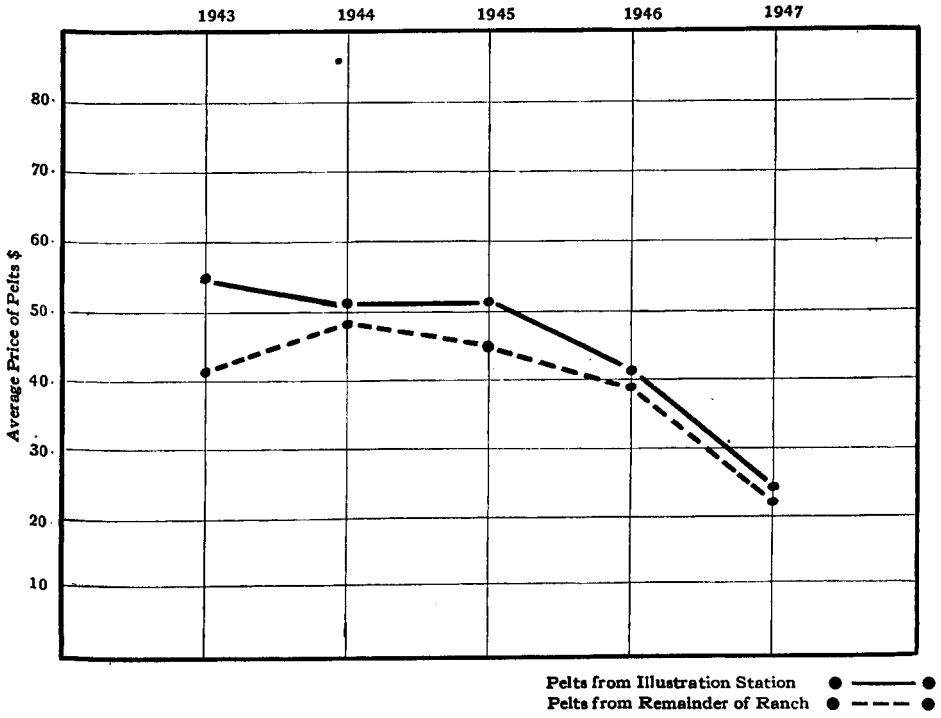


FIG. 11—Pelt Prices Received at Maritime Fox Illustration Stations.

Adult foxes are checked before the pup foxes, because the latter become prime about 3 weeks later than the adult animals. This was found to be the case particularly at the Salisbury Station where there was somewhat irregular priming of the fur among the foxes as a result of the method of feeding chunk meat, whole fish, etc., and some animals did not eat a balanced supply of the available feed ingredients. Where mixed feeds are used and each fox received an equal quantity of the same dietary ingredients, the priming process is quite uniform in pup foxes of the same breed.

PELTING OPERATIONS IN RELATION TO CARE OF THE RAW FUR

The examination of the raw fox pelt often shows the effect of bad handling by the operator, where he is not careful to keep the fur free from grease and properly stretched on the drying board.

Two Illustration Stations (Montague and Meteghan) built special cool dry rooms which are essential for storing pelts before they are shipped. These would accommodate from 1,000 to 1,500 pelts and were an excellent attribute to these Illustration Stations as an example to surrounding fox ranchers, in respect to the manner in which pelts should be handled during the actual operations of pelting, fleshing, drying and stretching on the pelting boards, turning and combing the fur, judging the fur for good and poor qualities in estimating the relative valuations, and storing the pelts until shipped.

