DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

POULTRY DIVISION

REPORT OF THE DOMINION POULTRY HUSBANDMAN

F. C. ELFORD

FOR THE YEAR 1929

Breeding house, Central Experimental Farm, Ottawa.

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POULTRY DIVISION

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GENERAL CONDITIONS

The year 1929 was a good average year for the poultry business in general. Hatching results in the spring of 1929 were quite the equal of previous years, a gradual increase being shown from year to year due mainly to improved methods of feeding and caring for breeding stock. An increase in the application of sanitary methods and disease prevention in rearing is gradually showing its effect on the quality of both farm flocks and specialized enterprises.

Egg prices were very similar to those of the previous year and returns were satisfactory on the average. Meat prices were rather disappointing on the whole particularly in so far as the turkey market was concerned. Poor prices for turkey meat were the rule in November and December prior to the holiday season. The price of fowl held up well however, through the year. British Columbia and Prairie eggs continued to come east in volume as in past years.

The hatching business continued to increase and orders for chicks were well up to the capacity of the hatcheries to supply.

THE DIVISION

With a few exceptions the work of the Division progressed very well during the year 1929. Fertility and hatchability were slightly superior to the previous year and viability of chicks was very much so. During 1928, 90·9 per cent of the chicks hatched were alive at three weeks of age, while during 1929—95 per cent were alive at that age. Production records for the laying season of 1928-29 were the best for some years past.

In experimental work a most successful year was experienced. Battery brooders were initiated into brooding operations with fair success. A large number of incubation, brooding and rearing experiments were successfully completed. A new series of egg production experiments was commenced in the fall of the year.

Contests and Registration experienced a successful year. More birds were registered than ever before since the inauguration of the Registration policy in 1922. A pleasing feature of the closing month of the year was the commencement of a poultry plant and Egg Laying Contest of forty pens on the Dominion Experimental Station at Harrow, Ont. This fills a long felt want in the province and gives a contest under less extreme climatic conditions than at Ottawa and similar to those of the section of the province which produces the bulk of Ontario's poultry products.

ACKNOWLEDGMENTS.—The officials of the division and the particular branch of the activities for which they are responsible are as follows:—

Mr. Robertson, Chief Assistant, has the direction of the division during my absence and is directly in charge of the breeding work and oversight of the Central Farm. He is responsible for that part of the report dealing with breeding.

Mr. Taylor is in charge of Canadian National Egg Laying Contests and Registration. The compiling of the Canadian National Poultry Record Association's Annual Blue Book, the official publication of the registered poultry breeders of Canada, is under his care.

Mr. Gutteridge has the oversight of experimental work, the direct supervision of those conducted at the Central Farm and assists in the direction of those carried on upon the branch Farms. Also, he has the responsibility of the compiling of this report.

Mr. Roy has charge of the work in the province of Quebec, including assistance to the poultry men upon the branch Farms, co-operation with the provincial Department of Agriculture, registration, inspection and survey work.

Mr. McConnell assists in the preparation of exhibit material for all shows where this division is represented, and he attends in person those places within distance of Ottawa. In addition to this he has charge of the poultry and egg account forms that are received from correspondents throughout Canada.

Dr. Weaver is the medium through which this division co-operates with the Health of Animals Branch of the federal Government. He is in charge of the laboratory at this office which is equipped for the investigation of poultry diseases. A large number of autopsies are made annually and methods of prevention and treatment for numerous ailments considered. The Experimental Farm flocks throughout the country are gradually being tested for pullorum disease through the agency of this laboratory.

WORLD'S POULTRY SCIENCE ASSOCIATION

A few remarks upon the activities of the president of this association, who, as has been noted before is the Dominion Poultry Husbandman, may be of interest.

Continuing the visit to European and other countries which was started last year the president in 1929 visited the following countries: France, Portugal, Spain, Italy, Switzerland, the province of Bavaria, Czecho-Slovakia, Austria, Hungary, Jugo-Slavia, Romania, Turkey, Greece, Egypt, and Palestine.

As was the case in 1928 the visit was for the purpose of interviewing the Ministry of Agriculture in each country with the object of securing recognition of the World's Poultry Science Association and co-operation in the World's Poultry Congress for 1930.

To make this visit, and to assist the local 1930 Congress Executive in London took a little over three months, a part of July, August, September and October. The result of the visit to these countries was very satisfactory, and one of the things noted on these visits was the same as was experienced last year, when so many of the ministers called upon made the statement that they had learned a great deal concerning Canada's greatness through the World's Poultry Congress held in Ottawa in 1927.

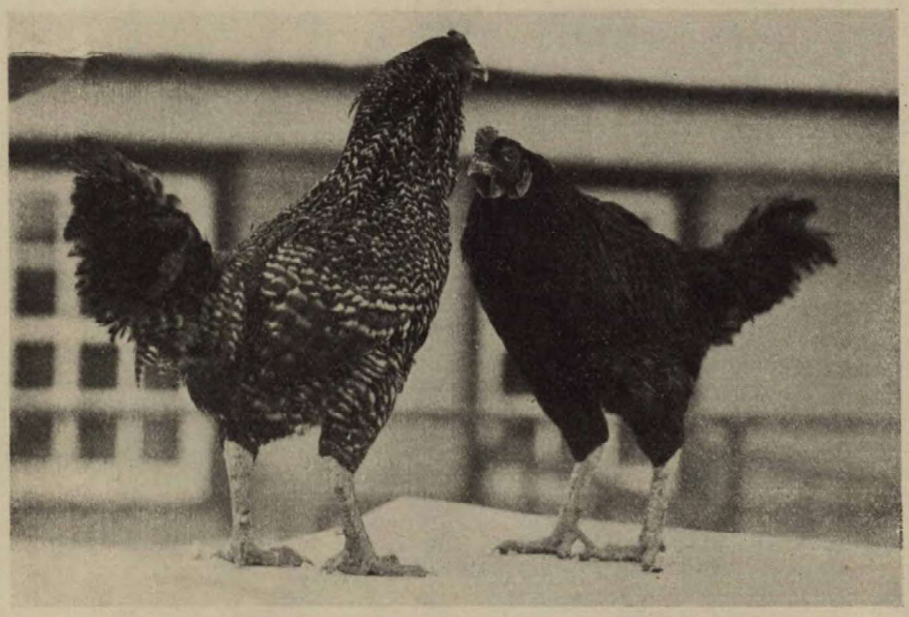
BREEDING

There were hatched during the past breeding season at the Central Experimental Farm 9,503 chicks of which 1,165 were sold as day olds, 2,274 used for feeding experiments or other experimental purposes, 589 sold as broilers and the balance used for the purpose of stock replacement, and the sale of breeding stock to farmers. For this latter purpose there were 575 birds disposed of, all the males being from dams that had produced at least 200 eggs in their pullet year

and the females sold were of similar lines being such as could be spared after meeting our own requirements. There were also disposed of 4,005 hatching eggs from stock of similar breeding to that which supplied our own hatching eggs and a limited number of duck eggs and breeding ducks and geese.

The year previous Rhode Island Red and White Wyandotte hatching eggs had been secured with the idea of hatching foundation stock, but after trapping the pullets raised from these eggs, it was found that the lines were not sufficiently satisfactory, so that no stock of these breeds has been retained and at the present time only Barred Plymouth Rocks and White Leghorns are being bred at this Farm.

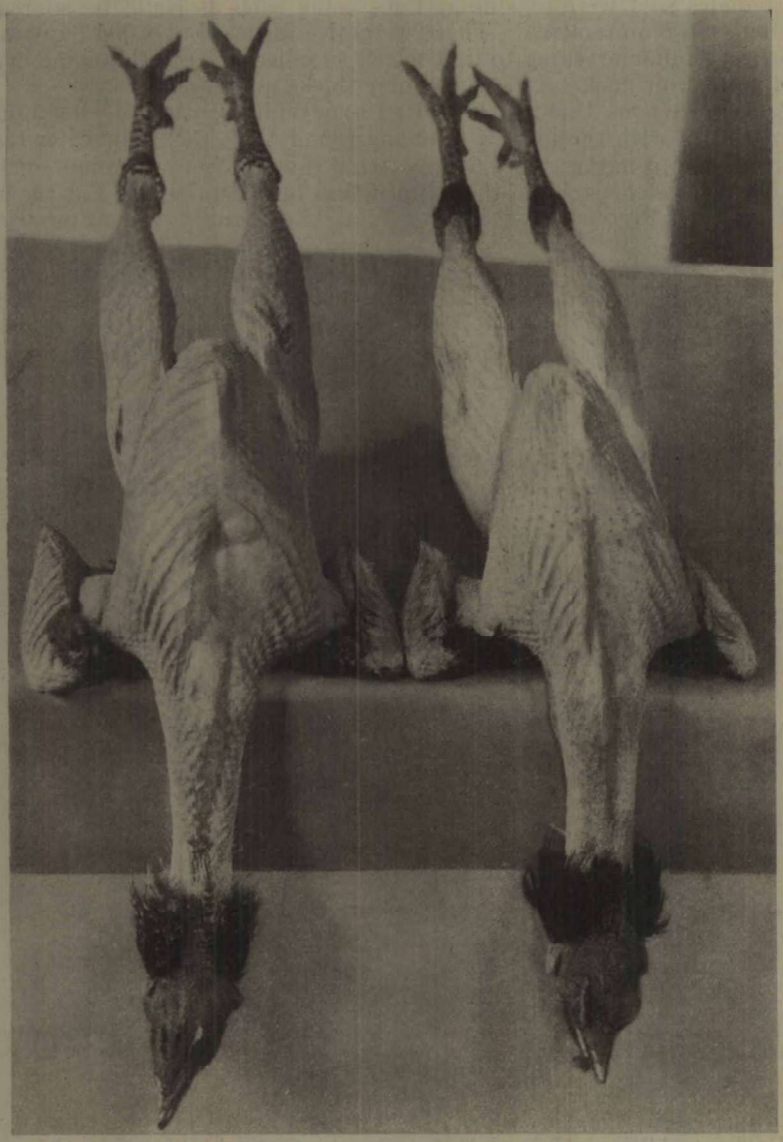
The Dark Cornish male was used as a top cross on females of a number of breeds. The resulting females were disposed of as broilers, and the cockerels were caponized. For this purpose Barred Rocks, Rhode Island Reds, Silver Gray Dorkings and Jersey Black Giants were used. The only breeds from which a



Males of Cornish x Barred Rock and Cornish x Rhode Island Red cross. Note particularly that Cornish type and carriage completely dominates the same characteristics of the Barred Rock and Rhode Island Red breeds in this cross.

sufficient number of chicks were raised to give a satisfactory estimate were Barred Rocks and Rhode Island Reds. In the Cornish-Barred Rock cross sex limited colour inheritance was apparent, the pullets all coming black and the cockerels of the Barred colour pattern, whereas in the Cornish-Rhode Island Red cross the sexes were indistinguishable at birth both maturing into red birds more or less marked with black. The birds resulting from the Cornish-Barred Rock cross were much more uniform than the Cornish-Red cross although some of the latter showed exceptionally nice finish when dressed.

One of the outstanding features of the past year was the phenominally low chick mortality experienced at Summerland. Special mention is made of this to call attention to results attained by close attention to strict sanitary precautions and by blood testing the flock for pullorum disease and the discarding of all breeders that reacted to the test. In 1924 only 37·5 per cent of the chicks hatched at the Summerland Farm were raised to wing-banding age (three weeks). In



Dressed capons. Left—Cornish male x Barred Rock female. Right—Cornish male x Rhode Island Red female.

1925 only 67·9 per cent. In 1926 the presence of pullorum was suspected and more strict precautions were taken along sanitary lines, with the result that 92·7 per cent of the chicks hatched were raised to wing-banding age. In 1927 blood testing was started and during that year 92·7 per cent of the chicks were raised and in 1928 this had risen to the splendid record of 98·2 per cent.

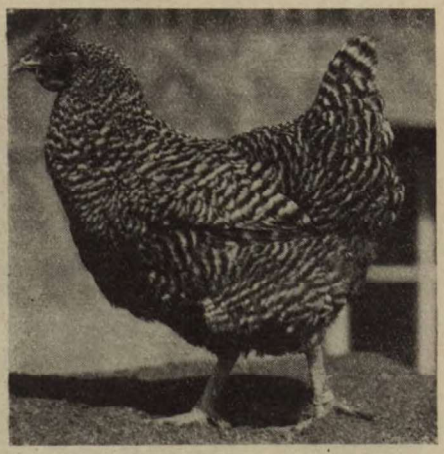
The most outstanding results in breeding during the past year were those obtained from the Barred Rock mating L 45 Sire 371 Dam J 78. This mating produced twelve pullets, three of which died, the other nine completing their pullet year's production as follows:—

Bird	Eggs laid	Egg size
132	*289	**2·2
141	200	1·14
148	314	2·4
157	227	2·1
158	230	1·14
162	221	1·15
167	262	2·0
171	270	1·14
173	213	1·15

* 302 before moulting.
** The decimal point is here used to denote sixteenths thus 2·2 means 2 and 2/16 ounces.

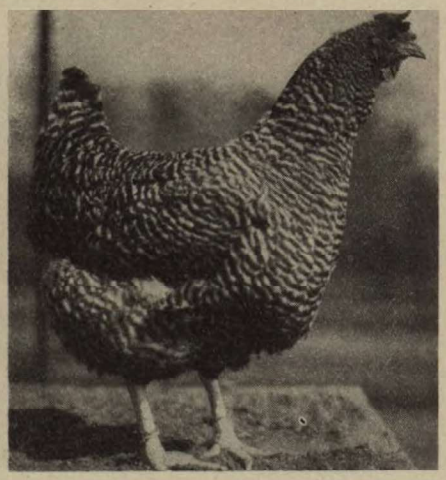
N.B.—The egg weights given above were taken during the flush of production in March. Egg weights for these birds taken during March of the following year showed all to be well over 2 ounces in weight with one exception.

The highest production was that of M 148 with 314 eggs and the lowest production that of M 173 with 213 eggs, and the nine sisters giving an average production of 254 eggs.

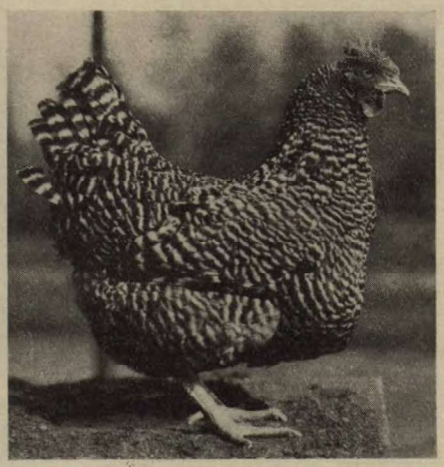


J78—212 eggs laid, average weight 2.1 oz.

M173—213 eggs laid, average weight 1.15 oz.



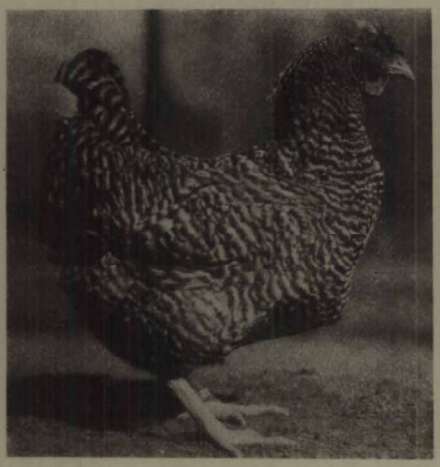
M148—314 eggs laid, average weight 2.4 oz.



M167—262 eggs laid, average weight, 2.0 oz.

M171—270 eggs laid, average weight 1.14 oz.

M132—289 eggs laid, average weight 2.2 oz.



M157—227 eggs laid, average weight 2.1 oz.

M158—230 eggs laid, average weight 1.14 oz.

M162—221 eggs laid, average weight 1.15 oz.

M141—200 eggs laid, average weight 1.14 oz.

Dominion Experimental Farms—Eggs and Breeding Records

PEN NO. 7 HATCHED 26.4.28 CHICK BAND NO. M 3235

VARIETY Barred Rock. OUT OF MATING L45 ♂ 371 ♀ J78 ADULT BAND NO. M 148

DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTALS	
NOV.			O																													27	
DEC.																																25	
JAN.																																23	
FEB.																																23	98
MAR.																																27	
APR.																																28	
MAY																																29	84
JUNE																																26	
JULY																																26	
AUG.																																27	79
SEPT.																																30	33
OCT.																																23	314

PULLET BODY WEIGHT 6.0 AGE AT FIRST EGG 190 DAYS

ADULT " " 6.14 EGG COLOUR BROWN. EGG SHAPE 2.9 × 1.19 EGG WEIGHT 2.4

YEAR	EGG RECORD		HATCHING RECORD					MATING
	WINTER	YEAR	EGGS SET	INF.	D.C.	HATCH	MORT.	
1	98	314	—	NOT	BRED	—		
2								
3								
4								
5								

B—BROODY T—TRANSFERRED S—SICK
N—ON NEST M—MOULT BEGUN D—DIED
O—FIRST EGG X—EGG BROKEN R—RETURNED

MALE OFFSPRING BRED

Egg production chart of the Barred Rock female, M148. Decimal points in egg measurements represent thirty-seconds of an inch. in egg weights sixteenths of an ounce.

PHOTOGRAPHIC RECORD

BOOK No. PAGE No.

NEGATIVE FILE No.

