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Canada

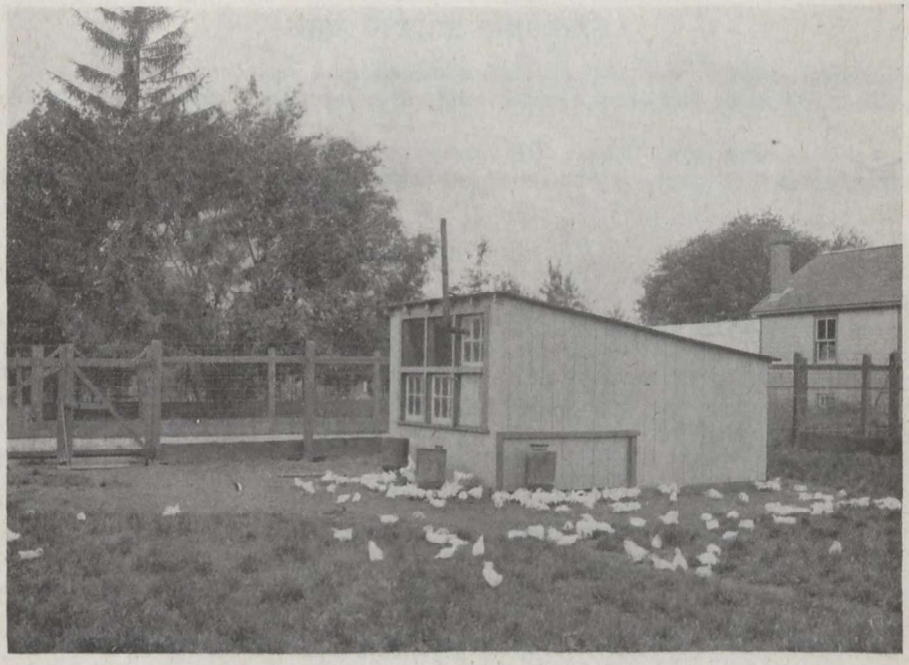
DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

POULTRY DIVISION

INTERIM REPORT OF THE DOMINION POULTRY HUSBANDMAN

F. C. ELFORD

FOR THE YEAR ENDING MARCH 31, 1921



Four Weeks Old

Printed by authority of the Hon. S. F. TOLMIE, Minister of Agriculture, Ottawa, 1921
29981—1

REPORT OF POULTRY DIVISION

Year ending March 31, 1921

BY

F. C. ELFORD, DOMINION POULTRY HUSBANDMAN

GENERAL CONDITIONS

During the year 1920-21, the general changed conditions have had their effect upon the poultry industry. Prices, as a rule, have been downward, though the downward tendency was not experienced as early as was the case with other farm products, nor has the fall been as marked. The lower prices, apparently, have not discouraged production, for, in spite of the increased consumption that would follow decreased prices, there seems to be as large a crop of poultry and eggs as usual.

The requests for general information have kept up to normal. Indeed, during the spring months the inquiries for information on incubation and brooding have been more numerous than usual. The demand for eggs and chicks has also been good, and the indications are that 1921 should be a fairly good year for the industry. The demand is good and the spring favourable for young stock.

NEW OFFICE BUILDING

A new and commodious administration building has been erected, containing ample space for offices, incubators, pathological laboratory, lecture room, and packing and candling rooms.

This accommodation and new equipment will expedite the work of the staff dealing with a constantly growing correspondence, and will facilitate the essential experimental work of the division.

INCUBATION

As a rule, all incubation upon the Experimental Farms is done artificially. The standard makes of incubator advertised or used in the various provinces are tested. They include lamp machines, both hot air and hot water, electric incubators, and mammoth machines of several sizes and makes. The mammoths in use up to three years ago have held from 1,200 to 2,400 eggs, but in 1918 one holding 10,000 eggs was installed. This did not give great satisfaction, and during this year a later model was installed in the cellar of the new office building. This model has been quite satisfactory, a few figures on the cost of its operation are given:

COST OF OPERATING A 10,000-EGG MAMMOTH BUCKEYE INCUBATOR

A few figures on the cost of operating the mammoth incubator have been collected, and may be summed up as follows:—

Consumption of oil: 21 days, 36 gals. at 28 cents	$10.08
Three 16-inch electric fans at 4 cents k.w.h	8.00
Cost of oil and electricity to hatch 10,400 eggs	$18.08
Cost to hatch one egg	0.18
Cost to hatch one chick (50 per cent hatch)	0.36
Cost including eggs at $10 per 100	$20.36

The averages are based upon the supposition that the machine is run to capacity.

THE INCUBATION OF CHILLED EGGS

To what extent a fertile egg can be subjected to the cold, and still hatch, is a question that has never yet been clearly solved.

To gain some information on this subject, an experiment was planned, the results of which, though they do not determine where the danger point is, show that a good strongly-germed egg may be subjected to considerable cold and still hatch. No doubt there are a number of features that enter into the results, some of which may be the condition of the breeding stock, the strength of the germ, and what might be termed the individuality of the egg.

If we suppose that up to a certain limit, it is a matter of individuality, the strong and robust being better able to withstand conditions more or less abnormal than the weak, then in the case of the embryo, there is the possibility that those germs that are the offspring of healthy and robust parents will withstand more exposure, whether by accident or design, than those that are from parents of poor stamina and low vitality.