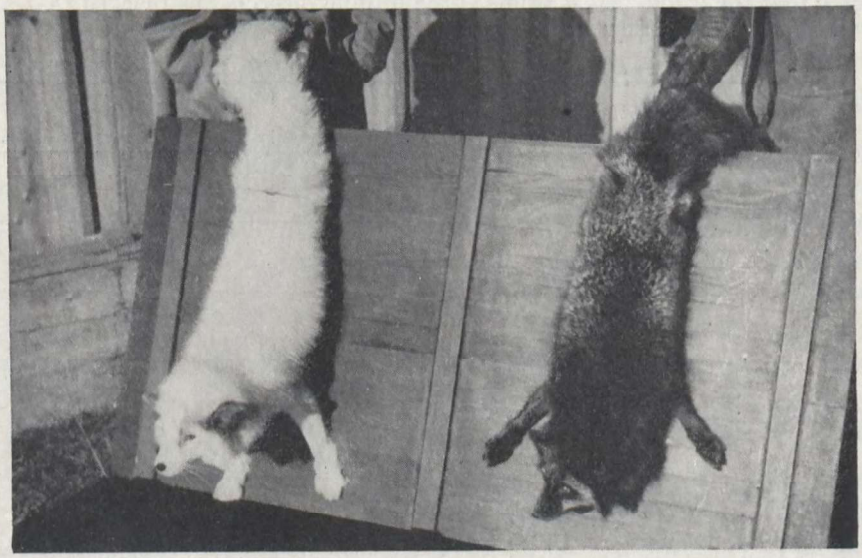


FIG. 12—The upper photograph shows the parent foxes, (Standard Silver and Standard Platinum). The Platinum parent was derived from a cross of Standard Platinum with Standard White Marked Foxes. The lower photograph shows the progeny from the cross, which are (Standard Silver, Standard Platinum and Standard White Marked pups). The presence of White Marked pups from such a cross shows genetic segegation of the two types, Standard Platinum and Standard White Marked, proving them to be distinct Mutant types.

Breeding of Foxes

BREEDING OPERATIONS IN RELATION TO SELECTION OF BREEDING STOCK

Comparison of the breeding methods employed at the Illustration Stations are outlined in Table 6, which shows not only whether simple selection or line-breeding was employed, but gives also the relative percentages of outstanding pups produced in the Station as contrasted with the other section of the ranch, as well as the number of superior dogs purchased, the percentage improvement from out-crosses, average pelt prices and prize-winning stock.

It may be seen that three Stations (Bridgetown, Fredericton, and Montague) used simple selection with the introduction of superior dogs, in contrast to the other Stations (Salisbury, Newcastle and O'Leary) which used a system of line-breeding in conjunction with the purchase of superior dogs.

The success of both methods depends largely upon the facts which influence the Station operator in selecting his superior male foxes.

The points upon which selection of such animals should be made have been outlined for the operators of the Illustration Stations. They are, briefly, individuality and ancestry.

The individuality was based chiefly on conformation, breeding record and fur qualities.

Ancestry of the same blood line as the foxes in the particular Illustration Station was recommended, with a history of good quality progeny back through the generations on the maternal and paternal side of the pedigree.

The main points emphasized were:—

(*a*) Size of foxes—good length and girth for large pelt size.

(*b*) Desirable fur characters—good density and length of fur, sharp, clear silver bars, clear-coloured guard and underfur. See Figure 13.

(*c*) High fecundity, quiet temperament, good milking characteristics are desirable. Avoidance of animals with rickets, curly fur, "V" necks and hereditary rusty tinge in the fur.

(*d*) Males—of good mating vigour and of particularly outstanding qualities, superior to the average vixen of the Station.

Certain instructive findings have been ascertained from the comparative data obtained where *simple selection* has been used in contrast to *line-breeding* and the purchase of outstanding dogs from time to time has been made in conjunction with each of these systems of breeding.

It may be noted that simple selection with the introduction of superior dogs has given rise to approximately 27 per cent of outstanding pups annually at the three Stations where it was practised—Bridgetown, Fredericton and Montague—which is a higher average than that obtained where line-breeding was conducted. In the latter case the average, where complete data are available, is just 17 per cent.

Improvement from the out-crossing with superior dogs showed a variable percentage of improvement of the stock, probably dependent upon how well the out-cross nicked with the Station stock and the quality of individuality in the outstanding dogs purchased.