DAUGHTERS

Dominion Experimental Farms—Pedigree and Photographic Records

M 148 314 2.4

Full Sisters
M 132
141
157
158
162
167
171
173

371 — 361 — 293 — E75/1 (Egg Record 243 2.1) — 204 — 117 B28/7 225
117 B29/0 243
82 F42 231
E75/5 (Egg Record 251 2.) — 117 B29/0 (Egg Record 243) — A1/3 195
G8 F21 232
291 — I809 (Egg Record) — 124 D68/7 210
79 A24/6 204
K46 (Egg Record 259 2.3) — I815 (Egg Record 217 1.14) — 124 C38/9 (Egg Record) — C2 F42 231
85 231
126 — B4/2 (Egg Record)
78
260 — G188 (Egg Record 201) — C108 (Egg Record 176)
82 F42 231
206 — 122 G89 (Egg Record 220)
81 F39 206
J78 (Egg Record 212 2.2) — I928 (Egg Record 182) — G30 (Egg Record 174) — 83 C57/4 (Egg Record 166)

Pedigree of the Barred Rock female M148 and her eight sisters.

Breeding results with the waterfowl were varied. With the domestic breeds, the fertility and hatchability were not good, due to the fact that the breeders were in too high condition. There is always more or less trouble with the waterfowl at this farm due to the fact that it is difficult to make inexperienced feeders realize that the breeders must be fed sparingly to keep them in good breeding condition. On the other hand, with the wild Canada geese the results were fairly good and with the wild Mallard ducks excellent. The average hatch with the latter was between ten and eleven ducklings, and one old duck brought out a brood of nineteen.

During the year an attempt was made to breed Snow geese, but without success. No evidence of pairing off or mating was ever noticed, and the birds were under close observation during the spring and early summer months. The flock of Snow geese wintered well and an attempt will be made to get them to breed this coming spring.

EXPERIMENTAL WORK

The year 1929 was a most successful one for investigational work. Some new work was undertaken and several experiments were completed after consideration over a period of years.

A feature of the year's work was the acquisition of two different makes of battery brooder with which experimental work was done. This added accommodation left the continuous fourteen-pen brooder house open to use for experimental work during the entire brooding period. As a result of this a large number of very successful brooding experiments were carried on. Another important feature of the availability of this brooder house was the fact that brooding investigations could be carried on during the normal brooding season rather than after the regular period as has been done of necessity in the past.

Accommodation was also available during the past year to carry brooding experiments over into the rearing period, which was done in a number of cases in the experimental house, which consists of fifteen separate pens. It will be readily appreciated that the longer period adds much to the value of results obtained.

Mortality, which has at times in the past been a serious limiting factor in rearing experiments, was quite low during the past season, a factor which greatly increases the reliability of the results obtained.

For the most part experiments were carried on with a view to obtaining practical results readily of use to the poultryman. To projects of this type have been added those of a more technical nature which, although not apparently of immediate practical use, yet furnish information which enables better understanding of the principles of feeding, breeding, or some other poultry practice.

In the discussion upon experiments which follows it is essential to bear in mind that in most cases the experiments will be carried on until such time as it is felt that definite conclusions can be drawn, which in some instances will be over a period of four or five years. The material here given may constitute only a progress report. When it is considered that conclusions are justified a final report will be made. A considerable amount of experimental work is being done by the branch farms, results of which may be found in the annual report of the farm or station concerned. In some cases brief mention will be made of experiments upon the branch farms which correspond with experiments carried on at this Division.

HATCHING SUMMARY

The hatching season of 1929 was a very successful one in so far as the Experimental Farm system was concerned. It should be noted that the results from the farm system are a fairly accurate barometer of hatching conditions in Canada being derived as they are from several different sections of each province of the Dominion from British Columbia to Prince Edward Island.

The table following shows hatching results over the Farm System for the years 1924 to 1929 inclusive.

TABLE I.—HATCHING SUMMARY—EXPERIMENTAL FARMS AVERAGE—SIX YEARS

Year	Total eggs set	Number fertile	Per cent fertile	Number of chicks	Per cent total eggs hatched	Per cent fertile eggs hatched	Number of chicks alive when wing banded	Per cent chicks hatched alive when wing banded	Total eggs required for 1 chick hatched	Total fertile eggs for 1 chick hatched	Total eggs required for 1 chick when wing banded
1924.....	63,820	49,528	77·6	21,813	34·1	44·0	14,605	66·9	2·9	2·2	4·3
1925.....	62,725	51,161	81·6	24,357	38·8	47·6	19,431	79·8	2·6	2·1	2·9
1926.....	75,169	60,010	79·8	27,761	36·9	46·3	17,293	83·7	2·7	2·2	3·3
1927.....	63,242	50,183	79·3	24,495	38·7	48·8	20,361	83·1	2·6	2·0	3·1
1928.....	85,066	68,979	81·1	39,303	46·2	56·9	29,970	87·2	2·1	1·4	2·36
1929.....	92,103	76,562	83·1	44,126	47·9	57·6	32,967*	86·5*	2·1	1·7	2·4*

*—Day old chicks sold.

It will be noticed particularly that fertility and hatchability were slightly superior to the previous year in keeping with the general increase during the past five years. Viability of chicks, however, is slightly inferior to the previous year although much improved over the percentages for some years past.

It is particularly gratifying to note the improvement in fertility and hatchability since 1924 and above all the decrease in mortality of chicks up to the age of three weeks. Improved technique in the compounding of rations, in the handling of brooder chicks and in the control of intestinal parasitism and pullorum disease are chiefly responsible without doubt for such satisfactory improvement.

Not a great many years ago it was considered that poultry could not be made to thrive in the portions of the country more extreme climatically such as the Prairie Provinces and the more northerly parts of the provinces. The following table shows results from farms situated under temperate conditions and under extreme conditions of cold. On the one hand there is fresh green feed and free range for practically the entire year while on the other hand is confinement often from November to April.

TABLE 2.—HATCHING RESULTS

Farm	Total eggs set	Number fertile	Per cent fertile	Number of chicks	Per cent total eggs hatched	Per cent fertile eggs hatched	Number of chicks alive when wing banded	Per cent chicks hatched alive when wing banded	Total eggs required for 1 chick hatched	Total fertile eggs for 1 chick hatched	Total eggs required for 1 chick when wing banded
Agassiz..	2,872	2,589	90·1	1,588	55·3	61·3	1,412	88·9	1·8	1·6	2·0
Sidney..	1,525	1,138	74·6	805	52·7	70·7	768	95·4	1·9	1·4	2·0
Scott....	1,788	1,693	94·7	1,188	70·1	66·4	1,094	92·0	1·5	1·4	1·6
Morden..	3,107	2,943	94·7	1,611	51·8	54·7	1,261*	93·1*	1·9	1·8	2·1*
Kapuskasing..	5,694	5,060	88·9	2,867	50·3	56·7	1,704*	88·7	1·9	1·7	2·1*
La Ferme..	9,387	8,567	91·2	5,792	61·7	67·6	5,622*	97·1*	1·6	1·5	1·6*

*—Day old chicks sold.

Of the farms shown in the above table Agassiz and Sidney represent very temperate conditions, + 13°F and + 22°F being the lowest winter temperatures, Scott and Morden severe winter climatic conditions — 45°F and — 23°F being the minimum temperatures, and Kapuskasing and La Ferme similar conditions to the last mentioned — 36°F and — 31°F, but with a longer period of cold weather and a much greater humidity at all times (1928). The first mentioned locations represent moderate temperatures with high humidity, the prairie farms low temperatures with very dry air and the last mentioned low temperatures with high humidity.

It will be readily recognized that in spite of extreme conditions, lack of range during the winter period and in most cases scarcity or entire absence of fresh green feed breeding stock can be maintained in sufficiently good condition to give good fertility and hatchability. Livability of chicks is also quite comparable under the extreme conditions. Improved technique in feeding, the use of vitamin feeds and good quality substitutes for fresh green feeds no doubt are important factors in these results.

With regard to time of hatch, this year's summary shows practically identical results for those set in March, April and May. Livability of chicks was superior for May settings.

Rhode Island Reds were superior in fertility with very little to choose between all breeds (Reds, Dottes, Rocks and Leghorns) in hatchability. Livability was superior with White Leghorns and Rhode Island Reds.

As has always been the case in the past fertility and hatchability were superior from hens as compared to pullets. Livability of chicks is practically equal from both classes. The fact that pullets usually are laying at a heavier rate than hens when they are bred, no doubt explains the constantly superior results from hens at least in part.

HATCHABILITY FROM LARGE AND SMALL EGGS

Experimental work to determine the relative hatching quality of large and small eggs was continued. A total of 6,280 eggs were weighed individually and classed according to the following scale of weights:—

No. I —Over 24 ounces to the dozen.

No. II —22-24 ounces to the dozen inclusive.

No. III—Under 22 ounces to the dozen.

The data following show the results obtained.

Class	Per cent fertile	Per cent fertile hatched	Per cent total hatched
No. 1	85·0	65·9	56·0
No. 2	83·7	68·5	57·4
No. 3	82·9	67·0	55·5

Discussion.—It is apparent that in this experiment practically no difference in hatchability was obtained from any of the above classes of hatching eggs.

The following figures represent a two year summary of hatching results covering over 8,000 eggs:—

Class	Per cent fertile	Per cent fertile hatched	Per cent total hatched
No. 1	80·8	66·5	53·7
No. 2	80·4	66·6	53·6
No. 3	78·7	67·2	52·9

A summary over the past two years shows practically equal hatchability from all classes.

INFLUENCE OF SHELL TEXTURE ON HATCHING RESULTS

This work was continued during the past year. Slightly superior hatchability was obtained from eggs classed as good shell which had no blemishes whatever. Misshapen eggs, buttermilk shells, checked shells, etc. gave slightly poorer hatchability than the control class which consisted of eggs set indiscriminately insofar as shell texture is concerned.

Further work will be done along this line before definite results will be attained.

ULTRA VIOLET RAYS IN INCUBATION

Results during the past season with eggs exposed to ultra violet rays for a period of ten minutes twice daily at a distance of two feet were very slightly superior to those untreated but allowed to cool during that time. The lamp used was a therapeutic Hanovia Ultra Violet Ray unit of the mercury vapour type. Further work will be done before any conclusions are warranted.

COSTS OF INCUBATION

In order to determine the cost per egg and chick unit of incubating in the small capacity incubator the following test was undertaken. A small machine was set with eggs and careful account kept of fuel consumed and labour expended. The detail following shows actual costs. The price of coal oil represents the wholesale price in purchasing in large quantities. The time allowed was that actually spent in working on the machine.

INCUBATION COSTS

Number of eggs set	405
Value of eggs set (at $10 per 100 eggs)	$40 50
Cost of fuel (18·6 gallons of oil at 26 cents)	$ 4 84
Cost of labour (5 hours at 35 cents per hour)	$ 1 75
Total cost of eggs, feed and labour	$47 09
Cost per egg	11·62 cents
Number of chicks hatched	212
Cost per chick	22·2 cents

Cost in small capacity hot water heated machine.

Any valuation desirable may be placed upon hatching eggs depending on their market value either as hatching eggs or food. The cost exclusive of the value of the eggs themselves can readily be calculated from the above.

BROODING AND REARING EXPERIMENTS

Brooding experiments during 1929 may be divided roughly into two groups those dealing with time of first feeding and those concerned mainly with definite feeds and rations. Of these the former will be reported under the title of "Starvation Period for Chicks" and the latter under "Rations for

Brooding and Rearing Chicks." The former are brooding experiments covering a period of only six weeks duration while some of the latter group were carried into the rearing stage and right through to maturity. Work with sunlight and the antirachitic vitamin will be dealt with under a separate head.

The basal ration given to all pens unless otherwise stated was as follows: One hundred pounds each of shorts, middlings, yellow corn meal and oat flour, with ten pounds each of bone meal, buttermilk powder and fish meal and twenty-five pounds of meat meal. To this ½ per cent salt and 2 per cent of crude codliver oil was added. A commercial chick scratch mixture was fed night and morning after the first week. Green cut clover was fed throughout until the end of the rearing period. Pens of 50 Leghorn chicks were used and cockerels were removed at six weeks of age.

The following was the arrangement of the pens:—

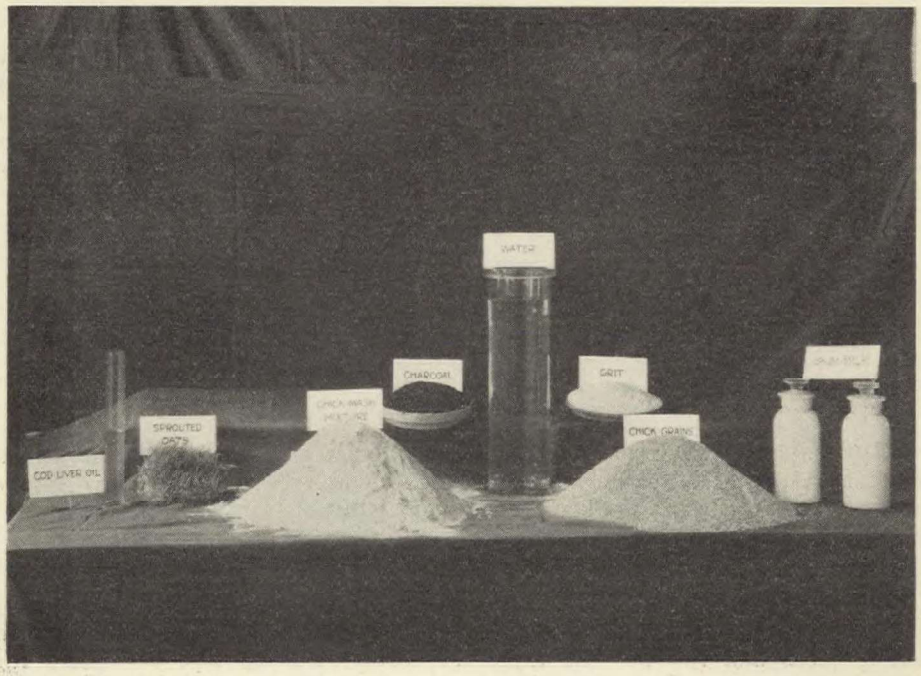
Pen 1. Basal ration (as above).

Pen 2. Dried whey, fed similarly to control pen but with a mash of the following formula: corn meal 50 pounds; shorts, middlings and oat flour 100 pounds of each; Soya bean meal 75 pounds, dried whey 100 pounds (Analysis: water 3·37 per cent, ash 10·74 per cent, protein 11·9 per cent; fat 1·8 per cent; lactose (milk sugar) 65·82 per cent and lactic acid 5·76 per cent, ½ per cent salt and 2 per cent crude cod liver oil.

Pen 3. Yeast and crude cod liver oil—basal ration but with the addition of 10 ounces of yeast to 100 pounds of mash. (Yeast—antineuritic (vitamin B) and cod liver oil antirachitic (vitamin D).

Pen 4. Ration without mash—a commercial chick scratch mixture with sour swim-milk to drink ad lib. 2 per cent cod liver oil in the grain at noon.

Pen 5. Wisconsin ration—no grain, skim-milk only to drink, greenfeed as for control pen and mash—ground kellow corn 70 pounds, middlings 20 pounds, bone meal 5 pounds, grit (limestone) 5 pounds, salt 1 pound, cod liver oil 2 per cent.



Essential brooder feeds. When possible fresh cut clover or alfalfa should substitute for the sprouted oats.

Pen 6. Commercial ration—No. 1—well known commercial poultry feed fed according to directions.

Pen 7. Commercial ration No. 2—well known commercial poultry feed fed according to directions.

Pen 8. Low protein ration—similar to basal ration except that protein level reduced by feeding a mash containing only 5 per cent of feeds of animal origin as follows: shorts, middlings, yellow corn meal and oat flour 100 pounds of each; fish meal 8 pounds; meat meal 13 pounds; salt ½ per cent, crude cod liver oil 2 per cent.

Pen 9. Basal ration fed 24 hours after completion of hatch.

Pen 10. Basal ration fed 48 hours after completion of hatch.

Pen 11. Basal ration fed 60 hours after completion of hatch.

Pen 12. Basal ration fed 72 hours after completion of hatch.

Pen 13. The use of electric lights in brooding—identical in treatment to control pen but with 24 hour feeding time by the use of electric lights.

RATIONS FOR BROODING AND REARING CHICKS

Under this heading are included pens 1 to 8 and as a matter of convenience pen 13 also, details of treatment accorded, each of which have been given under the heading "Brooding and Rearing Experiments 1929." The graph on page 16 shows details of these projects.

DISCUSSION.—In considering weight gains as indicated by the graph, it is noticeable particularly that in general two pens are outstanding, namely those on the basal and commercial rations, the former of which made the greater gains. The sudden levelling off of growth curve in the case of the commercial pen is coincident with maturity and production. The basal ration pen attained a greater weight and did not mature and come into production so rapidly. The same tendency is evident with the basal ration during the twenty-fourth week with an average weight greater by seven ounces than that of the commercial ration pen.

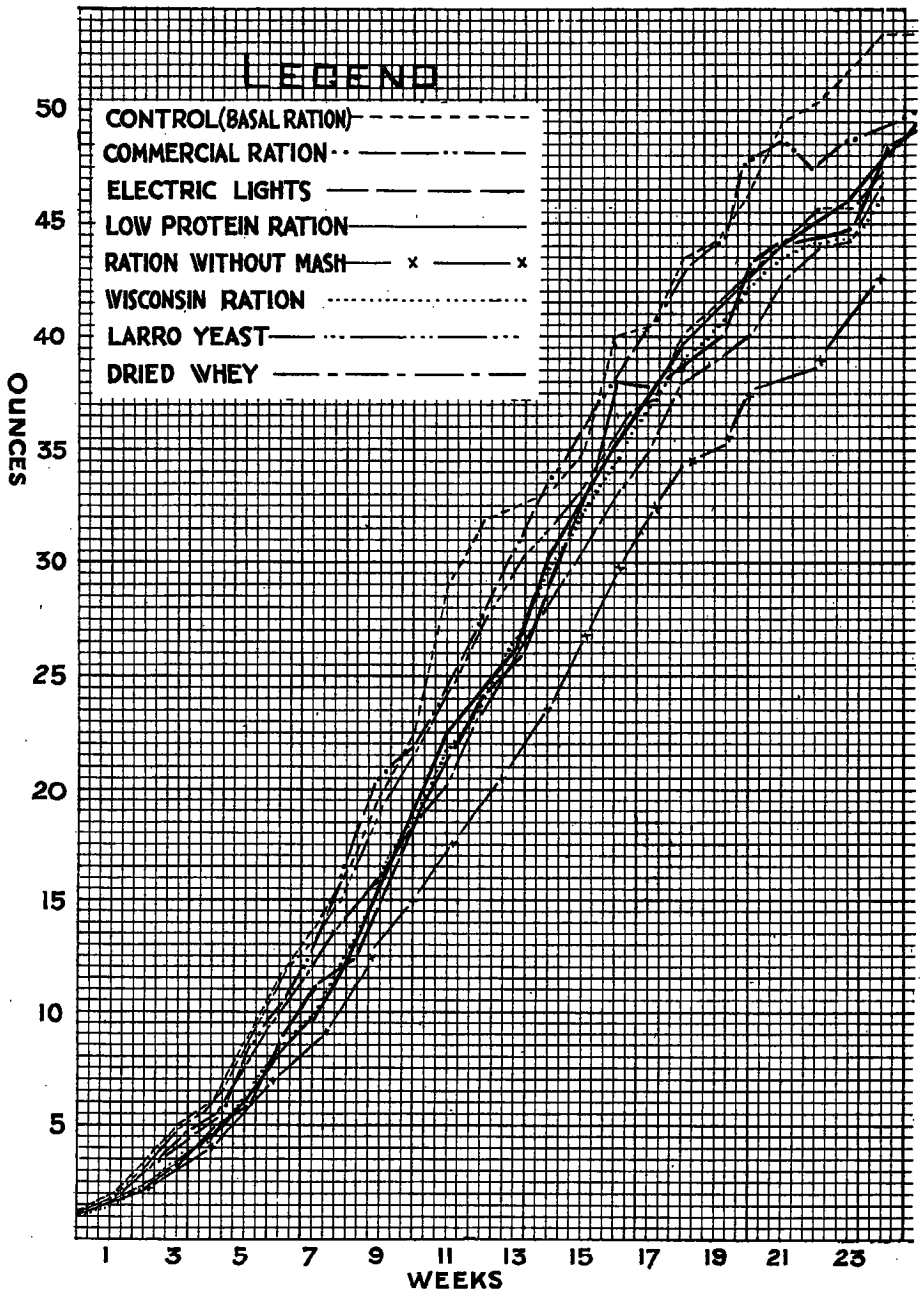
The other outstanding growth curve is that of the chicks on scratch grain and skim-milk only. It was thought that since skim-milk is considered to be a well balanced food with the exception of fat and since the mash is often considered merely as a vehicle for the animal feeds of the mash normal growth should result. Cod liver oil was given in the scratch grain daily at noon. It is apparent that an ordinary commercial scratch mixture supplemented with skim-milk only to drink was not satisfactory for good growth in chicks.

The birds under electric lights made fair gains only. It is surprising that those receiving only 5 per cent of animal feeds were almost on a par in final weight with the commercial ration. The birds were in good condition throughout.

The addition of a marmite yeast to the basal ration made no improvement and in fact smaller gains were made with the birds receiving this supplement.

In spite of the substitution of ground yellow corn for corn meal such as was used in previous years tests, poor results were obtained with the all mash Wisconsin ration. It is evident from five years results that this ration is not suitable for our conditions and will not give growth comparable to our control rations or to the best of our commercial rations of which Commercial ration No. 1 here used is one of the best representatives. In the United States where all mash rations of this type originated corn is plentiful and cheap and it was in order to find a high corn meal ration and therefore an economical one that rations of this type were originated without a doubt. This consideration does not apply to Canada, however, and therefore it is considered that rations featuring chiefly our home grown grains will give superior results and be more economical. Since mortality during the five years test was greater in every case on this ration than with the basal ration the matter of picking up filth with the

grain given in the litter as is done ordinarily may be disregarded. In cases where an outbreak of an infectious disease such as pullorum disease or coccidiosis is present the grain may be fed on top of the mash in the hopper as a precautionary measure.



Indifferent results were obtained with dried whey a milk product high in carbohydrates (milk sugar) and with 12 per cent of protein as used in this experiment. A high protein supplement soya bean meal was used to supplement the animal feed in this instance.

The table following gives the actual detail of the experiment as shown graphically above, with some additional details particularly relevant to four pens which are being carried through their first year of production.

TABLE 3—RATIONS FOR BROODING AND REARING CHICKS

Pen	Percentage mortality		Average weight of birds at end	Average weight best 15 birds at end	Average feed consumption per chick				Average cost of feed per chick		Total cost of feed	Feed cost per pound gain	Average weight at first egg
	First period (6 weeks)	Second period (18 weeks)			1st period (6 weeks)		2nd period (6 weeks)		1st period	2nd period			
					Grain	Mash	Grain	Mash					
			lb.	lb.	lb.	lb.	lb.	lb.	cts.	cts.		cts.	lb.
Control	0·0	0·0	3·33	3·60	0·33	2·16	9·49	8·91	7·18	54·80	61·98	18·61	3·32
Dried whey	4·0	0·0	2·92	.....	0·32	1·49	8·36	6·88	5·59	47·18	52·77	18·07	.....
Yeast	0·0	0·0	2·95	.....	0·30	1·58	10·58	8·04	5·99	58·53	64·52	21·87	.....
No mash	0·0	4·0	2·66	.....	1·30	.....	11·31	.....	*5·71	48·68	54·39	20·44	.....
Wisconsin ration	4·0	4·0	2·89	.....	.....	1·43	.....	12·23	*5·54	46·64	52·18	18·05	.....
Commercial No. 1	6·0	0·0	3·10	3·12	0·34	1·40	10·12	10·10	8·69	84·90	93·59	30·79	3·26
Commercial No. 2	8·0	21·0	2·73	.....	0·40	1·20	11·51	7·88	6·58	88·06	94·64	34·67	.....
Low protein	2·0	20·0	3·0	3·08	0·32	1·34	15·65	5·79	4·47	63·56	68·03	22·68	3·46
Electric lights	6·0	22·7	3·07	3·10	0·33	1·85	10·72	10·05	6·29	61·87	68·16	22·20	3·08

* Cost of milk included.

DISCUSSION.—It will be noted particularly that no mortality was experienced in the control pen and in the yeast pen which may be considered as similar to the control. Very little mortality was experienced in the all grain pen, but the birds were obviously in poor condition. The same may be said to a lesser extent of the dried whey pen. Mortality was also low on the commercial ration No. 1. Greatest gain over the twenty four week period was made by the control pen followed by that of the commercial ration No. 1 and those under electric lights. The control ration gave outstanding results in this respect. The low protein ration also gave good results following closely on the electric light pen. Commercial ration No. 2 and the no mash ration gave poor growth.

When fifteen of the best pullets were selected out, the control pen was still more outstanding as several small type birds were eliminated at that time. The other three pens namely commercial No. 1, low protein, and electric lights were practically on a par.

Consumption of feed was quite similar for all pens. The cost of feed per pound of gain was high for the birds on the commercial rations but quite similar and considerably lower for the other pens.

The average weight at date of first egg was greatest for the birds on the low protein ration, followed by the control pen, the commercial ration and electric lights. In the case of the first mentioned pen a few birds only were laying up to the period covered by this report consequently the figure is not so indicative of an actual average. These four pens are being continued for egg production, fertility and hatchability. All of the above pens were confined throughout the experiment.

SUMMARY

The following observations are made from the results of the above experiment:—

(1) The basal ration used as the control for the above experiments gave lowest mortality, greatest weight gains and the most economical growth up to the time of maturity. With one exception, it also gave the greatest body weight at time of first egg.

(2) A commercial ration representative of the finest quality of commercial rations on the market in Canada at the present time gave excellent weight gains and low mortality. The cost per pound of gain, however, was very high. The control ration mentioned above gave superior and more economical results. Another commercial ration used gave inferior results.

(3) The use of electric lights to give a twenty-four hour feeding day throughout the rearing period gave no improvement in any way over the same ration without lights. The birds appeared to be of a more nervous temperament in the lighted pen.

(4) The feeding of a commercial chick scratch feed and later a similar hen size scratch grain mixture without mash and with skim-milk to drink *ad lib* gave very indifferent results in spite of the fact that the ration was otherwise fortified by greenfeed and cod liver oil.

(5) Good gains were made on a ration using only 5 per cent of animal feeds. It would seem that the protein requirements of birds during the rearing stage are much lower than is often recommended.

(6) A ration making use of dried whey as the source of animal feeds gave only fair results in this experiment.

(7) The addition of a marmite yeast to the control ration has over a period of years (See annual reports of this Division 1924-28 inclusive) given no appreciable increase in growth over the basal ration with cod liver oil. Gains made were not so economically attained when yeast was fed. The present

experiment further emphasises this fact. When an otherwise well balanced ration is fed as was done here, there appears to be no need for the feeding of yeast in any form. (See particularly annual report for 1928).

(8) During the past four years (See reports for this Division 1925-28) consistently poor results have been obtained with a high corn meal all mash ration supplemented with skim-milk to drink, known herein as the Wisconsin ration. Results here obtained further substantiate past work. It is suggested that under our conditions this ration is not suitable for brooding and rearing chicks since the control rations used give superior results.

STARVATION PERIOD FOR CHICKS

During the years 1925, 1926 and 1928 experiments dealing with the proper length of time which should elapse between time of hatch and date of first feed were conducted. These have been reported from time to time, a summary of which results with conclusions derived, was published in the annual report from

Brooding in the orchard at the Central Experimental Farm. Shade, green feed and range are well provided under these conditions.

this station. As a final test and to obtain confirmatory data this experiment was repeated during 1929. The test was increased in duration from the customary three weeks to six weeks of age to ascertain that growth of all lots continued normally.

Four pens of fifty-six chicks were used and were fed at twenty-four, forty-eight, sixty and seventy-two hours after completion of hatch. The completion of the hatch was considered to be the end of the twenty-first day. For example, if the eggs were set at 10 a.m. the completion of the hatch would be 10 a.m. on the twenty-first day.

The table following shows results of the experiment.

TABLE 4—STARVATION PERIOD FOR CHICKS

Treatment	Number at beginning	Average weight	Average weight at end of 1st week	2nd week	3rd week	4th week	5th week	6th week	Gain	Percentage gain	Mortality	Percent Mortality	Total feed consumption
		oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.				lb.
First feed 24 hours.....	50	1·18	1·84	2·82	4·40	5·94	8·18	10·96	9·78	828·8	0	0·0	87·9
First feed 48 hours.....	50	1·22	1·90	2·98	4·52	6·06	8·20	10·53	9·31	763·1	3	6·0	90·0
First feed 60 hours.....	50	1·20	1·81	2·83	4·36	5·74	8·20	10·65	9·45	787·5	4	8·0	88·6
First feed 72 hours.....	50	1·18	1·77	2·69	4·18	5·74	8·02	10·44	9·26	784·7	1	2·0	86·8

DISCUSSION.—A study of the above table shows the earliest fed chicks to have an advantage in growth, livability and economy of gains. Since this is in perfect accordance with three years of work already published no further work will be done on this subject. This experiment also demonstrates that uniform growth continues after three weeks and presumably to maturity.

It is evident that the old accepted practice of allowing chicks to go from forty-eight to seventy-two hours of age before feeding is not in the best interests of high livability and maximum development.

During three years out of four in controlled experiment no mortality was experienced among the earliest fed chicks and in the case of the single exception no other pen had lower mortality. The same applies to growth in the one exception two pens making slightly greater gains. It is recommended, in view of the results obtained that chicks be fed as soon as convenient after incubation.

It is well to bear in mind that the chicks here used were quite free from disease. In cases where pullorum disease is present in the chicks when hatched it is conceivable that owing to poor absorption of yolk as often found with this disease, the matter of a starvation period might well be of some importance.

THE EFFECT OF SUNLIGHT UPON GROWTH OF CHICKS

Work with direct sunlight, glass substitutes, irradiation with ultra violet rays and vitamin supplements was continued during the past season. The results obtained confirmed those of previous years in every way. Since chemical analyses of bones are not as yet available the project will not be reported upon in detail at this time.

BATTERY BROODERS VS. ORDINARY BROODING METHODS

In the early spring of 1929 a system of battery brooders was installed in a special room fitted up for the purpose and supplied with brooder stoves for heating purposes. The batteries were of the type without individually heated compartments and which depend upon the heat of the room for suitable brooding temperatures. Three different sizes in two different makes of battery were used and were deemed sufficient to carry chicks to maturity. The room in which they were situated was well supplied with windows and a large ventilating shaft to within one foot of the floor was installed near the stoves. It was found necessary before using the batteries to modify this ventilation by the addition of two stove pipe ventilators from the windows to the floor of the room on the side opposite to the stoves. No difficulty was experienced in maintaining a sufficient and uniform temperature and the ventilation supplied was found to be sufficient after the above mentioned improvement had been made. It was found that temperatures lower than under the ordinary brooder stove were quite satisfactory even for young chicks.

As the young chicks grew and required less heat they were moved from the top to the lower compartments where the heat was not so great. It was found, however, that the difference in temperature between top and bottom compartments was not sufficient to keep the larger chicks from being overheated in temperatures which were just high enough for the very young chicks in the top drawers. When the birds were transferred to the broiler and later to the largest size of battery they were so well feathered that temperatures could not be varied sufficiently to accommodate the different ages. Unless more than one room is available or a very large room used so that the larger batteries can be moved some distance from the stoves this system of battery brooders in a heated room cannot be quite satisfactory from this standpoint.

From the standpoint of the commercial poultryman one of the most important features of the battery brooder is the measure of protection from readily transmitted diseases and infections claimed for this type of brooding. Owing to the fact that batteries are fitted with wire bottoms the birds have not access to their own droppings and thus a very common avenue of reinfestation is eliminated. The fact that all feed and water is outside the compartments is another measure of safety. There is no doubt that under these conditions chicks may be raised free from infection. On the other hand, on plants which are heavily infested with worms and coccidia even the battery brooder is not completely safe, and unless fortified by rigid disinfection and cleanliness infestation may result. In spite of reasonable precautions coccidial infection was fairly common during part of the battery brooding season. It was concluded that dust in the room was the carrier. In this connection it is well to remember that strong disinfectants are often quite powerless in destroying coccidia. At this division coccidia have been moulted and have remained alive in a 2½ per cent solution of potassium dichromate which is considered to be a powerful disinfectant.

In considering the factor of mortality and condition our results here are interesting. A great deal of mortality with young chicks was occasioned by the fact that the wire mesh in the bottom of the trays was too large and the chick letting its hock joint slip through the mesh was either killed or maimed by the other chicks and its own efforts to escape. This mortality could readily be overcome by using a finer mesh but the droppings do not pass through such a mesh so readily. Up to a period of three to four weeks growth and condition were apparently good and mortality, apart from the cause just mentioned, was fairly low. From this time on, however, mortality was heavy owing to feather pulling and cannibalism. At the same time the birds were far from normal as evidenced by a very flighty disposition. On the attendant approaching the batteries the birds would fly to the corners and pile up. Being on wire their toe nails were very sharp and in piling up deep cuts were made in the backs of the under birds which resulted in immediate cannibalism. In conjunction wtih the conditions mentioned lopped combs among the leghorn cockerels and a dry ruffled appearance of the feathers was common. The best test of comparative condition was obtained by liberating battery reared chicks at about eight weeks of age with birds of the same age reared under natural conditions. The contrast in apparent condition was startling although it had not been so apparent until they were placed together. It is important to note here that cannibalism and feather pulling are overcome almost completely by keeping the room darkened. This does not, however, overcome the flighty disposition or the other indications of improper physical development already mentioned.

A great many variations were made in the rations during these battery experiments. Mashes with feeds of animal origin varying from 5 to 25 per cent, of the whole, the addition of slightly sprouted oats to supply bulk, the use of germ meal and of a well known commercial ration for battery brooding made no appreciable improvement. Fresh cut clover was available in large quantities throughout the experiment.

A hatch of white leghorn chicks of May 27, 1929, was divided into seven equal lots of ninety chicks each, five lots of which were reared in battery brooders and two lots which were reared in sections of a continuous pipe system brooder house. These birds had access to a very small cement run. The mashes used were as follows:—

Mash

——	5%	10%	15%	20%	25%
Shorts	100	100	100	100	100
Middlings	100	100	100	100	100
Corn meal	100	100	100	100	100
Oat flour	100	100	100	100	100
Fish meal	8	17	27	37	50
Meat meal	13	27	44	61	85
Cod liver oil	2%	2%	2%	2%	2%
Salt	1%	1%	1%	1%	1%

The above mashes correspond roughly to 5, 10, 15, 20 and 25 per cent of feeds of animal origin.

A commercial scratch grain mixture (chick scratch) was fed throughout.

The pens receiving 20 and 25 per cent were duplicated but in a continuous pipe brooder house as mentioned above. These pens were considered as controls in the experimnt.

The table following shows a comparison of results from the varied treatments.

Table 5—Battery Brooders

Ration	Average weight at beginning	Average weight at end of 8 weeks	Gain per chick	Per cent gain per per chick	Mortality	Percent mortality
5% battery	1·50	13·53	12·03	802·0	19	21·1
10% battery	1·60	14·74	13·14	821·2	31	65·5
15% battery	1·52	16·40	14·88	978·9	27	30·0
20% battery	1·00	13·53	12·53	1,253·0	21	23·5
25% battery	1·00	15·27	14·27	1,427·0	27	30·0
20% brooder house	1·12	14·93	13·81	1,233·0	11	13·3
25% brooder house	1·07	14·81	13·74	1,284·1	10	11·1

In so far as weight gains are concerned it is noticeable that on a percentage basis greater gains were made by the birds on each succeeding ration as the percentage of feeds of animal origin increased. Greatest actual gain in weight was made on a ration with mash containing 15 per cent of feeds of animal origin. Actual weight gains made under ordinary brooder conditions were somewhat inferior to those made with the same rations in the batteries. This was not unexpected since the greater activity of the former lots would prohibit them from putting on quite as much weight.