It is noteworthy from Table 6, that a higher average pelt price was obtained by operators of Stations where line-breeding was employed. This is related to the fact that well matched bundles of pelts are worth more than where the pelts are variable in type and quality. Out-crossing, using simple selection methods of breeding, gives more variability and less uniformity of type in the herd of foxes than where line-breeding is practised. This is an important fact ascertained from correlating the average values received for pelts and the method of breeding

TABLE 6.—DATA IN RELATION TO BREEDING METHODS AND RESULTS—6 STATIONS

Station	Methods	Percentage outstanding pups in station	Percentage outstanding pups in remainder of ranch	Number superior foxes purchased	Percentage improvement from out-crosses	Average pelt price	Prize winners
		%	%		%	$ cts.	
Bridgetown	Simple selection with introduction of superior dogs	30	20	7 vixens 11 males	50	53 00	10 per year.
Salisbury	Line-breeding, simple selection and introduction of superior dogs	10	5	5 vixens 5 males	30	39 00	4 or 5 per year.
Fredericton	Simple selection and introduction of superior dogs	30	20	0 vixens 0 males	0	29 00	(No district show).
Newcastle	Line-breeding and introduction or superior dogs	20	5	5 vixens 10 males	20	65 00	(No district show).
O'Leary	Line-breeding and introduction of superior dogs	20	15	5 vixens 9 males	30	47 00 ($100 for single pelt)	1 or 2 per year.
Montague	Simple selection with introduction of superior dogs	20	10	5 vixens 2 males	40	46 00	5 per year.
Average of 6 Stations		22	13	4 vixens 6 males	28	46 50	

Meteghan Station in operation 1 year only—data not significant.

used. However, the data show that a higher percentage of prize-winning individuals were obtained on a basis of the simple selection breeding method. Here, however, individuality of the foxes is paramount in obtaining preference over competitors in the show class but not by increasing uniformity of the herd.

Hence, the combination of line-breeding with the introduction of superior dogs gives greater uniformity of the herd and average pelt value, but to some extent neutralizes the spectacular effects of out-crossing with outstanding dogs, because the greater prepotency of the line-bred herd tends to hold the quality of the progeny from out-crosses closer to the average herd value.

The good effects of a definite system of breeding were well recognized by the neighbouring fox ranchers in the districts surrounding the Maritime Fox Illustration Stations where a conservative estimate of the percentage of Station foxes superior to those of neighbouring ranches was made, as shown in Table 6. Similarly, the recognition of the superior quality of foxes bred at the Stations is amply reflected in the annual live-animal sales as listed in Table 7.

Reference to Table 5, gives the average price of $29.44 paid for fox pelts throughout the Maritime fox ranches in 1945. This figure is significantly lower than the average return of $52.50 for Illustration Station pelts, as indicated in the graph (Fig. 11) for the corresponding year. These figures are compared because of available statistical data for fox pelts from the Maritime fox ranches (Table 5) and also because they are more representative prices for Canadian fox pelts than during the last two years when prices have been affected by post-war conditions.

During the past five years, 5 per cent new mutant-type foxes have been included among the breeding stock of the Maritime Fox Illustration Stations to bring them in line with the average Maritime fox ranch.

The methods for breeding these mutant-type foxes have been clearly outlined in the bulletin, "Genetics of Some New Type Foxes," which explains the genetical basis, with formulae showing the results of different crosses and the most economical manner in which mutant foxes can be produced. Similarly, some of the apparently contradictory results of breeding these mutant-type foxes have been explained; that is, the occasional production of white-marked progeny from crosses of standard platinum foxes with standard silver animals. This evidence of segregation shows that the white-marked mutant and standard platinum types are distinct mutant types. See Figure 12. Such information has assisted Maritime fox ranchers to grasp the scientific basis of breeding mutant-type foxes and has cleared up many of their breeding problems, thus making the Illustration Stations focal points for authoritative information. The operators of the Stations have been of considerable assistance to beginners in fox-ranching procedure.

Figure 11 shows the relative price received each year for pelts from the Illustration Stations and for pelts taken from other foxes on the remaining parts of their ranches. Here, the difference in pelt value is not very great because the same operator managed both ranches, introducing many of the practices employed at the Station, and also used matings from superior station dogs on his other stock on the remainder of his ranch.

BREEDING OF FOXES IN RELATION TO MONOGAMOUS AND POLYGAMOUS BREEDING PROCEDURES

A study of production on the Maritime Fox Illustration Stations shows that average vixen production ranged from 2·9 to 4·1 and average ranch production from 2·4 to 3·7, as shown in Table 4. Corresponding figures for the remainder of the foxes at these Stations were lower, with figures for average vixen production 2·5 to 3·0 and average ranch production 2·1 to 2·84 per litter. A comparative study of monogamous breeding, as practised in modified form at the

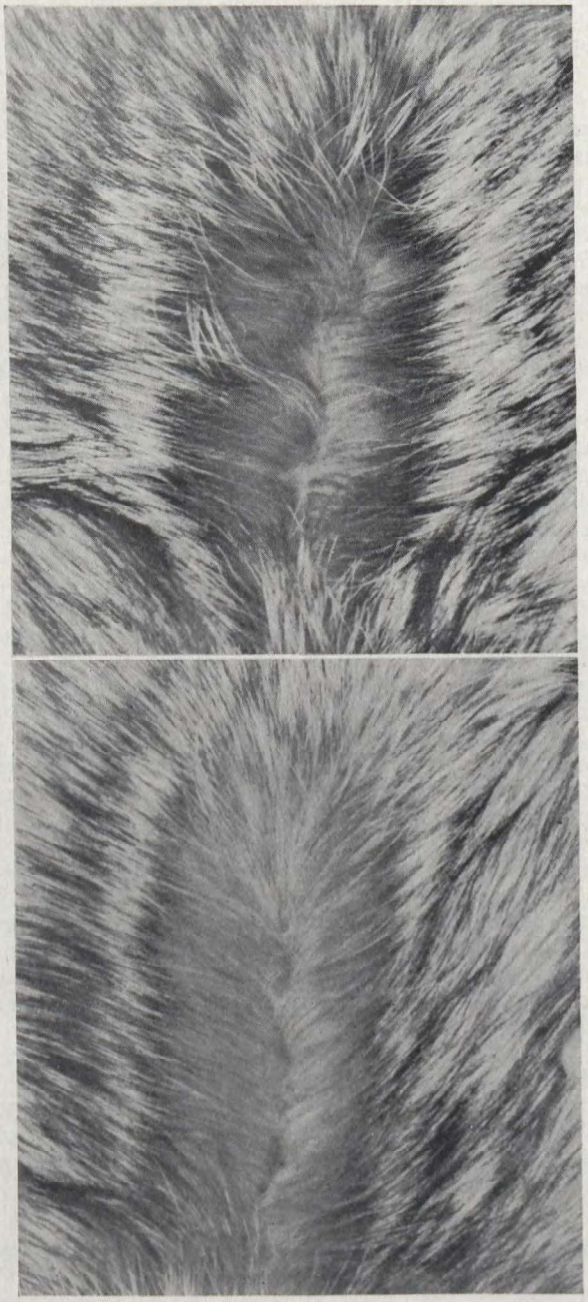


FIG. 13—Top photograph shows: Sharply defined silver bars of desirable length in the fur of a standard silver fox. The underfur is clear, dark slate blue in colour. Lower photograph shows: Lighter coloured, clear underfur, in a fox of lighter colour phase.

Salisbury Station, in relationship to production, shows that the highest production was obtained at this Station. Although this system greatly reduces labour it entails the maintenance of a larger number of male foxes than where polygamous mating is practised, the latter system enabling the rancher to sire more progeny by his most outstanding dogs.