It is probable that under the conditions of this experiment mortality is the truest gauge of physical condition. Mortality was considerably lower among the birds in the brooder house A percentage of the mortality among the chicks in battery brooders was due to the size of the bottom wire, as mentioned, and consequently was avoidable. By far the greatest mortality in all pens was due to cannibalism however. Of the mortality in the pens under ordinary brooder conditions none was caused by cannibalism. In order to keep the chicks to their own pens wings had to be clipped once weekly and occasionally too

close a cut drew blood. In spite of this no cannibalism developed. No explanation can be offered for the high mortality on the 10 per cent ration since less was occasioned on the 5 per cent ration and on higher protein rations still mortality was mostly due to cannibalism. In the light of these results it is interesting to speculate as to just what degree the cannibalism in the batteries was a vice rather than a symptom of nutritional deficiency. The chicks in the brooder house had considerably more space to move about than those in the battery but still would be considered to be in very cramped space if compared to chicks under ordinary brooding conditions. Feeds given were identical in both cases. The ration was apparently sufficient for the birds in the brooder house with limited range but not so for those in batteries. This suggests that those in the brooder with more to interest them and keep them busy did not fall into the cannibalistic vice while those in the battery being crowded for space and with nothing to do got into the only mischief possible by picking at each other. Had it not been merely a case of vice one would think that the sight of blood at least would have started cannibalism in the brooder, which was not the case as mentioned above. Since the battery chicks practically did not grow more rapidly than those in the brooder it would seem that their requirements would not be greater to any appreciable extent. The fact that darkness will overcome the vice in batteries is interesting in this discussion.

The results obtained to date seem to indicate that at the present time battery brooding has certain drawbacks which time and experiment only can correct. By darkening the battery room excellent gains in weight can be made and as a consequence for rearing of broilers for special markets they are proving to be excellent. In hatching work, where a surplus of chicks may have to be carried over for a few weeks or where chicks are raised to four or five weeks the pullets disposed of and the cockerels carried on to broiler age they would also prove useful. In so far as the ordinary commercial poultryman is concerned the battery brooder has several serious drawbacks. In cases where chick diseases are very prevalent the battery brooder offers the commercial poultryman an opportunity to raise clean chicks to say four weeks of age and then to transfer them to fresh brooding ground where they should remain comparatively free from trouble.

THE VALUE OF MILK PRODUCTS IN THE PREVENTION OF COCCIDIOSIS

In order to determine, if possible, the value of certain milk products in the control of coccidiosis this experiment was undertaken. Dried buttermilk powder and dried whey, a milk product high in lactose, were used. According to some investigators the lactic acid formed in the digestive tract of the bird is responsible for the inhibition of the coccidiosis producing organism. It was thought therefore that the high lactose content of the dried whey might be useful in the prevention of this malady. Unfortunately, although a very pathogenic strain of coccidia was moulted and fed in its most virulent stage, in the wet mash no mortality was occasioned even in the control pen receiving no milk product of any kind, a fact difficult to explain. It is possible that the birds used had already gained immunity to the organism through previous light infection.

It is worthy of interest here to note that both buttermilk powder and dried whey fed at levels of 30 per cent of the mash had a purgative effect upon the birds. So serious was this in the case of the latter that the birds consumed great quantities of water and the droppings could literally be poured from the dropping tray.

This result suggests the question as to whether the value if any, of milk products in coccidiosis control, is due to direct action of lactic acid on the coccidia or to the purging of the bird to such an extent that all coccidia are voided with the faeces.

It is hoped to do further work along this line in the near future.

CAPON FATTENING EXPERIMENT

In continuation of work reported during 1927 a ration containing a large percentage of raw cull potatoes was fed in contrast to more commonly fed fattening mixtures. The following mixtures were given to three lots of cross-bred capons having 13 birds in each lot.

Pen 1. Equal parts of yellow corn meal, ground oats and wheat middlings.

Pen 2. Equal parts of ground barley, ground oats and wheat middlings.

Pen 3. Equal parts of ground oats, wheat middlings and ground raw poatoes.

The above mashes were mixed with a solution of one part of buttermilk powder in seven parts of water.

The table following shows detail of the results obtained.

TABLE 6—CAPON FATTENING EXPERIMENT

Pen	Average weight per bird at beginning	Average weight per bird end of first week	Gain per bird	Average weight per bird end of second week	Gain per bird	Total gain per bird	Cost of feed per pound of gain
	lb.	lb.	lb.	lb.	lb.	lb.	cts.
1. Corn-meal	7·38	7·77	0·39	7·85	0·08	0·47	30·8
2. Barley meal	6·46	6·92	0·46	7·04	0·09	0·55	24·0
3. Potatoes	7·00	7·33	0·33	7·58	0·25	0·58	17·95

DISCUSSION.—In considering the results here presented it must be pointed out that the birds under experiment received soft food in the confinement of a pen for two weeks prior to this period of crate fattening. It is not surprising then that good gains were only made during the first week. It must not be considered that the above are typical gains under these conditions. The greatest gain was made with potatoes at the lowest cost. Greater gains at a lower cost were made with barley than with corn meal. During 1927 cheaper gains were made with one-fifth of the mash being potatoes in place of corn meal. A greater economy and greater gains were made during this experiment using one-third of raw potatoes for the same amount of corn meal. Corn meal is expensive and often difficult to obtain in some districts. Cull potatoes and barley are cheaper and usually found on any farm in Canada.

The following observations may safely be made from the above experiment:—

(1) During two years cheaper gains have been made with ground raw potatoes substituting for the corn meal of a fattening mash. During the present experiment weight gains were greater and cost per pound of gain was considerably less with potatoes.

(2) During this experiment greater gains at a lower cost were made with ground barley than with corn meal.

(3) Since both ground barley and cull potatoes are cheaper and more easily obtainable than corn meal in most places in Canada, it would appear that poultrymen and farmers could make a considerable saving by using home grown feeds such as barley and cull potatoes in fattening birds rather than the more expensive imported product which is often difficult to obtain. Potatoes particularly and barley also have the advantage of giving a whiter flesh than corn meal which is a factor of importance on some markets.

EXPERIMENTS FOR EGG PRODUCTION

Experimental work with various feeds and treatments for egg production was continued during the winter of 1928-29. Eight pens of thirty birds each, White Leghorn pullets were used and chosen as uniformly as possible for each pen with regard to maturity, size and apparent quality. The following was the arrangement of the pens.

Pen 1. Grain and mash hopper fed. This pen received the basal ration as follows:—

Grain—a commercial scratch grain mixture. Mash—alfalfa leaf meal 50 pounds, bran 50 pounds, middlings 100 pounds, yellow corn meal 100 pounds, ground oats 100 pounds, meat meal (60 per cent protein) 45 pounds, fish meal (60 per cent protein) 20 pounds, bone meal 4 pounds, salt 1 per cent, crude cod liver oil 2 per cent (15·7 per cent of animal feeds). The grain was fed in hoppers in lieu of in the litter as is customary. Grit, shell and greenfeed in the form of cabbage, mangels and sprouted oats were available.

Pen 2. High protein fish meal (70 per cent protein)—Ration similar to the above except that 55 pounds of a 70 per cent protein fish meal was substituted for the meat meal and fish meal of the basal mash making 12·9 per cent of animal feeds and approximating the animal protein content of the basal ration. Treatment otherwise similar to the control pen (pen 4).

Pen 3. Ultra violet rays (mercury vapour lamp). Basal ration as for the control pen but receiving irradiation from a quartz tube mercury vapour lamp for a period of twenty minutes daily, at a distance of three feet from the subject.

Pen 4. Control pen—basal ration as given above (see pen 1) in every detail except scratch grain given in litter rather than in hoppers.

Pen 5. Cod liver meal—basal ration as for control pen but with 5 per cent of cod liver meal making 15·7 per cent of animal feeds and approximating the animal protein content of the basal ration.

Pen 6. Ultra violet rays (carbon arc lamp) basal ration as for control pen but birds irradiated for a period of six hours daily with an old type street lamp using sunshine carbons.

Pen 7. Iodine Supplement—basal ration but receiving a supplement of two drops daily for the pen, of a 50 per cent solution of potassium iodine in water. This was increased gradually to four drops daily.

All pens were housed and handled alike throughout the experiment. During the months of February, March and April all eggs were weighed according to pen. Fertility and hatchability were determined by placing a male bird in each pen and alternating from day to day. Three such mating periods were carried out with one week between each and the 150 eggs saved from each pen were incubated, the average of the three periods being used for comparison. Each experiment will be dealt with separately.

The following table shows detail of the experiments worked out on a bird day basis.

The values of the different mashes were as follows: basal mash, $2.75 cwt.; fish meal, $2.80 cwt.; cod liver meal, $2.70.

TABLE 7—EXPERIMENTS FOR EGG PRODUCTION

Treatment	Gain or loss in body weight	Total feed consumption	Number of eggs laid	Average weight of eggs	Total weight of eggs laid	Pounds of feed per pound of eggs	Percentage fertile eggs	Percentage fertile hatched	Per cent total hatched	Total cost of feed	Value of eggs laid	Feed Cost per pound of eggs laid	Profit over cost of feed	Profit plus value of weight gained
	lb.	lb.		oz.	lb.	lb.	%	%	%	cts.	cts.	cts.	cts.	cts.
Pen 1, Grain and mash hopper fed	+0·52	49·69	71·8	2·04	9·16	5·42	62·0	80·6	50·0	111·49	298·3	12·2	186·8	198·2
Pen. 2, Fish meal	+0·79	49·91	77·7	1·98	9·61	5·19	80·0	56·7	45·3	113·28	333·8	11·8	220·5	237·9
Pen 3, Ultra violet rays (mercury vapour)	+0·67	57·07	76·8	1·99	9·55	5·97	70·0	77·1	54·0	124·94	325·4	13·1	200·5	215·2
Pen 4, Control pen (cod liver oil)	−0·13	42·96	75·4	1·94	9·14	4·70	77·3	82·7	64·0	98·86	321·7	10·8	222·8	220·0
Pen 5, Cod liver meal	+0·69	51·55	82·9	2·01	10·41	4·95	69·3	81·7	56·7	115·22	358·1	11·1	242·9	257·9
Pen 6, Ultra Violet rays (carbon arc.)	+0·52	48·05	80·2	1·97	9·87	4·87	84·0	69·8	58·7	106·52	340·6	10·8	234·1	245·5
Pen 7, Iodine	+0·9	54·65	73·9	2·04	9·42	5·80	78·7	78·8	62·0	124·20	336·0	13·2	211·8	231·8

The value of eggs laid was calculated on the total weight of eggs laid estimated on the average weight for February, March and April times the number of eggs laid, on a value per pound basis at prevailing prices. Value of weight gain was calculated at 22 cents per pound.

METHODS OF FEEDING LAYERS

Both pens in this project received the basal ration, the one being the control pen and receiving scratch grain in the litter in the usual way, the other having grain hoppers opened only for a short period morning and evening. Both pens had dry mash available throughout. It is often considered that the feeding of scratch grain in hoppers precludes the possibility of disease and mortality through the picking up of filth from the litter as no doubt happens when the grain is fed broadcast over the floor.

Examination of the results from pens 1 and 4 as given in the above table shows a substantial weight gain for the hopper fed birds as against a slight loss for the control pen. This no doubt explains in part the increased food consumption in the first mentioned pen since egg production was less than the control pen and would normally require less food. Taking egg size into consideration, however, it may be noticed that practically the same weight of eggs was produced. Pounds of feed per pound of eggs was least for the control pen owing to the food required for the increase in body weight in the hopper fed pen. It is apparent that practically equally efficient use of feed was made by both pens. Against these results must be considered the fact that mortality was very much higher for the hopper fed pen.

In considering fertility and hatchability it will be noticed that the control pen was superior throughout. In this connection it is interesting to note that this was the case in spite of loss in body weight.

To determine economy of returns the cost figures must be examined. The value of eggs laid on a total weight basis was greater for the control pen although the weight laid was the same due to the fact that these birds produced at a greater rate during the period of high egg values. Feed cost per pound of eggs laid was least for the same pen owing to the fact that no feed was required in this pen for body weight increase. Profit over cost of feed was also greatest for this pen. Allowing 22 cents per pound for weight gain and deducting at the same rate for the loss of weight in the control pen greater profit of roughly 20 cents per bird was returned by the control birds.

It is apparent from the above analysis that two factors were chiefly responsible for the results obtained, firstly a greater feed consumption by the hopper-fed pen, the chief result of which was an increase in body weight since the total weight of eggs laid was practically identical for both pens, and secondly, a greater value of eggs laid by the control pen due to heavier production during the months November to February inclusive, or the period of high prices.

In this instance the feeding of grain in hoppers gave no improvement over feeding in the litter. It would appear that any filth which may have been picked up with the grain in the litter had no effect upon results, since mortality was much greater in the hopper-fed pen, the factor of loss in body weight only being excepted.

It must be remembered that hoppers of grain were only opened for a short period morning and evening, as experience has shown that grain consumption would be so great that egg production would suffer greatly to the too great benefit of body weight if they had access to grain at all times. Consumption of grain was considerably greater for the hopper-fed pen, a fact which no doubt partly explains the increase in body weight.

FISH MEAL VS. A COMBINATION OF ANIMAL FEEDS INCLUDING FISH MEAL

A good quality high protein (70 per cent) fish meal was contrasted with the animal protein feeds as given in the basal ration and containing fish meal (57 per cent protein), meat meal (60 per cent), and bone meal. Treatment of both pens was otherwise identical.

Analysis of the results given by pens 2 and 4 in the table "Experiments for Egg Production" shows a large increase in weight for the birds on fish meal and a slight decrease for those of the control pen receiving the mixture of animal feeds. A corresponding increase in feed consumption may be noticed, which may be accounted for by the body weight increase and also an increase in numbers and size of eggs over the control pen. On a basis of pounds of feed per pound of eggs the control pen is slightly superior owing to lower food consumption and indirectly the fact that no weight gains were made.

In considering hatching results, hatchability was superior for the control pen, although in respect to fertility the fish meal pen is slightly superior.

Feed costs were greater for the fish meal pen owing to the greater cost of the mash and increased consumption. The value of the total weight of eggs laid was slightly greater for the fish meal pen. Feed cost per pound of eggs laid was superior for the control pen, and consequently the profit over cost of feed was very slightly superior for that pen also. When the value of the added weight gain of the birds of the fish meal pen is added to the profit over cost of feed, as it should be, the profit is considerably greater on fish meal.

Analyzing the above considerations, it is apparent that the fish meal mash gave greater production and profit, being inferior only in hatchability. The birds made more efficient use of their feed than did those of the control pen.

A summary of two years' results contrasting fish meal with meat meal and with a combination of meat meal, fish meal, and bone meal shows a greater production of 7·3 eggs per bird and a greater profit of 70·8 cents for fish meal as the only animal feed of the mash. In a previous year a 57 per cent protein fish meal was very much superior to all meat meal for the animal protein of the ration.

THE INFLUENCE OF ULTRA VIOLET RAYS ON EGG PRODUCTION

Continuing work of previous years, the effect of ultra violet rays on egg production was the subject for experiment. Three pens of thirty birds were used, all being treated identically except that one was irradiated with a mercury vapour lamp for a period of twenty minutes daily at a distance of three feet from the subject, another with an old-type street lamp with a carbon arc and using sunshine carbons, and a third receiving no special treatment as control pen.

In considering pens 3, 4, and 6 of the table "Experiments for Egg Production" it is again noticeable that the control pen is the only one losing weight. A feature of the feed consumption is the large amount used up by the mercury vapour pen. Total weight of eggs produced was greatest on the carbon arc lamp, followed by the mercury vapour lamp. The control pen was inferior in this respect. Pounds of feed per pound of eggs was least for the control pen owing to low feed consumption. Fertility was superior on the carbon arc and hatchability on the control ration, and poorest with the carbon arc. The carbon arc and mercury vapour pens were both superior to the control pen in value of eggs laid. The carbon arc pen was the only one in the experiment which equalled the control pen in feed cost per pound of eggs laid. Profit over cost of feed evaluating body weight was greatest for the carbon arc pen, with the control and mercury vapour pens almost equal.

An important consideration in connection with the carbon arc lamp was the fact that 165 carbons at 15 cents each were used over the period, or a total cost of $24.75 for the pen, which equals 82½ cents per bird based on the number of birds commencing the experiment, or an additional cost of 1·3 cents for every egg laid by the pen. There is a possibility, however, that six hours' exposure per day was greater than is necessary, with a consequent too great

wastage of carbons. The recommendation of the carbon manufacturers was followed in this regard. At the above cost for operation it is doubtful whether the excess profit was sufficient to cover the investment. A cheap street lamp was used, but if a good carbon arc lamp had to be purchased the overhead would be much increased.

A summary of four years results with ultra violet rays using the mercury vapour lamp is given in the following table. Also of the same period with crude cod liver oil in addition to the control ration.