At the Newcastle and Bridgetown Stations, polygamous breeding methods are used with but a slightly lower production scale as shown. However, a considerably higher percentage of outstanding fox pups, 20 to 30 per cent, were sired at these Stations as against 10 per cent where polygamous mating was practised. This is correlated to the ability of the operator to use the outstanding sires to a greater extent on the ranch using a polygamous mating system. Where very large numbers of foxes are maintained the monogamous system of mating is the only feasible method to employ (e.g., Colpitts) in spite of its other defects.

TABLE 7.—SERVICE OF MARITIME FOX ILLUSTRATION STATIONS TO FOX RANCHERS

Station	Average number of visitors per year	Live foxes sold annually to neighbouring ranchers	Percentage of neighbours who adopted Illus. Sta. type pens	Percentage of station foxes superior to those of neighbours	Percentage of neighbouring ranchers assisted with problems
			%	%	%
Newcastle	200	25	75	50	90
Fredericton	25	15	50	30	15—20
Salisbury	25	4	5	10	—
Bridgetown	100	26	75	50	95
Meteghan	35	25	60	60	95
O'Leary	100	31	75	50	50
Montague	100	2	50	10	50

STANDARD OF EXCELLENCE IN EACH ILLUSTRATION STATION

This project was affected during the war years as a result of gasoline shortage, restriction of travel, reduction of number of field days and fox shows which limited the station operators' opportunity to make comparison of their stock with those of their neighbours at field days and at the different Illustration Stations. This condition was partly overcome by the Supervisor making an impartial rating of the fox pups at each Station annually and conveying the information to the operators. This was done on a comparative basis between Stations and with respect to the rating given the fox pups the previous year, as to whether or not they showed as much improvement in quality as might be expected.

The work, in respect to comparative estimates of quality and growth, was seriously hindered by feed shortages during war years of essential ingredients in the fox rations. See Table 8.

However, under controlled conditions within the individual ranches it could be observed that the foxes, under station conditions of sanitation and management, showed a consistently higher percentage of outstanding fox pups than the remainder of the ranch herd, as shown in Table 6.

TABLE 8.—LABOUR AND FEED SHORTAGES AT MARITIME FOX ILLUSTRATION STATIONS—7 STATIONS

Province	Station	Labour Shortage Years	Horse-meat	Tripe	Fish	Liver	Spleen	Bone-meal	Cereals	Kinds of meats used
Prince Edward Island....	O'Leary	1940-1946		x	x	x	x			(Frozen meats used).
	Montague	1943-1946	x		x	x				(Fresh and frozen meats).
New Brunswick.....	Newcastle	1940-1946							x	(All fresh meats).
	Fredericton	1946-1947	x					x		(Fresh and frozen meats).
	Salisbury	1940-1947		x	x	x	x			(Fresh and frozen meats).
Nova Scotia.....	Bridgetown	1943-1947		x		x				(Fresh meats).
	Meteghan	1946-1947	x	x		x				(Fresh and frozen meats).

x=Products in short supply.

Special Practices and Examination in Relation to Parasites

Several methods requiring some scientific training and equipment have been introduced into the methods of fox ranching procedure, such as the testing and treating of foxes for parasitic worm infestation, the testing of males for spermatozoa, testing of vixens for "heat" by direct examination of swelling of the vulva or the vaginal smear test.

SPECIAL PRACTICES AND EXAMINATION IN RELATION TO PARASITE TESTS

The test for parasitic ova in the feces of foxes was demonstrated to the operators of the Fox Illustration Stations by the former Supervisor of these Stations, J. C. Jack. It consists of examination of the droppings for worms or parasitic eggs. To find and identify the eggs, a microscope is necessary with a minimum magnification of approximately 100 diameters. The procedure is as follows: clinically significant cases may be detected by a simple fecal smear on a microscope slide, while a more detailed examination may be carried out by the flotation method whereby half an ounce of stool from the fox to be examined is placed in a half-pint bottle containing 3 to 4 tablespoonsful of salt solution (dissolve 1 lb. table salt in a quart of water) and broken up as thoroughly as possible. The bottle is then filled with salt solution and allowed to stand 10 to 16 hours. Worm eggs float to the surface of the salt solution in the bottle and can be conveniently transferred to a slide by means of a glass rod or pencil. The latter is brought into contact with the surface of the salt solution and the small drops that adhere to it are transferred to a microscope slide. A cover slide is placed over the droplets before they are examined under the microscope.