TABLE 8—ULTRA VIOLET RAYS FOR EGG PRODUCTION

Treatment	Year	Total cost of feed	Eggs laid	Value	Feed cost per dozen	Profit over cost of feed	Percentage fertile eggs	Percentage fertile eggs hatched	Percentage total eggs hatched
				cts.	cts.	cts.	%	%	%
Ultra violet rays	1926	146·6	82·8	472·9	21·3	326·2	83·7	36·1	30·2
	1927	157·6	95·0	584·8	19·9	427·2	71·4	48·9	34·9
	1928	145·5	103·5	474·5	16·9	328·9	78·7	64·9	51·1
	1929	124·9	76·8	325·4	19·6	200·5	70·0	77·1	54·0
Average	.....	143·6	89·5	464·4	19·4	320·7	74·8	65·8	49·2
Control pen	1926	136·8	77·0	441·2	21·3	304·4	74·7	15·3	11·4
	1927	168·1	100·7	592·9	20·0	424·8	68·1	42·0	27·8
	1928	147·7	79·4	362·6	22·3	214·9	79·3	66·6	52·8
	1929	98·9	75·4	321·7	16·2	222·8	77·3	82·7	64·0
Average	.....	137·9	83·1	429·6	19·9	291·7	75·3	74·4	56·0
Crude cod liver oil	4 year ave.	138·6	88·2	460·2	18·8	321·8	78·3	62·3	48·8

As shown by the above table only during 1927 did the control pen exceed the ultra violet pen in number of eggs laid, while during 1929 only was the profit over cost of feed greater for the control pen.

Fertility was practically equal for both pens over the period but hatchability was much superior for the control pen. In order to make a fair comparison as to the comparative efficiency of the lamp however, it must be contrasted with crude cod liver oil which represents a more economical method of supplying the same factor to the ration. Examination of the results in the above table shows that production and value of eggs was almost identical with cod liver oil as compared to ultra violet rays. Feed cost per dozen eggs laid was least and profit over cost of feed was very slightly superior with crude cod liver oil. Fertility and hatchability were almost identical from both pens.

With regard to fertility and hatchability an average for the years 1927, 28 and 29 gives practically identical results with all three pens. In addition it is apparent that some uncontrolled factor affected the results during 1926 since results from both pens were very poor. One such factor is the small number of the number of eggs set during that year. It is to be expected that fertility and hatchability would be less affected than egg production by the use of the lamp and oil since hatching was done in April and May when the sunshine entering all pens would be sufficiently potent to supply a large amount of ultra violet rays.

Mortality was considerably higher for the pen on ultra violet rays than for either the control or cod liver oil pens.

It is apparent from the above that ultra violet rays as administered in this test gave superior results to the unsupplemented ration. Crude cod liver oil

in addition to the control ration at the rate of 2 per cent of the mash gave almost identically equal results to the treatment with ultra violet rays. In view of the cheapness of the latter supplement it is no doubt the most economical way of adding the accessory factor which apparently is capable of increasing egg production.

VITAMIN FEEDS FOR EGG PRODUCTION

The use of cod liver meal rather than cod liver oil as a supplement to the laying ration is quite common at the present time. Work was continued during the past year feeding the meal as a supplement to the basal ration at the rate of five per cent. Since cod liver meal is roughly 40 per cent oil the feeding of five per cent of this food approximates the amount of oil that would be fed in giving 2 per cent of crude cod liver as is commonly recommended. The amount of animal feeds in the mash was reduced to make up for the protein unavoidably added with the cod liver meal.

Reference to the results obtained as shown in the table "Experiments for Egg Production" shows a substantial gain in body weight for the pen on the meal. The total weight of eggs laid was quite superior on the meal and the pounds of feed per pound of eggs was fairly comparable in spite of the increase in feed consumption in the meal pen.

Fertility was superior for the control pen but hatchability was practically equal for both.

In considering the economy of production the cod liver meal pen was quite superior in all but feed cost per pound of eggs laid.

As this is a complete reversal of results obtained during the previous year no definite conclusions can be drawn. This is also not in agreement with growth experiments with chicks over a period of years in which cod liver oil was quite superior (see Annual Report 1928). The possibility of lack of uniformity in quality in the two products is a possible explanation for such variable results.

THE NEED OF IODINE IN POULTRY FEEDS

The trend of poultry husbandry at the present time has been towards the feeding of complicated rations with many supplements in the form of vitamin feeds and minerals. Among the latter iodine is one of those used and recommended oftentimes with very little in the way of actual experimental work to indicate its value or the proper method of its use. The project here reported represents some preliminary work designed mainly to determine reaction in egg production and condition to a dosage of the most commonly used form of iodine, potassium iodide. Two drops daily of a 50 per cent solution of potassium iodide were given to the thirty birds of this pen in the drinking water for a period of two months. At the end of this time the dosage was increased to four and later to six drops per day.

An outstanding feature of the results from the iodine fed pen was the large weight gain made by the birds of this pen. Feed consumption was also high as would be expected with a large weight gain and the production of a comparatively large weight of eggs as well. Pounds of feed per pound of eggs was much greater than for the control pen due to the body weight gain, the weight of eggs and the resultant increase in food consumption.

Fertility and hatchability were almost identical for both pens.

Profit over cost of feed, gain in body weight neglected, was superior for the control pen. When the value of the additional body weight is calculated profit greater to the same extent is shown by the iodine fed pen.

No toxic effect was produced by the dosage of iodine at any time and the birds appeared to compare well with the control pen in condition. On the other hand, very little benefit was obtained in the feeding of this mineral. More exhaustive tests are at present under way, feeding iodine in several forms.

SUMMARY—EXPERIMENTS FOR EGG PRODUCTION

(1) The feeding of the grain mixture in hoppers gave no better results than the accepted method of broadcasting in the litter in this experiment. The birds whose grain was scattered in the litter were superior in hatching results and profit over cost of feed but gave an equal weight of eggs produced. Mortality was least for the "broadcast" pen, but a loss in body weight was experienced as against a substantial gain for the hopper fed pen.

(2) The use of a high protein fish meal gave superior production and profit over cost of feed with an increase in body weight. Hatchability was superior for the control pen receiving a meat meal, fish meal, bone meal mixture of animal feeds.

A summary of two years results shows superior returns from fish meal over meat meal in one instance and over the above mentioned combination of animal feeds in the latter case.

(3) Superior production and profit was obtained with irradiation from a carbon arc lamp followed closely by the control pen (cod liver oil) and the birds irradiated with the mercury vapour lamp. The cost of carbons used in this experiment with the carbon arc lamp was so great as to make its use uneconomical.

A four-year summary shows irradiation with a mercury vapour lamp to give superior results to the unsupplemented control ration. When the control ration was supplemented with crude cod liver oil at the rate of 2 per cent of the mash, however, equally good returns were made as with irradiation and more economically if the cost of the lamp is considered. Mortality was greatest for the irradiated pen.

(4) In the experiment here reported cod liver meal was a more efficient supplement to the laying ration than was crude cod liver oil. This is at variance with previous results and with results in growth experiments, consequently no conclusions are justified.

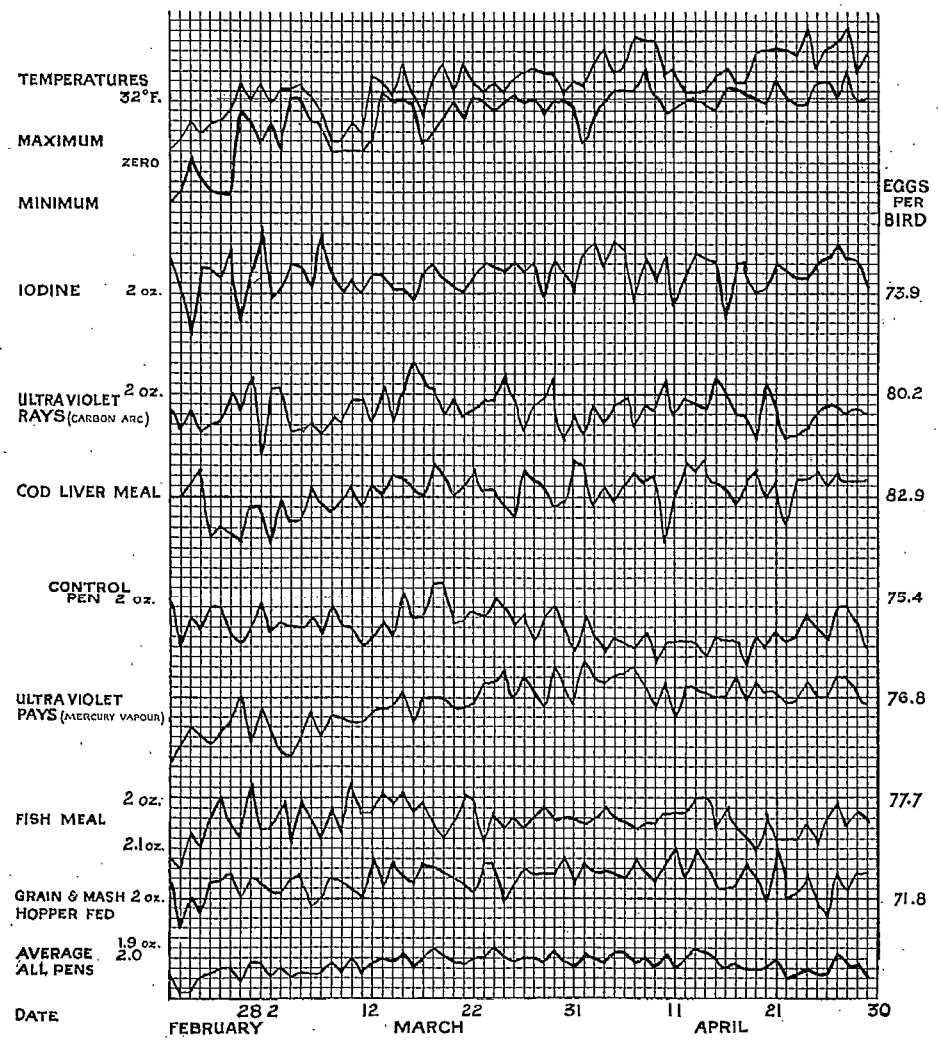
(5) The feeding of iodine in the form of potassium iodide to laying hens gave greater body weight and a greater total weight of eggs produced. When the value of increase in body weight was considered a slightly greater profit over the control pen was obtained. This work is being continued and no conclusions may be drawn from the one year's results.

A STUDY OF RANGE OF EGG WEIGHTS

The chart reproduced herewith is given mainly as a graphical way of illustrating the large variation from day to day in average egg weight and also in egg weight over a period of months, between pens which are similar in breeding, method of rearing and condition and with but slight variation in treatment.

An outstanding feature of the graph is the large size of egg in the pen grain and mash hopper fed and the pen receiving iodine. At least a partial explanation of this fact would appear to be the factor of number of eggs laid which is low in each instance. It is generally considered that a great number of eggs has a tendency to limit egg size.

Another comparison of interest is that between the two pens irradiated with the carbon arc and mercury vapour lamps respectively. The ration was identical, the only factor of difference being the source of irradiation. In this case the higher egg production (carbon arc) gave the smaller egg and vice versa (mercury vapour).



In comparing the grain and mash hopper fed pen with the control pen whose feeding was identical except that the hopper fed birds consumed a proportionately greater amount of scratch grain, the same holds true, namely, higher egg production, smaller eggs and vice versa. In this case the total weight of eggs laid was identical within a few decimals. In the case of the control pen a slight loss in body weight was experienced while a substantial gain was made in the hopper fed lot. It may be significant that the pen which lost weight laid such small eggs since the number laid was not appreciably greater for the large egg pen. The sudden slump in egg size as shown by the graph from the 22nd of March on, may well be linked up with loss of condition and body weight in the control pen.

In view of the egg size variations and the tendency to decrease in egg size with large numbers of eggs it is not suggested that the feeds or treatment given were responsible for increase or decrease in egg size as shown by this graph.

It is interesting to note that egg size as shown by the curve for "average all pens" increased gradually during February and early March, held steadily for a period and then dropped off again towards the middle of April. A gradual

increase in egg weight is usually expected in pullets during the first few months of laying which might account for the above mentioned increase during February and March. The decrease in April corresponds quite closely to the spring flush of egg production during which period the number of eggs laid increased very considerably. It would appear that with increase in numbers of eggs the egg size dropped off in this instance.

There is apparently no correlation between egg size and temperatures as shown in this study.

BEST KIND OF LITTER

For several years past peat moss has been used in Canada as litter for poultry houses to a considerable extent. Up to the present time its practicability has been seriously lessened by its cost, a factor, which has in the past completely overshadowed the many good points of the material as litter. Recent months, however, have seen a considerable reduction in cost and a subsequent increase in its use throughout Canada.

During the winter of 1928 a test was undertaken in order to gauge the relative usefulness of the two materials straw and peat as litter for the laying house. Three pens were used in the experiment on having straw only for litter, another having a mixture of straw and peat and a third with peat only. Straw was purchased for $9 per ton while peat litter cost $2.20 per bale of roughly 145 pounds.

The following table shows the detail of the experiment.

TABLE 9—BEST KIND OF LITTER

Type of litter used	Number of birds at beginning	Total mortality	Percentage mortality	Total weight litter used	Weight used per bird	Cost of litter per bird
			%	lb.	lb.	cts.
Straw	50	11	22·0	1,053	28·0	12·6
Straw and peat	55	8	14·5	838	17·4	19·1
Peat	50	11	22·0	642	14·9	22·3

The above table covers a period only of six months from November 1 to April 30 or the period of the year during which damp and cold weather cause frequent changing of litter. It is important to note in this connection that while the straw litter was changed seven times during the period and the straw and peat mixture five times two changes only were made in the peat litter pen and the last such change being made during the final month of the experiment, the litter was not changed again for a period of six weeks. Thus we have only two changes of litter over a period of seven and one half months as against seven and five respectively for a period of six months. The importance of this factor from the stand point of saving of labour is readily realized. Over a twelve month period this saving of labour would be increased. Worked out on a monthly basis we have a cost of 79 cents for straw as against $1.28 for peat. If a valuation could be placed upon the extra labour required in changing straw the difference between the two would be still further decreased.

Variation in mortality is so slight as to be insignificant particularly since deaths were almost all due to an epidemic which swept all three pens. In so far as the apparent health of the birds is concerned there is nothing to choose since all pens produced at a satisfactory rate and appeared to be in good condition with the exception of the epidemic just noted.

The cost of litter was not appreciably decreased in using a combination of straw and peat and such a mixture was found to be unsatisfactory in many ways. The straw became damp and decreased the useful life of the peat considerably. Whereas the all straw and all peat pens made an attractive appearance the combination was unsightly.

It is commonly stated that peat litter is undesirable on account of its dusty tendency. This was not found to be the case in this experiment since if the cotton screens are brushed occasionally no inconvenience is given by the dust. If the grain is fed in hoppers the amount of dust is still further diminished.

It would appear from this experiment that peat moss is a highly desirable type of litter for laying houses. If purchased as cheaply as was done in this experiment, the quotations given being on carload lots delivered at Ottawa, there is little doubt as to its practicability considering the saving of labour accomplished and other desirable features of the litter. On the other hand, if straw is available at lower rates than those quoted in this experiment it would not be economical to use the more expensive product.

As was previously stated a depth of from four to six inches of peat litter was used. It is quite posible that half of this amount might have been equally satisfactory. When this is done it will be found necessary to rake the peat to the front of the house at intervals since the birds scratch facing the light and pile the litter back under the dropping boards. With but two to three inches covering, the floor would have a tendency to become bare very quickly.

At the present time this work is being repeated using much smaller amounts of litter. One can readily appreciate that the practicability of this material would be very much increased if smaller amounts could be used with efficiency.

At the present time it is hoped that Canada's numerous peat bogs may be made to supply a good grade of peat moss at a much more reasonable price than is possible for the imported material. Should this be the case there is no doubt that a huge consumption of peat litter could be built up by Canada's poultry industry.

HEATED VS. UNHEATED HOUSES

During the winter of 1927-28 a heated house of commercial manufacture was contrasted with an unheated house such as is commonly used in these latitudes, as to health of birds and economy of production. The heated house embodies a special type of ventilation designed through its rapidity of action to permit of accommodating twice the commonly recommended number of birds per floor space. A hot water heating system is used with pipes under the dropping boards. The building itself is faced on the inside with galvanized sheets using shavings as insulation between this and the outer wall.

During the first season superior results were obtained in the unheated house but certain uncontrollable factors made the results obtained of little value. During the season of 1928-29 more satisfactory and uniform results were obtained. A 20 by 20 foot house with straw loft and open front was used as the control or cold house containing one hundred leghorn pullets as against two hundred in the same floor space in the other house.

The following table shows detail of results for the second experiment.

TABLE 10—HEATED VS. UNHEATED HOUSES

Type of house	Number of birds at beginning	Percent mortality	Total value of feed	Value of coal used	Value of litter used	Value of feed, fuel and litter	Eggs laid	Value	Production cost per dozen	Profit over cost of feed
		%	cts.	cts.	cts.	cts.		cts.	cts.	cts.
Heated house....	199	43·2	178·77	12·84	13·10	204·71	144·1	552·58	17·04	347·87
Unheated house..	101	27·7	203·25	.....	26·58	229·83	151·0	574·78	18·26	344·95

Figures on a per bird basis for feed values, etc.
Depreciation—
Heated house 30 cents per bird based on value of $600 less 10 per cent—Profit less depreciation $3.18 per bird.
Unheated house 39 cents per bird based on value of $390 less 10 per cent—Profit less depreciation, $3.06 per bird.

The most significant feature of the above table is mortality, that in the heated house being greater by 16 per cent. This condition was fully reflected in the condition of the birds, those in the unheated house being in excellent condition throughout except for a short period when roup broke out, and they were in excellent condition at the end of the experiment. On the other hand those in the heated house were in only fair condition for a considerable part of the time in spite of all that could be done from a feeding standpoint. The epidemic of roup mentioned took greater toll and was more difficult to control in this pen. It was apparent by a foul odour in the mornings that sufficient ventilation was not given for the number of birds. Considering mortality and valuing the pullets at $2 per bird there was a greater loss by mortality of $116 in the heated house as against the unheated one.

It will be noted that the excess cost of coal for heating was more than made up by the extra cost of litter in the colder pen. Feed consumption was also higher in the cold pen which may be explained by the greater production of this pen and greater requirements in food for the maintenance of body heat. More eggs were laid in the unheated pen at a greater value but at a higher production cost, leaving a greater profit over cost of feed, fuel and litter of roughly 3 cents per bird for the heated house.

Considering depreciation the heated house shows a greater profit of 12 cents per bird.

The factor of most importance in so far as the heated house is concerned is the number of birds per floor space. In consideration of the condition of the birds and the mortality experienced it is possible that this factor while favourably affecting the profit to some extent, was also the greatest drawback to the health of the birds. The loss through mortality far overshadows any additional profit through economy of egg production. It must be remembered that all birds were of similar breeding, condition and development at the commencement of the test.

An interesting comparison presented itself with regard to egg size in the heated and unheated pens. It was noticed in the early winter that egg size was considerably greater from the unheated house which might merely have been a coincidence. Actual weights showed the average to be 2·08 ounces from the unheated house and 1·89 ounces from the heated one although both pens were quite similar in breeding.

In proof of this similarity of breeding the egg size of the sires dam and of the dam of the pullets in both houses was traced.

With regard to the birds in the heated house, on the sires side 42·8 per cent were from grand dams laying 2-ounce eggs, 16·6 per cent from 2·3 ounce eggs, and 42·8 per cent from 2·4 ounce line. The average weight of the eggs of the dams of the pullets under consideration was 2·02 ounces.

In the case of the unheated house 57·2 per cent were from a sire whose grandam laid 2·6 ounce eggs and 43·8 per cent from one whose grandam laid 2·0 ounce eggs. The average egg weight of the dams of the pullets in the unheated house was only 1·94 ounces.

It would appear that from the viewpoint of heredity both pens had an equal chance for large egg size.

No conclusions are justified however until more work is done.

A more obvious example of the difference in size is indicated by the number of eggs in each class from settings for a size of egg experiment previously reported.

Pen	24 ounces and over	22 to 24 ounces	22 ounces and under
	%	%	%
Heated house	24	46	32
Unheated house	51	40	8

This experiment, heated vs. unheated houses, is being repeated, using one hundred and fifty birds in each pen. It is hoped thus to improve condition in the heated house and economy of production in the unheated one.

EXPERIMENTAL WORK ON THE BRANCH FARMS

Experimental work on the branch farms is gradually increasing in quality as accommodation and properly trained help is available. For the most part practical problems confronting the farmer and poultrymen in the district of each farm are mainly considered. A brief summary of certain projects in operation over a number of farms is in order here as giving an analysis of results from a " bird's eye view " of the subject which is not possible to the individual farm.

SKIM-MILK VS. MEAT MEAL

An analysis of experimental results shows that upon four farms, on some of which the project has been under way for a period of years, there is practically nothing to choose between the above-mentioned animal feeds as a source of protein for egg production from the standpoint of profit obtained over the cost of feed. Skim-milk is slightly favoured throughout, however. Availability and labour would seem therefore to be the important factors to consider in the use of these feeds.

FISH MEAL VS. MEAT MEAL

Out of five farms carrying on this test, the results from two of which represent three years' work, and one a period of two years, four show results in egg production and profit decidedly in favour of fish meal. In one instance there was little to choose between the two animal feeds.

It would appear that a great many excellent fish meals are available at the present time and that they have a very useful place as a source of animal feeds in laying mashes.

POTATOES AS A SUBSTITUTE FOR CORN MEAL IN FATTENING

Reports from three farms show excellent results in substituting cooked cull potatoes for corn meal in a fattening mash, in one instance over a period of two years. Greater gains were made and a superior dressed fowl produced. In one instance raw chopped potatoes were equally as efficient as the cooked.

It is interesting to note here that one farm has obtained good results over a period of three years substituting cooked potatoes for corn meal in the laying mash by the use of wet mashes.

CORN VS. BARLEY

Reports from three farms in substituting barley for corn in the scratch grain and mash of the laying ration show a great deal of variation in results. In one case barley was inferior over the first few years, but with a more carefully supplemented ration gave greater production during the final year of the experiment. A four-year average at another farm shows slightly greater profit for barley, while a third shows slight superiority with corn.

A great deal more work will have to be done on this subject before the proper status of barley in relation to corn for this purpose is understood.

DRY VS. WET MASH

A summary of results from several farms over a period of years shows no benefit from the feeding of a wet mash rather than dry mash only, almost without exception. When the factor of labour is considered in addition it does not seem practicable under average conditions to go to this extra trouble.

SUPPLEMENTARY FEEDS FOR FERTILITY, HATCHABILITY AND VIABILITY

Results from five farms to date show that superior fertility, hatchability, and viability of chicks was obtained with the feeding of cod liver oil and liver or a combination of both to breeding stock.

SNOW VS. WATER

Work on three farms indicates that equally efficient results can be obtained when snow is used in place of water for laying birds. This would obviate the necessity of keeping water above freezing temperatures or of leaving birds for long periods with ice only, as often happens in severe winter weather.

COSTS

Numerous experiments have been carried on over a period of years upon most branch farms relative to costs of incubation, brooding, rearing, fattening, egg production, etc. Reference to the annual report of the Experimental Farm in the vicinity of the farmer or poultryman concerned will show valuable information as to expected costs in the different poultry operations.

CANADIAN NATIONAL EGG LAYING CONTEST

REGISTRATION AND INSPECTION

During the year 1929 thirteen egg laying contests were conducted by this division. The Canadian Contest was conducted at the Central Farm. This contest is international in scope. The remaining twelve contests are provincial in nature and were conducted on Experimental Farms or Stations in the various provinces.

TABLE 11—NAME OF CONTEST AND NUMBER OF BIRDS: AVERAGE POINTS PER BIRD: LEADING PEN, PRODUCTION AND POINTS OF HIGHEST REGISTERED BIRD IN EACH. NOVEMBER 1, 1928 TO OCTOBER 23, 1929

Contest	Number of birds	Average eggs per bird	Average points per bird	Leading pen per number of points	Highest registered bird	
					Eggs	Points
Canadian	790	170·6	171·5	2,607·7	313	369·9
Prince Edward Island	200	186·9	200·2	2,532·6	288	325·0
Nova Scotia	220	170·6	171·1	2,237·0	272	317·3
Nova Scotia Southern	200	161·6	159·4	2,076·4	242	273·0
New Brunswick	200	168·1	190·6	2,558·5	293	345·2
Quebec Eastern	200	187·9	189·1	2,264·5	244	311·6
Quebec Western	200	168·0	187·7	2,276·7	250	319·0
Ontario	600	173·2	172·6	2,359·4	256	323·9
Manitoba	270	189·3	203·3	2,725·8	299	372·2
Saskatchewan	400	159·0	163·6	2,367·0	222	287·0
Alberta	290	156·6	163·4	2,316·8	246	292·9
British Columbia	460	203·0	218·5	2,893·6	303	346·9
Vancouver Island	340	202·2	218·5	2,793·3	305	349·3
Total	4,370	176·5	183·5			

NOTE.—Ten birds constitute a pen.

TABLE 12—NUMBER OF BIRDS AND AVERAGE PRODUCTION OF ALL CONTESTS, 1928–29

Variety	All contests		
	Number of birds	Average production	Average points
S. C. White Leghorn	1,970	174·5	187·0
Barred Plymouth Rock	1,640	181·8	185·2
White Wyandotte	340	161·3	168·0
S. C. Rhode Island Red	230	172·9	189·3
White Plymouth Rock	60	161·7	178·3
Ancona	50	143·1	137·0
Buff Orpington	20	155·5	169·7
Black Minorca	10	186·9	209·4
Light Sussex	10	180·1	181·3
S.C. Brown Leghorns	10	148·9	166·4
R.C. White Leghorns	10	146·5	150·9
S.C. Black Leghorns	10	162·2	149·8
R.C. Rhode Island Reds	10	122·0	122·1
Total and average	4,370	176·5	183·5

The Canadian National Egg Laying Contest has been in operation for ten years and a review of the work is worth while. Table 13 gives the number of birds entered each year, together with the average production.

TABLE 13—BIRDS ENTERED IN CONTEST—BY YEARS

Contest year	Total number of birds	Average production per bird
1919-20	1,610	122·5
1920-21	2,480	137·0
1921-22	2,590	146·3
1922-23	3,000	164·3
1923-24	3,710	169·6
1924-25	4,100	172·2
1925-26	4,220	179·5
1926-27	4,210	172·5
1927-28	4,230	175·4
1928-29	4,370	176·5

The figures in the foregoing table show the gradual increase in number of birds each year. The number of birds in contests has remained fairly constant since the 1925-26 contest. This condition can be attributed wholly to the lack of contest accommodation, as during the past four years no additional contest pens have been built. The number of poultry breeders desirous of entering birds in laying contests has always been in excess of the pens available. This is especially true in the provinces of New Brunswick, Ontario and British Columbia, and in the Canadian Contest.

During the first seven years of contest work there was a gradual increase in production. A decrease in production took place during the 1926-27 contest and a slight increase took place in production during the 1927-28 contest, and again in the 1928-29 contest year.

While the increase in production in 1928-29 was only slight; being only 1.4 eggs per bird, there was a very decided increase in egg size which amounted to 6.4 points per bird.

Like the 1927-28 contest the one conducted in 1928-29 was of 51 weeks duration and when compared with those held previous to 1927 which were 52 week contests it can be seen that production per bird compares very favourably.

1929-30 CONTESTS

The 1928-29 contest year closed October 23, allowing one week for returning the birds, cleaning the pens and putting in the incoming birds. Another series of Egg Laying Contests commenced November 1, 1929. No additional accommodation was provided for contest pens during the year so that the number of birds in contests remains practically the same as in the previous year. At present there are 4,400 birds in 440 pens and 880 spare birds, making a total of 5,280 birds in all contests.

Since egg laying contests in Canada are carried on primarily for registration purposes the regulations are drawn up in such a way as to encourage breeders who are paying particular attention to egg size in their breeding flocks. To accomplish this end birds are now scored on size of egg as well as on production. Points are allotted as follows:—

26 ounce eggs	1·2
25 ounce eggs	1·1
24 ounce eggs	1·0
23 ounce eggs	0·9
22 ounce eggs	0·8
21 ounce eggs	0·7
20 ounce eggs	0·6

Eggs weighing less than 20 ounces to the dozen are disregarded entirely, and eggs weighing 26 ounces to the dozen or over are scored as being 26 ounce eggs.

REGISTRATION

During the year 1,579 birds were registered in Canada. This number was made up of 323 males and 1,256 females. Registration is granted to males which are bred from second or subsequent generation females and from approved or Registered males. These cockerels must be at least six months of age and be worthy specimens of the breed they represent. Registration was granted to all females which laid 200 eggs or over in any of the Canadian National Egg Laying Contests, providing the eggs laid averaged 24 ounces or over to the dozen and the birds were typical of the breed and free from standard disqualifications. Birds of the Mediterranean breeds which laid eggs with tinted shells were disqualified and refused registration.

There were 1,666 birds which laid the required number of eggs but of this number 464 failed to measure up to the required standard as to breed character, size of egg, stubs or down on feet or legs, foreign colour in lobes or plumage, etc. The distribution by contests was as follows:—

TABLE 14—REGISTRATION

Contest	Number of birds in contest	Number laying 200 eggs or over	Qualified for registration	Disqualified		
				Small eggs	Stubs or down	Other causes
Canadian	790	248	146	94	.....	8
Prince Edward Island	200	86	77	9	.....	.....
Nova Scotia	220	62	37	24	.....	1
Nova Scotia Southern	200	53	30	21	.....	2
New Brunswick	200	94	69	25	.....	.....
Quebec Eastern	200	109	69	40	.....	.....
Quebec Western	200	64	54	10	.....	.....
Ontario	600	203	126	75	.....	2
Manitoba	270	124	94	25	2	3
Saskatchewan	400	79	61	17	.....	1
Alberta	290	61	46	14	.....	1
British Columbia	460	284	227	39	.....	18
Vancouver Island	340	199	166	27	1	5
Total	4,370	1,666	1,202	420	3	41

In addition to the 1202 contest females which qualified for registration there were 54 females which were spare birds which laid the required number of standard sized eggs to qualify.

During the year 1929 there were 245 breeders doing mating and hatching work with registered hens. The distribution of breeders and birds is shown in table 15.

TABLE 15—DISTRIBUTION OF BREEDERS AND REGISTERED HENS

—	Breeders	Registered hens
Prince Edward Island	12	38
Nova Scotia	14	53
New Brunswick	25	142
Quebec	25	139
Ontario	62	306
Manitoba	10	61
Saskatchewan	10	32
Alberta	15	59
British Columbia	72	598
Total	245	1,427

REPORTS

At the end of each week a report was sent out from each office where an egg laying contest was held giving the individual production of each bird for the week. These reports also gave the total eggs and points to date. Reports were sent to all contestants and interested parties, not only in Canada, but in the United States as well. In addition to those already mentioned the mailing list also included many poultry breeders and egg laying contest managers in England, Ireland, Scotland, France, Holland, Australia, New Zealand and South Africa.

A four-weekly report of eggs laid was also compiled and sent to the Canadian poultry press.

At the completion of the 1928-29 contest year a production and identification chart was prepared and sent to each breeder giving him important detail in connection with the performance of his birds while in the contest. The information on the chart gave pen and bird number, the wing label numbers if she was the daughter of a second or third generation registered hen, the flock name and breeder's mark, also the tattoo mark if the bird was registered, the body weight of the bird, the number of eggs laid, points secured and average weight of eggs laid, and disqualifications if such were present.

With such complete information at hand the breeder should be prepared to act wisely in the mating up of his registered hens the following season. These charts are especially useful in determining the worth of a bird not only from her egg producing ability, but also from the standpoint of the size of egg and size of bird as well.

BREEDER'S CATALOGUE

During the year 1929 poultry registration work made marked progress in Canada. Registered male birds are now showing up quite prominently and the demand for them is extremely keen. Many breeders with good average farm flocks are purchasing these registered males to head their breeding pens. They realize what the registered sire means in stock breeding and wish to secure the best male bird available to increase the production of the pullet offspring.

The second annual catalogue, known as the Blue Book, was issued by the Canadian National Poultry Record Association in December 1929. This publication has become extremely popular with the poultry public and the demand for the information which it contains is becoming quite marked. This Blue Book contains the constitution of the association, the rules of entry to the egg laying contests, an outline of Canada's National Poultry Registration Program and short articles relative to poultry registration and breeding work as conducted by this division. In addition this Blue Book has advertisements from the leading poultry breeders throughout Canada. This publication has been distributed to poultry breeders in all parts of the world, the majority of the copies going to breeders in Canada and the United States.

The effect the catalogue has had on the poultry industry is very promising indeed. Inquiries are coming from far and wide for registered birds and numerous sales of registered males or of eggs or chicks from reliable breeders are ever on the increase.

The catalogue itself is neatly gotten up, contains eighty pages and we believe is the forerunner of a greatly increased trade for Canadian registered poultry.

INSPECTION

During the year 1928 five registration inspectors have been employed in the work of inspection of registered stock. Assistance has also been given to these inspectors by the Record of Performance inspectors employed by the Live Stock Branch. In Quebec, J. D. Lang of the Lennoxville Station assisted, as did R. M. Hopper of the Experimental Farm, Brandon, Man.

Inspections were made for the purpose of:—

1. Identifying (by means of breeders registered tattoo marks) as qualified registered stock, the females mated for the season's hatchings.

2. Approving as to standard quality and fitness the males mated to registered females.

3. Examining trap-nets and hatching records and instructing breeders as to the best methods of handling same.

4. Checking up and identifying the sealing of bands on all chicks within a given time after hatching.

5. Examining and labelling those pullets that are qualified to enter a contest and to pass and tattoo qualified cockerels from registered matings.

6. Inspecting new breeders desirous of entering laying contests and tattooing all qualified females in the contests at the completion of the contest year.

7. Giving advice and instruction, when desirable, to the breeders in the carrying on of their pedigree breeding work.

As the work with registered poultry goes on from year to year it is interesting to know that intelligent effort on the part of the breeders to advance the quality of their stock is having its reward. The most successful breeders soon realized that their most hearty co-operation with the inspector in carrying out the program as outlined was the surest and most rapid way to success. At the present time the fullest co-operation exists between the breeder and the inspector. The remark often heard is, "Why does the inspector not make more visits to the flocks doing work under the Registration plan?"

To those most closely associated with the work it is clear that even at this early date (the seventh year of registration) the calibre of the breeder and the consistent performance of his birds is quite evident in the laying contests.

TABLE 16—NUMBER OF REGISTERED HENS MATED AND CHICKS HATCHED, 1929

—	Hens mated 1929	Chicks wing banded
Prince Edward Island	38	396
Nova Scotia	53	447
New Brunswick	142	2,028
Quebec	139	1,803
Ontario	306	3,425
Manitoba	61	714
Saskatchewan	32	214
Alberta	59	419
British Columbia	598	7,463
Total	1,427	16,909

During the 1929 hatching season there were 1,427 registered hens mated to registered or approved males. This was 37 hens more than were mated the previous year. The number of chicks banded in 1929 was also larger than the previous year. The average number of chicks banded was 11·8 per registered female.

The number of birds wing labelled as suitable for entry into contests is low, there being little or no reason for banding more pullets than can be accommodated in the contests. It is expected that in the near future provision will be made so that all suitable pullets from qualified registered matings may be listed for registration under the National Poultry Registration Policy.

WORK WITH POULTRY DISEASES

(In co-operation with Health of Animals Branch)

Report prepared by Dr. C. H. Weaver, Pathologist, Health of Animals Branch

ROUTINE LABORATORY SERVICE

Following will be found two tabulations, the one (No. P1) being a compilation of the five preceding years' and the other (No. P2) a tabulation of the current year's laboratory examinations.

These are derived from the general public as ailing fowl having been submitted for a diagnosis; dead fowl from the Egg Laying Contests; cadavers from the Farm Flock and chicks and fowl from the experimental work.