This ability to identify the different species of parasitic worm ova has been a factor in making the Illustration Station operators of service to surrounding fox ranchers where ranchers did not have microscopes or the technical knowledge to carry out the test. Figure 14 shows ova of fox internal parasites and coccidia.

The recommended practice at the Stations is that the operators check and treat their foxes for parasitic infestation (worms, fleas and earmites) at the onset of hot weather and again in late autumn well before the breeding season, but after the autumn freeze-up so that reinfestation cannot occur that year.

Testing the semen of male foxes for fertility is now routine practice on Maritime fox ranches chiefly as a result of the assistance and example set at the Illustration Stations.

The technique of testing semen for fertility is briefly as follows: A small glass rod is introduced into the vagina of the vixen. The seminal fluid adhering to the rod is then smeared on a glass slide and examined for sperms under a microscope with about 100 to 300 magnifications.

If a drop of semen cannot be obtained, the glass rod should be moistened with a salt solution before inserting it into the vagina. A good smear when freshly drawn shows numerous cells, and broken cells of various sizes from the vagina are usually present. Occasionally the sperms in the smear are dead. This does not necessarily indicate that the male is sterile, but may depend upon the length of time the smear was taken after mating, the temperature of the smear, contamination with urine, or from dirty glassware. It is found that sperms do not live very long in the vagina, as conditions there are not favourable for their existence. Temperature is also important because sperms quickly lose their activity when the temperature becomes lower than that of the body.

Abnormal and broken sperms in the smear do not necessarily indicate that the male is at fault. They may be the result of crushing the sperms with the glass rod, or with another slide when the smear is dry, or particularly from allowing the smear to get frozen. When smears are made, the proper precautions should be taken to get live, active sperms before condemning the male.