For the current year a total of 1,659 examinations were made. This is 185·5 per cent greater than six years ago, despite the fact that action has been taken to reduce as far as possible the specimens in keeping with the facilities for dealing with the material, and as a compensation thereto to make greater use of the information made available by the examinations.

Recording and tabulation of the autopsies makes the information available for comparative purposes. Accordingly the five preceding years' work is compiled and the precentages give a fair average to be expected in the material for each succeeding year, subject of course to normal fluctuations and variations due to the application of disease control measures or failure to control with probable increases following.

Disease laboratory outbuildings for small animals and poultry, Poultry Division, Ottawa.

TABLE P. 1—AUTOPSY TABLE FOR THE FIVE YEARS 1924 TO 1928

Item No.	Disease	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Number	Per cent
1	Intestinal parasitism-pathological	69	92	106	84	59	57	58	134	164	149	156	176	1,304	20·68
2	Roup and chicken pox	3	.....	4	1	7	11	2	1	4	1	.....	.....	34	0·53
3	Roup only	44	84	69	66	57	64	96	38	34	14	13	28	607	9·63
4	Pox only	.....	1	2	2	2	4	2	.....	.....	.....	1	.....	14	0·22
5	Tuberculosis	12	8	7	13	13	19	13	15	8	15	17	14	154	2·44
6	Pullorum	5	9	3	51	18	69	83	92	23	2	18	22	395	6·26
7	Pericarditis	4	4	3	....	6	1	3	6	7	4	1	3	42	0·66
8	Vent Gleet	5	2	3	3	4	2	4	3	5	1	3	3	38	0·60
9	Peritonitis	29	26	26	24	45	69	57	48	43	33	32	36	468	7·42
10	Reproductive	17	27	18	19	48	31	53	55	52	40	26	29	415	6·58
11	Avitaminosis	8	21	18	17	20	20	24	32	13	27	30	21	251	3·98
12	Cannibalism	8	13	12	17	44	77	70	25	15	12	8	11	312	4·95
13	Hemorrhage	20	19	13	18	23	27	40	35	25	24	12	24	280	4·44
14	Visceral gout	5	8	5	3	13	7	10	6	5	5	9	9	85	1·34
15	Digestive and liver	10	13	22	21	20	20	24	38	30	14	10	15	227	3·60
16	Tumor	7	13	13	30	15	18	19	13	19	6	7	9	169	2·68
17	Leukemia	9	11	11	6	10	13	13	15	11	12	12	12	145	2·30
18	Paralysis	3	14	15	15	11	8	19	12	10	9	3	6	125	1·98
19	Heat Prostration	.....	.....	.....	.....	.....	.....	1	20	1	5	.....	.....	27	0·42
20	Undetermined	21	17	19	16	23	222	229	102	110	63	31	30	883	14·00
21	Miscellaneous	20	25	14	24	21	26	45	63	31	25	8	26	328	5·20
	Total	299	407	383	430	459	765	865	753	610	461	397	474	6,303	.....
	Per cent totals	4·74	6·45	6·07	6·82	7·28	12·13	13·72	11·94	9·67	7·31	6·29	7·52	.....	.....

TABLE P. 2—AUTOPSY TABLE FOR THE POULTRY YEAR 1929

Item No.	Disease	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	No.	Per cent
1	Intestinal parasitism-pathological	22	19	9	7	10	25	18	31	42	33	32	44	292	17·60
2	Roup and chicken pox	.....	4	.....	9	2	1	1	.....	.....	.....	.....	.....	17	1·02
3	Roup only	6	[41	66	26	8	11	17	4	7	3	3	2	194	11·69
4	Pox only	3	4	1	1	.....	.....	1	1	.....	1	.....	.....	12	0·72
5	Tuberculosis	4	2	1	2	2	3	4	1	2	2	1	2	26	1·56
6	Pullorum	.....	.....	2	.....	3	28	44	21	1	.....	1	.....	100	6·02
7	Pericarditis	4	1	2	.....	2	4	.....	1	4	1	.....	.....	19	1·14
8	Vent Gleet	5	5	5	6	2	1	2	.....	.....	.....	.....	1	27	1·62
9	Peritonitis	5	11	10	7	10	24	18	17	10	12	6	10	143	8·61
10	Reproductive	5	4	5	5	8	10	12	6	5	5	4	5	74	4·33
11	Avitaminosis	6	6	3	5	5	15	8	1	5	13	3	7	77	4·64
12	Cannibalism	7	24	5	9	19	38	19	17	18	8	3	18	185	11·15
13	Hemorrhage	4	3	6	9	4	2	7	4	4	7	3	6	59	3·55
14	Visceral gout	.....	.....	3	2	4	3	2	2	3	2	1	3	25	1·50
15	Digestive and liver	1	3	4	6	4	7	4	3	5	5	2	5	49	2·95
16	Tumor	4	2	6	2	5	3	3	1	2	2	2	5	37	2·23
17	Leukemia	.....	5	5	6	1	2	3	2	3	6	1	8	42	2·53
18	Paralysis	.....	.....	3	2	2	1	.....	1	.....	.....	.....	1	10	0·60
19	Heat Prostration	.....	.....	.....	.....	.....	.....	11	7	3	1	1	.....	23	1·38
20	Undetermined	7	6	7	5	21	47	34	47	20	11	7	4	216	13·01
21	Miscellaneous	5	1	3	2	3	3	1	4	4	1	2	3	32	1·92
	Total	88	144	146	111	115	228	209	171	138	113	72	124	1,659	.....
	Per cent totals	5·30	8·67	8·80	6·69	6·93	13·74	12·59	10·30	8·31	6·81	4·33	7·47	.....	.....

Of the 6,303 specimens for the five years 1,304 or 20·68 per cent are tabulated as intestinal parasitism, heading the list by more than double the number due to roup, the next highest disease condition.

Items 20 and 21 containing undiagnosed specimens for such reasons as putrification, no apparent cause, etc. and miscellaneous materials, probably would be as well omitted in calculating the various disease incidence. If the 1,211 or 19·21 per cent occuring under these headings are deducted from the total leaving 5,092 there is then of this number 25·60 per cent as due to intestinal parasitism.

The monthly percentage is lowest in November, the first month of the poultry year, with 4·74. There is a constant and gradual increase to the maximum of 13·72 per cent in May, followed by a gradual decline to 6·29 per cent in September, then a rise again in October to 7·52 per cent.

This year's monthly mortality shows the same rise and fall as for the five years' period. The peak occurs in the spring time, but one month ahead of the average, that is April.

A spring time peak in poultry mortality is explainable from these tables and from a mortality study reported in last year's annual report. By the latter it was shown that the spring time peak of mortality is correlated with the seasonal rise in egg production, in pullet flocks. In the table for this year the mortality causes commonly associated with the laying peak are highest in April, cannibalism leading with 38, peritonitis 24 and avitamimosis 15. By that month roup has decreased though contrary to the rule. Chick losses naturally swell the number seasonally, both from pullorum and coccidiosis.

According to the disease percentages between this year's tabulation and the average, intestinal parasitism with 17·6 per cent is below the average. Roup is 2 per cent, peritonitis 1·2 per cent, reproductive diseases 2·2 per cent and cannibalism 6·2 per cent above the average.

The undetermined specimens (item No. 20) contains many where but a partial autopsy or laboratory examination had been made. This pertains to chicks from studies of a defined or circumscribed nature where it was but necessary to ascertain whether or not some one thing was in existence. As an example, in the pullorum control work the brooder mortality subjects were merely cultured for *B. pullorum* and if negative which was the rule as the flock approached the point of freedom from infection, the number was entered as cause of death undetermined. Similarily in nutritional studies all deaths were examined for the cause under study and if negative would go to the undetermined column, unless clinical evidence suggested further examination. If of suitable age the latter groups would be cultured for pullorum, as an additional check on the pullorum control work. Again intestinal parasitism was watched for as these diseases influence the use made by the birds of their rations, and if present might if undetected and properly reckoned with give a false interpretation of the usefulness of the ration in such infested subjects.

PULLORUM DISEASE CONTROL

Blood testing as applied heretofore to the flocks on the Experimental Farms has been for the purpose of determining whether or not infection existed in the birds and to what extent if present. This was followed by systematic testing, including all birds comprising the flock units for the purpose of detection, removal of carrier infected individuals and subsequently the eradication of the disease.

Disease free flocks have been established with indications of others being added to the list as the work progresses. This leads to a consideration of the possibility of a modification of the plan heretofore followed and the substi-

tution, where indicated, of a partial test or intermittent tests at longer intervals. The extent of testing subsequent to the establishment of clean flocks cannot be definitely predetermined, but will be dependent upon future developments.

Chances of reinfection of the flock varies greatly between the different units because of varying circumstances, such as the amount, kind and source of outside stock introduced into the flocks. For these and many other reasons each flock becomes a separate consideration.

During the year some flocks now pullorum free were not tested and others were given but a sample test. This has resulted in a slight decrease in the number of blood samples tested. If sample testing or testing at longer intervals suffices to maintain accurate knowledge of the state of the flocks, once considered free of infection, and additional flocks are added to the clean list then a corresponding decrease in testing may be anticipated.

A total of 6,858 blood samples were submitted to the agglutination test during the year.

BLACK-HEAD OF TURKEYS (*Entero-hepatitis*)

Report of experiments in which is given evidence of practical control measures.

REASONS FOR STUDY

The routine service of this laboratory deals with a fairly large number of turkey specimens, and from this and correspondence on diseases attention has been focused on the importance of the disease under consideration through its preponderence over other diseases.

In order to reply authoritatively and advise intelligently on means of control it became necessary to obtain first-hand information on the subject. Accordingly experimental rearing was undertaken as will be outlined, with the results obtained.

PLAN OF EXPERIMENT

By the plan black-head was to be experimentally controlled, if possible, in comparatively close proximity to a plant known to be badly infested with fowl intestinal parasites. This point is important because it has been shown that the parasite of black-head, attacking primarily the ceca, does so only in the presence of ceca worms. Furthermore it has been learned on parasitic disease control of chickens that the ceca worm was the most easily carried by human agencies of all forms of intestinal worms. Consequently black-head control becomes a problem in sanitary science as the intestinal parasitisms are filth-born diseases. Accordingly the entire scheme of control is based on prevention of avenues of infection between the source of infection (poultry plant) and the young turkeys during brooding and rearing. This to be further supplemented by frequent movement of portable yards in order to check the spread of parasites among the birds in the event of even the minimum number being carried to them. This proved a valuable aid as will be shown later.

THE EXPERIMENT AND ITS RESULTS

HATCHING.—One hundred eggs were purchased on the market of a turkey raising section, and were incubated artificially. Of these 26 were infertile, 5 had dead germs and 43 chicks were hatched, with a number not appearing strong and making rather a poor start.

BROODING.—The 43 chicks were placed in battery brooders on the morning of June 7. Fine oyster shell, grit, water and a good grade of commercial chick starting mash were constantly kept before them. Ten days later a chick scratch corresponding to the mash was added, and green feed in the form of lawn clippings on June 26.

In the battery brooder certain difficulties occurred. Though temperature was maintained adequate to the needs of the youngsters according to age, nevertheless a decided tendency to huddling was encountered. An electric light suspended in the battery proved effectual against the trouble. A second cause of losses was of a mechanical nature, in which the hock would become anchored through the mesh of the floor of battery tray, when the chick so caught would be trampled upon and killed by its mates. Half inch mesh bottoms were replaced by $\frac{5}{8}$ inch size, overcoming the cause.

Green feed was purposely withheld as long as possible, for fear of parasitic contamination, and on June 25th, vitamin B deficiency made its sudden appearance. Admission to direct sunlight and addition of green feed failed to completely control the later development of deficiencies.

RANGE.—July 18 the 31 chicks weighed 34 pounds 14 ounces or a gain of slightly better than one pound each. On this date they were put in outdoor coops with covered runs (see cut on page . . .) and were placed on a lawn border near the poultry plant. The grass consisted of blue grass with a fairly liberal sprinkling of white clover. The run approximately 6 by 12 feet was denuded of green feed after two days, necessitating frequent shifting of the quarters if for no other reason than to supply a much needed green feed supply.

August 7; by this date the housing conditions had become decidedly too small to accommodate the stock, and there was suffering from lack of green feed through the limited area used having been completely pastured over. The stock was then transferred to a colony house in the orchard, with a run on current year's seeding of mixed clovers on light sandy soil, an area being provided 24 by 48 feet in size. The house was 10 by 12 feet fitted with roosts, planer shavings used for litter on a board floor, and mash and scratch feeding in hoppers with the water and food supply all indoors. This house had previously been used for adult chickens, but before the turkeys were placed in it a thorough cleaning and scrubbing with hot lye solution (1 pound to 30 gallons of water) was given.

By August 19, the green feed was completely eaten from the yard. The house and yard was then shifted sufficiently to give new yarding the same size as the preceding. It was impossible to shift further throughout the remainder of the season.

September 11 the flight feathers had to be cut to confine the birds as they had been flying out for some little time. Getting out of the run was probably mainly induced by shortage of green feed and annoyance of females by the males.

On this date a change was made in the mash from the chick growing feed to a hen laying mash, though both were of the same commercial brand.

MORTALITY AND AUTOPSY EXAMINATION

The mortality may be conveniently divided into chick losses and deaths occurring at a later age, because the chickhood losses have no bearing in this instance upon the problem of parasitic control.

Date	Number of deaths	Causes
June 10	1	No apparent cause.
June 11–17	5	Smothered and trampled to death, after becoming caught in floor of battery.
August 10	1	Had developed nutritional deficiency and was killed to examine the gut for presence of parasites-negative results.
Sept. 24	1	Died of black-head, Ceca worms present.
Oct. 11	1	Subnormal for some time previous to death. Very few Ceca worms present and possibly some evidence of black-head, lesions very slight.
Oct. 15	1	Nutritional. Killed (see photo).
Nov. 14	1	Subnormal. Killed for autopsy. Slight indications of black head.
Nov. 21	1	Died of black-head.

Of the total mortality of twelve, one half was chick losses. Of the remaining six which died or were killed two had definite lesions and the other two possible evidence of black head. The fact should be mentioned, however, that even in those cases listed as dying of black-head the lesions were slight compared to the condition encountered in birds dying of the disease under the usual range conditions. Birds in excellent flesh are often dressed for table purposes, and are found possessed of lesions far in advance of those encountered in the birds listed as dying of the disease. Under close confinement once a bird becomes subnormal its chances of feeding against the abuse of more active members are greatly reduced, probably accounting for the difference. In these instances lack of proper nourishment would play a very important part. Again turkeys are peculiar in their feeding as well as other living habits, moving and behaving more or less as a unit. When the leaders feed they all follow the example, or try in so far as they are capable of taking their places at the hoppers, but at other times there is slight tendency on the part of the weaklings to take advantage of the available feed.

Ceca worms could not be demonstrated in more than four of the twenty-five birds autopsied, and then the number in any case was very small.

It is reasonable to assume that infestation took place during the early brooding period because of the greater susceptibility of birds of that age, and the greater probability of parasites being carried to them during that period due to the closeness of the operations to the probable source of infection.

The very limited nature of the infestation likely resulted from the precautions taken in frequent shifting of the stock to fresh ground.

December 16, after being suitably prepared by withholding feed, nineteen of the birds were killed. The following day they were weighed and carefully autopsied. The maximum dressed weight was 20 pounds, the minimum 11 pounds, with an average of 15·1 pounds each.

Autopsy consisted of the examination of each internal organ for abnormalities. All passed as normal. The intestine of each bird was examined throughout its length with suitable microscopical examinations for the determination of presence of coccidia and the various species of worms. All were negative. The carcases were likewise visibly examined for evidence of previous existing deficiency disease, and here again the results were negative.

SUMMARY AND CONCLUSIONS

Turkey chicks were artificially hatched and reared with a reasonably low loss from disease on a poultry plant where parasitic infestation among the hens were known to exist to a relatively high degree.

The plan was based on segregation between plant stock (hens) and young turkeys; control in so far as possible of carrying parasitic infection to the turkeys by human agencies or otherwise and frequent shifting of house during the early and susceptible age to check the spread between birds of any infection that may have been acquired.

To be successful turkey raising in confinement must include an adequate supply of green feed. The physical condition of the growing stock fluctuated directly as the green feed supply was plentiful or limited.

During brooding there is a tendency to huddling, which was controlled by electric lights.

The young turkeys grew well in battery brooders; many were lost, however, by defective construction of the particular equipment; and nutritional diseases appeared rather suddenly.

Arrangements should be provided for the segregation of the sexes at not later than three months of age.

Ordinary poultry rations were used with satisfactory results as to growth and weight gains.

Persons operating poultry plants and attempting to raise turkeys in confinement would be well advised to place the turkeys at considerable distance from the hens in order to reduce the hazard so far as possible.

EXPLANATION OF CUTS

TURKEY POULTS IN CONFINEMENT AT SIX WEEKS OF AGE

This cut shows a small portable house with covered run used for the poults when they were removed from the battery brooder.

TURKEYS IN CONFINEMENT AT FOUR MONTHS OF AGE

This cut gives an indication of the development of the birds at the age as indicated. The confinement was far too close, as shown by the entire absence of green feed.

TURKEYS IN CONFINEMENT AT SIX MONTHS OF AGE

This photo was taken just before the birds were killed.

NORMAL BIRD—FOUR MONTHS OF AGE WEIGHED $13\frac{1}{4}$ POUNDS

This cut is used as a contrast to the one following.

NUTRITIONAL DISEASE—SAME AGE AND REARING CONDITIONS AS ABOVE BIRD

The nutritional deficiency disease exhibited in this subject had its inception in the battery brooder. At that time the bird's beak was slightly crossed with some tendency to a deformed condition of the legs. When first removed to range the condition improved, but as the season advanced and the green food became lessened a relapse occurred, developing to the stage shown in the cut. The bird was killed and an autopsy showed freedom from intestinal parasitism, or other contributing factors, to such disease.

DRESSED TURKEYS—TOMS

This cut shows that the birds' keels were straight and the carcases fairly well finished. The breast, however, lacked the plumpness shown in the following cut.

DRESSED TURKEYS—HENS

This cut indicates that the six months of age was sufficient to give a well finished carcase in the female.

DRESSED TURKEYS

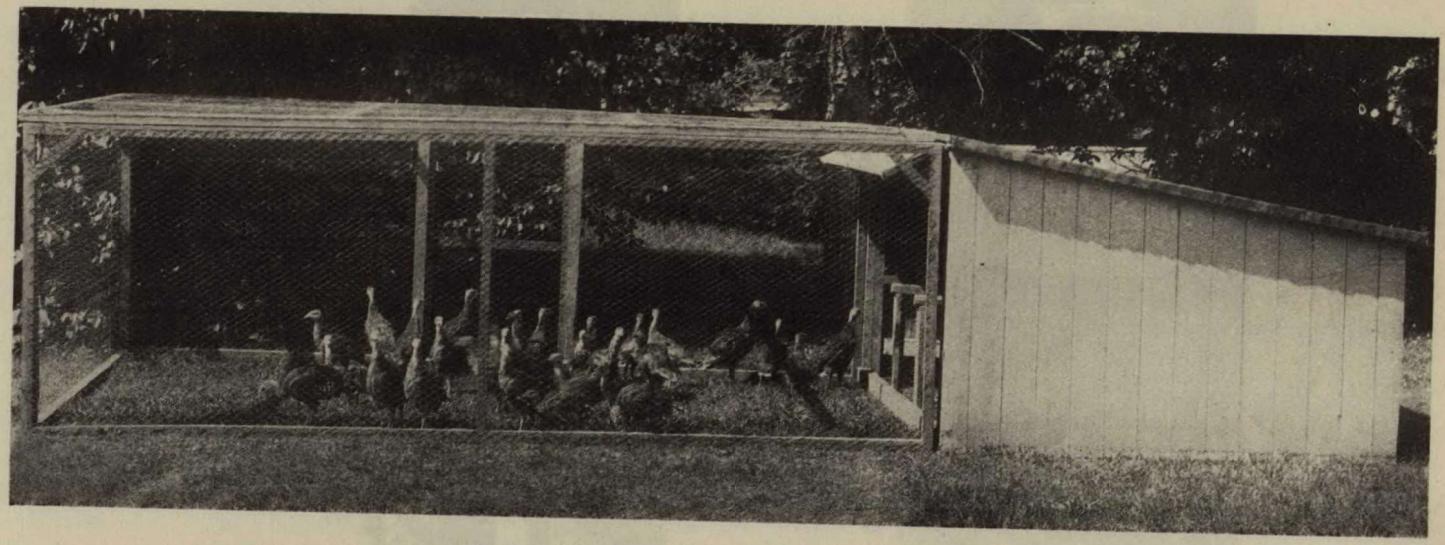
Note the keel parallel to body. This cut is included as a contrast to the one following.

DRESSED TURKEYS

Sloping keel. This condition was most noticeable in the largest of the toms and was particularly marked in this individual. As the growing birds were held over a rather long period on the border line of deficiency disease it may be taken as a possible indication of such a cause as a contributing factor, since it occurred in a more pronounced form in the largest, fastest growing, conquently most susceptible individual.

TURKEY LIVERS

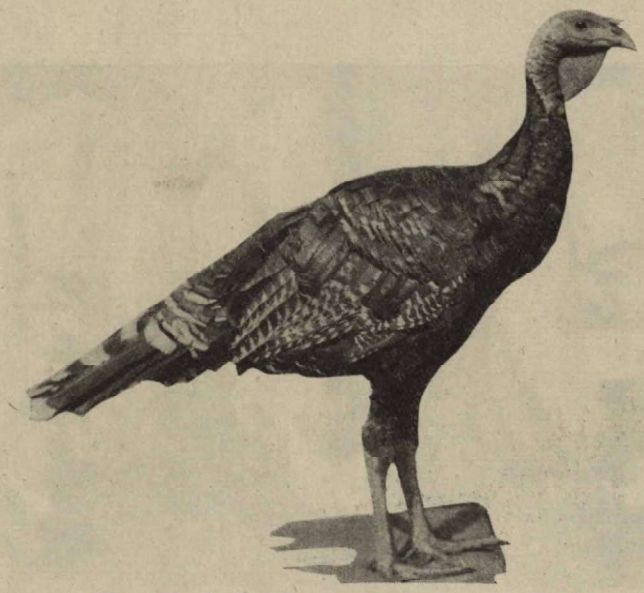
These cuts are included to show some of the more common disease conditions affecting the livers of turkeys. The fact should be pointed out that No. 2 —blackhead—and No. 4—tuberculosis—are very advanced cases. Liver No. 3 shows large, often bile-stained, irregular areas of necrosed tissue. This condition may be easily confused with the early stages of blackhead. Liver No. 5 shows a large number of small necrosed areas which have become calcified through the deposit of lime material. The condition may be readily confused with the early stages of tuberculosis.



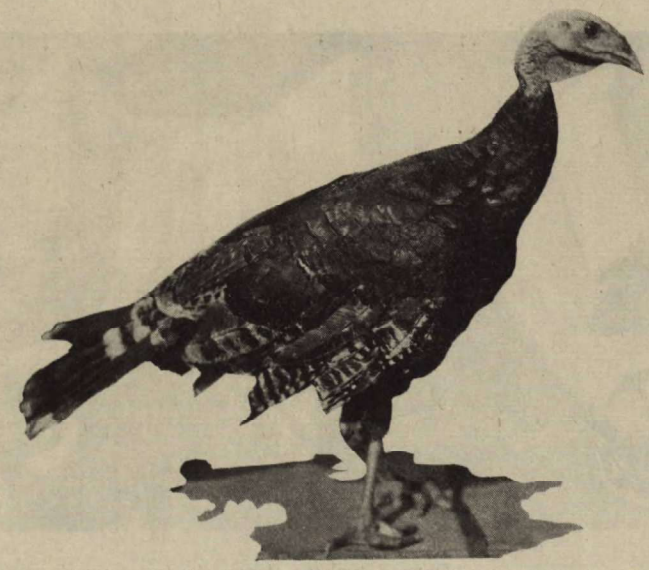
Turkey poults in confinement at 6 weeks of age.

Turkeys in confinement at 4 months of age.

Turkeys in confinement at 6 months of age.

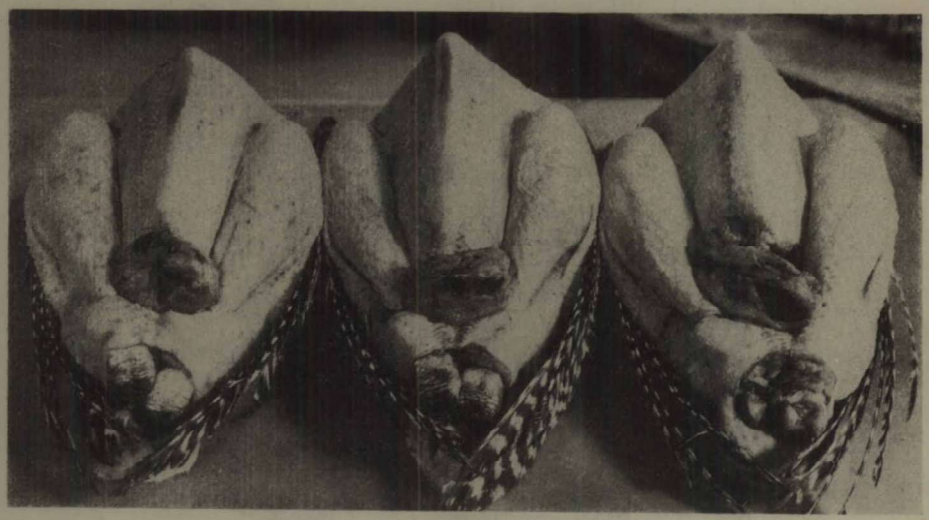


Normal bird, four months old, weight 14¼ pounds.

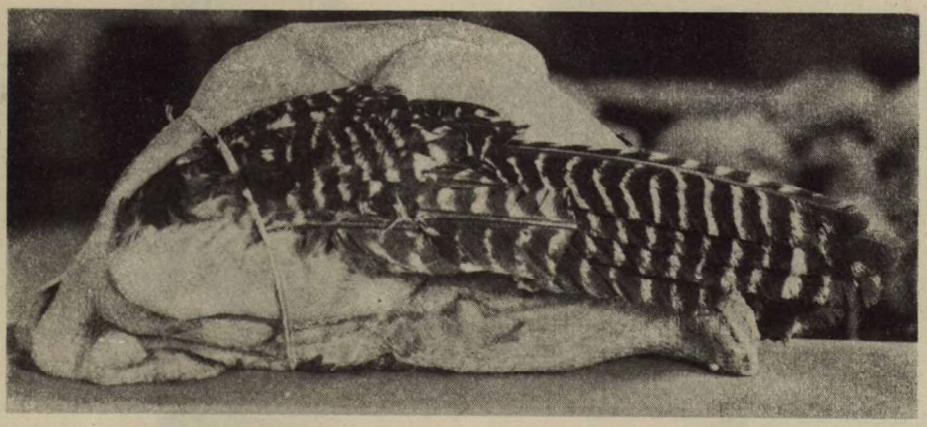


Nutritional disease. Same age and rearing conditions as the bird above.

Dressed turkeys—hens.



Dressed turkeys—toms.

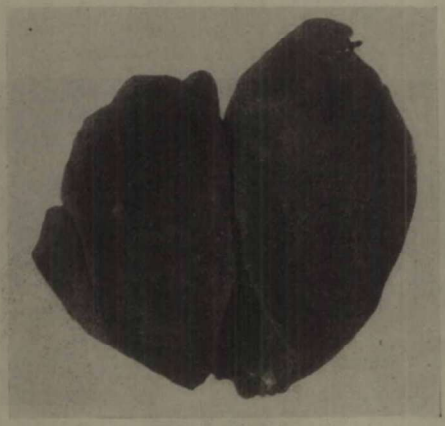


Dressed turkey—note keel parallel to body.

Dressed turkey—sloping keel.

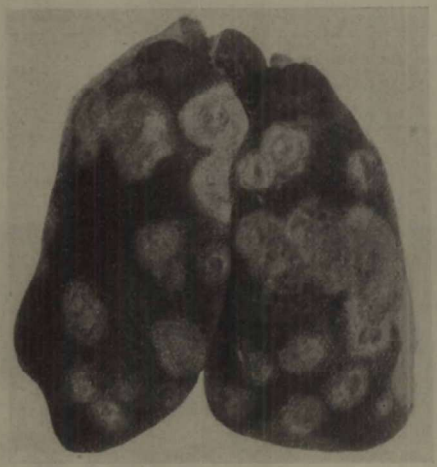
TURKEY LIVERS

Some of the more common conditions involving the organ.

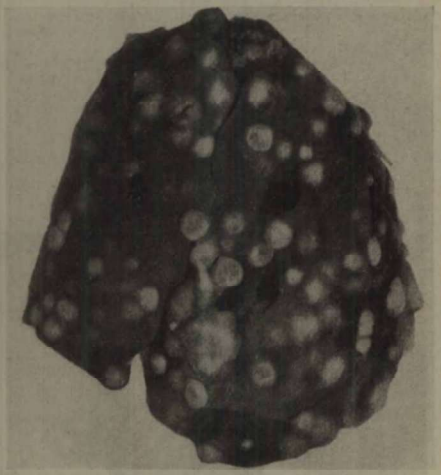


No. 1—Normal.

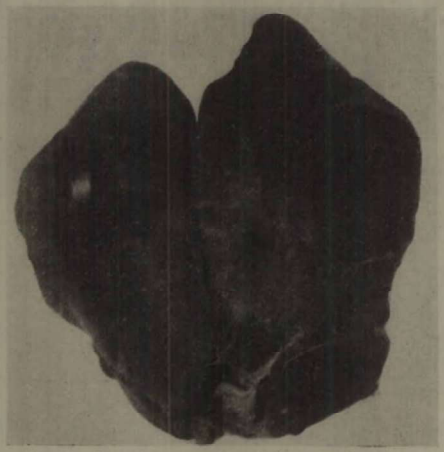
No. 3—Focal necrosis.



No. 2—Blackhead (entero-hepatitis).



No. 4—Tuberculosis.



No. 5—Focal necrosis with calcification.

FARM, EGG AND POULTRY ACCOUNTS

There is an ever-increasing demand for the Farm, Egg and Poultry Account forms supplied by the Poultry Division, especially noticeable from amateurs starting into the poultry work and from boys' and girls' poultry clubs. It is also interesting to note that some of the first persons to submit these forms several years ago are still mailing the monthly reports regularly. This indicates that these poultrymen endeavour to keep closely in touch with their farm enterprise and consequently to carry on on a business basis.

Monthly circular letters are sent out and correspondence with the readers of reports is kept up and many questions answered.

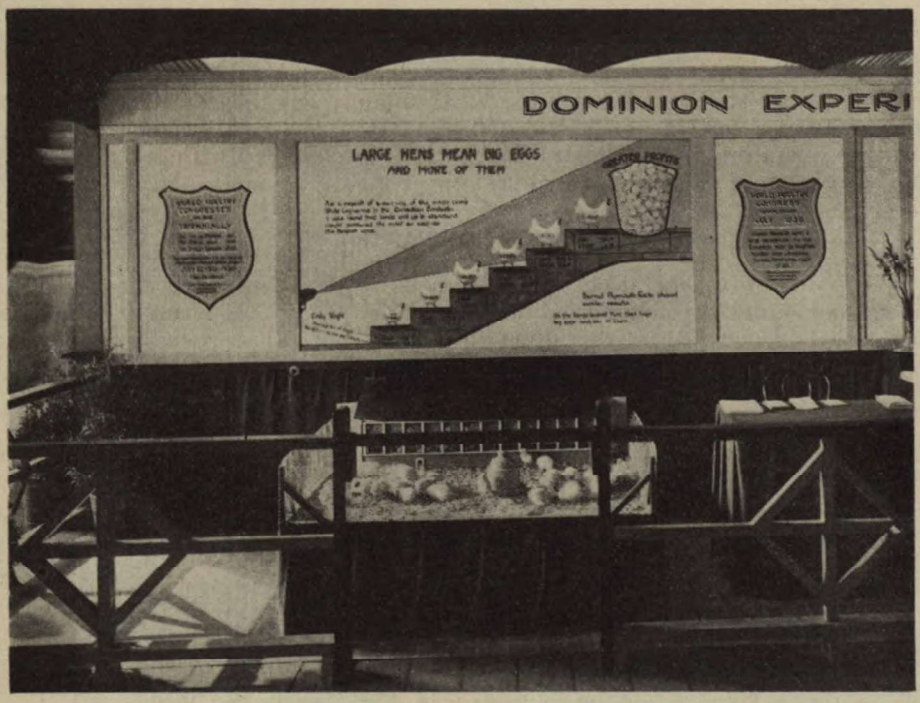
That the correspondence and the simple monthly forms supplied by the Poultry Division are often instrumental in stopping serious leakages and in greatly increasing the efficiency of poultry farm management is shown by the increased profits of the correspondents from year to year. The Farm, Egg and Poultry Account service serves as a systematic record of expenses, production and income showing up ways in which saving may be made.

This monthly report form service is available to poultrymen and farmers in all parts of Canada. The French monthly report form service also increases with a considerable amount of correspondence resulting.

General French correspondence on poultry matters is increasing and is a healthy indication of the growing status of poultry work in the province of Quebec.

DEMONSTRATIONS AND EXHIBITS

Attractive exhibits consisting of explanatory panels, models of poultry appliances, feeds, live birds, transparencies and appropriate legends, prepared by the Division of Extension and Publicity, were erected at various shows, the Central Canada Exhibition, Ottawa, Canadian National Exhibition, Toronto,



Poultry exhibit, Canadian National Exhibition, 1929.

Royal Winter Fair, Toronto, Amherst, N.S. Winter Fair, and fairs at Quebec, Montreal, Sherbrooke, Picton, Belleville, Peterboro and many other places throughout Canada. These exhibits are proving as interesting and instructive as ever, judging by the number of visitors attending the shows and numerous requests for literature. Demonstrations of caponizing, killing and plucking were also put on at various winter poultry shows.

A very attractive exhibit entirely devoted to pedigree breeding was sent to all leading fairs and exhibitions on the prairies. It was well received and was an excellent medium for supplying information to many prairie farmers.

CO-OPERATION WITH OTHER AGENCIES

HEALTH OF ANIMALS BRANCH

The poultry disease work that is being conducted in co-operation with the Health of Animals Branch is producing good results. Dr. C. H. Weaver, who is in charge of the work in this division, is producing valuable material of great assistance to the poultrymen of Canada. It is hoped that in the near future additional pathologists will be available This will no doubt make it possible to conduct needed investigations that up to the present have not been possible owing to the lack of pathologists and laboratory room.

CHEMICAL DIVISION

Considerable co-operative work has been conducted with the Chemistry Division in the analysis of feeds, tests of digestibility of feeds, etc. The Chemistry Division is always willing to co-operate in experiments that are of interest to the poultry work.

ILLUSTRATION STATIONS

As has been the case for several years, the poultry work at the Illustration Stations is assisted by this Division. Hatching eggs and breeding stock are supplied under certain conditions. The poultry inspectors from time to time visit the operators of the Illustration Stations in company with the Supervisors and meetings are arranged at many of the Stations.

PROVINCIAL DEPARTMENTS

The fullest co-operation with the poultry department of the provincial governments and the colleges is maintained. Assistance is secured from these, and this Division is always willing to assist them. The friendly attitude of all provincial authorities toward this Division is much appreciated and fully reciprocated.

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