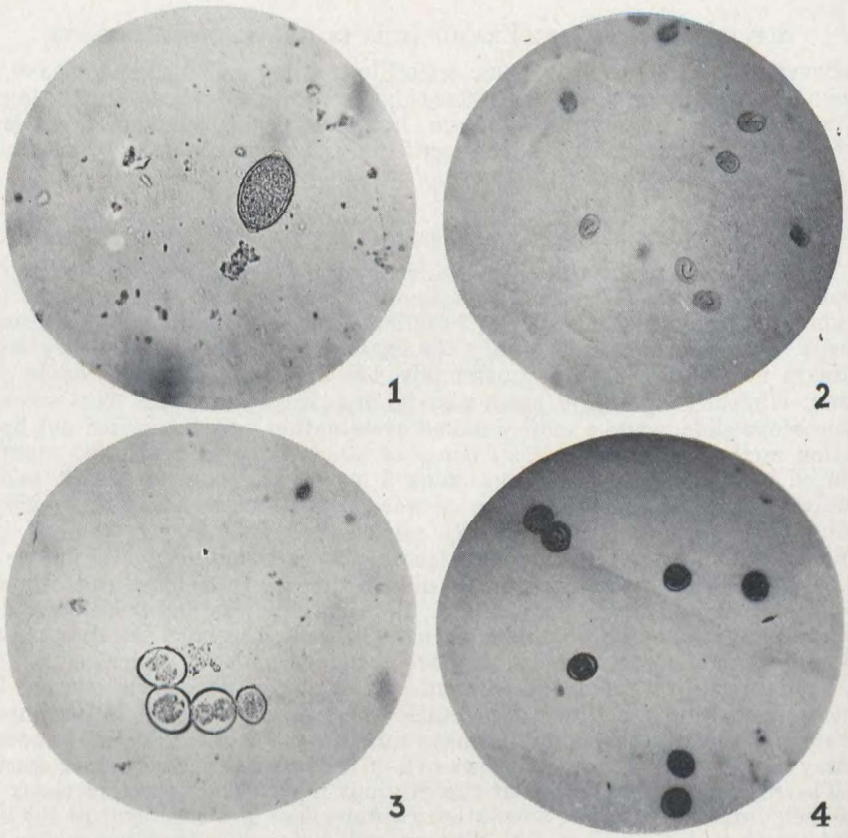


FIG. 14—*Coccidia and Ova of Fox Endoparasitic Worms.*
1. Fox Lungworm Egg (*Crenosoma decoratum*) x 375.
2. Fox Hookworm Eggs (*Uncinaria stenocephala*) x 100.
3. Fox Coccidia (*Isospora bigemina*) x 375.
4. Fox Ascarid Eggs (*Toxocara canis*) x 100.

SPECIAL PRACTICES AND EXAMINATION IN RELATION TO FOOD POISONING

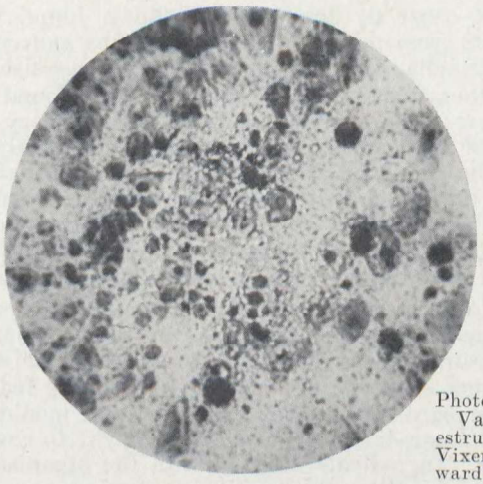
The problems of food poisoning or food infection and the feeding of unsuitable kinds of fish to fox pups, and of bloating, resulting from mouldy cereal feeds, have been carefully watched at the Illustration Stations where outbreaks of such trouble have arisen.

The Illustration Stations also have been of great service to the surrounding fox ranchers not only by setting an example but by offering personal advice in matters pertaining to the proper handling and storage of fox feeds. This factor has been very evident in the Illustration Station records, as indicated in Table 7 under percentage of neighbouring ranchers who have been assisted with their problems.

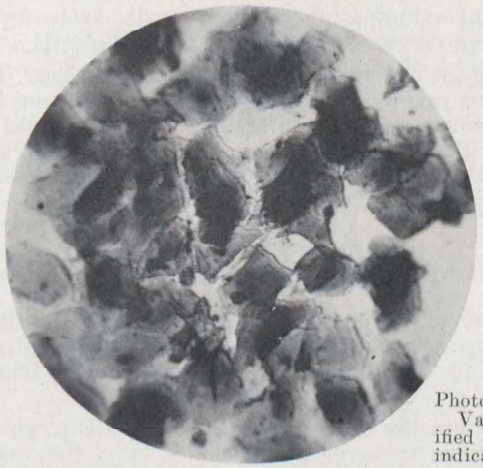
Food poisoning is probably the chief cause of deaths among growing fox pups and the following recommendations are in operation at the Illustration Stations.

The possibility of bacterial infection is particularly dangerous during hot weather, at which time feeds tend to spoil rapidly unless adequate refrigeration facilities are available, and also because of the greater possibility of contamination by flies at this season. In such cases, where food infection is suspected, consultation with the local veterinarian is recommended.

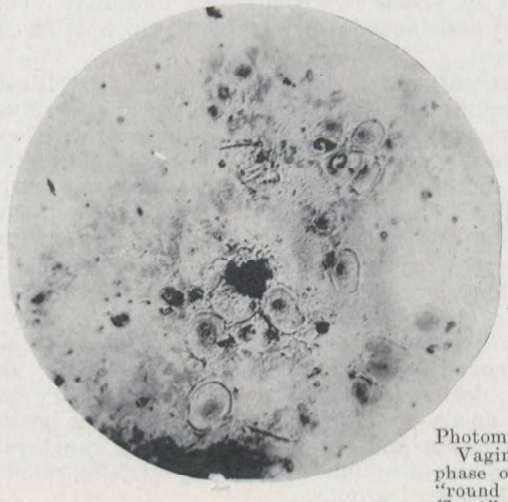
FIG. 15.



Photomicrograph X 375
Vaginal Smear showing "Pro-estrus phase"[8] of oestrus cycle. Vixen may come in "heat" toward end of this phase.



Photomicrograph X 375
Vaginal Smear showing "Cornified cell phase" of oestrus cycle indicating period of "heat".



Photomicrograph X 375
Vaginal Smear in metoestrus phase of oestrus cycle, showing "round cells" indicating end of "heat" period.

Another important cause of deaths and sickness found to occur among growing fox pups results from the feeding of scales, fins and entrails of certain species of fish, such as smelts, carp and suckers, etc. These fish, when mixed in the raw state with other ingredients of the feed, are found to destroy the vitamin B_1 of the other feeds, giving rise to a B_1 deficiency in such a diet. The early symptoms of this disease are weakness and paralysis of the hind limbs of fox pups. The condition is progressive and eventually causes death of the affected animal unless adequate treatment with the required vitamin B_1 (thiamine chloride) is carried out. This deficiency can be avoided by cooking the fish before mixing it with the other feeds, or where cooking is inconvenient, the fish may be filleted or fed alone once or twice a week to the foxes.

Bloating in foxes often results from eating mouldy or fermented cereals. This condition is particularly associated with the use of concentrated cereal feeds which tend to absorb water and swell greatly when moistened. Bloating can be avoided by proper soaking of the cereal before it is fed and by storing all cereal feeds in a dry place so that they do not become mouldy. Cereal feeds manufactured flour or fungus-infected meals are thought to cause sickness and deaths among fox pups. Ingredients infected with the organisms causing ropy flour may be made into biscuits which will not disclose the presence of this danger. Upon bacterial examination of such feeds, spore-forming organisms will be found which have survived the cooking of the biscuits.

Care is necessary in the choice of cereals and their storage. The latter should be such that it keeps out rats and mice, as fecal contamination by these rodents is a well recognized source of food infection. Meats should be kept under refrigeration and when there is any doubt of an uninspected carcass being free from infection, the meat should be cooked or tried out on a few animals before it is used generally throughout the ranch.

SPECIAL PRACTICES AND EXAMINATIONS IN RELATION TO BREEDING FOXES

The usual procedure to determine whether or not a vixen has come in heat during the breeding season, except where monogamous mating is practised, is to examine the vulva for swelling on alternate days and to trial test the vixens with active male dogs.

However, on large ranches where testing all the foxes which are found to show swelling of the vulva involves an enormous task, the vaginal smear test for detection of heat in vixens overcomes this difficulty. This test has also been found of special assistance with pup foxes which often show little or no swelling of the vulva.

The system in operation for checking vixens on the Illustration Stations, however, has been mainly dependent upon swelling of the vulva and trial tests when a polygamous mating system has been employed, with use of the vaginal smear test in exceptional vixens which were difficult to get mated. The average percentage of vixens mated among those kept for breeding purposes is given in Table 4. Considerable assistance has been given by the Station operators to ranchers who experienced difficulties with the mating of their foxes.

The kinds of service rendered by operators of Maritime Fox Illustration Stations to surrounding ranchers are as follows:—Assistance in selection of breeding stock for fur quality; assistance in detection of primeness of fur and pelting procedure; assistance in drawing up breeding schedules; assisting in testing foxes for potency, (sperm test); assisting in testing vixens for "heat", (vaginal smear test); demonstrating construction of sanitary wire-floored pens; assistance in storing meats and methods for slaughtering horses; assistance in checking foxes for parasites and treatments; advising ranchers with regard to the genetics in the breeding of mutant-type foxes; advising ranchers in the treatment of anaemia in platinum fox pups.

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