It is impossible to recognize a strong and healthy embryo until some development has taken place, but some of the risk may be overcome by selecting only the most vigorous stock for breeding purposes. This is not necessarily infallible. Occasionally the most likely-looking parents prove deceptive, and sterile birds may be found among the healthiest.

In judging the results of this experiment, therefore, it is necessary to take into consideration the many accidental agencies that may go far to disprove any conclusion.

The Chilling Process

Two hundred and forty White Leghorn eggs were selected, and divided as evenly as possible into four lots, of 40 each. These were again sub-divided into six lots of 10 each.

Lot No. 1 of 60 eggs was then packed ready for shipment, the object being to subject these eggs to the same conditions that might occur to a package of eggs for hatching that had been handled negligently and left exposed on a railroad platform in severe weather.

Lot No. 2 of 60 eggs was left in a nest, as might happen through negligence or unavoidable circumstances.

Lot No. 3 of 60 eggs was exposed in an ordinary unlined 2½-gallon fruit basket, such as might be used in collecting eggs.

Lot No. 4 of 60 eggs was set as a control, by which it was possible to decide fairly accurately, by comparison, what the result would be had lots 1, 2 and 3 been set in the same manner. From each of Lots 1, 2 and 3, 10 eggs were removed and carried to the incubator cellar (temperature 62° F.) at intervals of 15 minutes, 30 minutes, 45 minutes, 1 hour, 3 hours, and 5 hours, allowed to rest from 24 hours in this temperature, and then placed in an incubator, with the following results:—

TABLE SHOWING RESULTS OF FIVE LOTS

Lot 1—Eggs Packed for Shipment, Left Exposed from Fifteen minutes to Five Hours.

Outside Temperature	Period Exposed	Total No. Eggs Set	First Test			Second Test		Total Hatched	Per cent Fertile	Per cent Fertile Hatched	Per cent Total Eggs Hatched	Temperature
			Infertile	Blood Rings	Left in	Dead Germs	Left in					
14°F	15 minutes	10	2	2	6	2	4	Nil	80.0	Nil	Nil	62°F
14°F	30 "	10	3	3	4	3	1	Nil	70.0	Nil	Nil	"
14°F	45 "	10	.....	2	8	3	5	1	100.0	10.0	10.0	"
16°F	1 hour	10	2	.....	8	2	6	Nil	80.0	Nil	Nil	63°F
24°F	3 "	10	3	1	6	2	4	3	70.0	42.9	30.0	
26°F	5 "	*9	4	.....	5	.....	5	4	55.5	80.0	44.4	
	Total.....	59	14	8	37	17	25	8	76.3	17.7	13.5	

% Blood rings, 13.5
% Dead Germs, 28.8
*1 egg cracked packing
Rested 24 hours in normal cellar temperature

Lot 2—Eggs Left in Nests, Exposed From Fifteen Minutes to Five Hours.

Nest Temperature	Period Exposed	Total No. Eggs Set	First Test			Second Test		Total Hatched	Per cent Fertile	Per cent Fertile Hatched	Per cent Total Eggs Hatched	Temperature Outside Cellar	
			Infertile	Blood Rings	Left in	Dead Germs	Left in						
14°F	15 minutes	10	2	.....	8	3	5	5	80.0	62.5	50.0	14°F	62°F
14F	30 "	10	3	.....	7	3	4	3	70.0	42.8	33.3	14°F	"
14°F	45 "	10	1	.....	9	3	6	2	90.0	22.2	20.0	14°F	"
26°F	1 hour	10	5	.....	5	2	3	2	50.0	40.0	20.0	16°F	63°F
26°F	3 hours	10	2	.....	8	.....	8	5	80.0	62.5	50.0	24°F	
26°F	5 "	10	2	.....	8	2	6	3	80.0	37.5	30.0		
	Total....	60	15	.....	45	13	32	20	75.0	33.3	33.3		

% Blood Rings, Nil
% Dead Germs, 21.7
Rested 24 hours at cellar temperature

Lot 3—Eggs Left in Baskets, Exposed From Fifteen Minutes to Five Hours.

Outside Temperature	Period Exposed	Total No. Eggs Set	First Test			Second Test		Total Hatched	Per cent Fertile	Per cent Fertile Hatched	Per cent Total Eggs Hatched	Temperature
			Infertile	Blood Rings	Left in	Dead Germs	Left in					
14°F	15 minutes	10	3	.....	7	5	2	1	70.0	14.3	10.0	62°F
14°F	30 "	10	4	1	5	1	4	3	60.0	50.3	30.0	
14°F	45 "	10	2	1	7	3	4	3	80.0	37.5	30.0	
16°F	1 hour	10	.....	1	9	2	7	7	100.0	70.0	70.0	
24°F	3 "	10	3	1	6	1	5	4	70.0	57.1	40.0	
26°F	5 "	10	2	1	7	3	4	1	80.0	12.5	10.0	
	Total.....	60	14	5	41	15	26	19	76.6	41.3	31.6	

% Blood Rings, 8.3
% Dead Germs, 25.0

Lot 4—Control Eggs Put in Cellar Under Ordinary Conditions.

Breed	Total No. Eggs Set	First Test			Second Test		Total Hatched	Per cent Fertile	Per cent Fertile Hatched	Per cent Total Eggs Hatched	Cellar Temperature
		Infertile	Blood Rings	Left in	Dead Germs	Left in					
W. Leghorns.....	60	13	4	43	17	26	17	78.3	36.2	28.3	62°F

% Blood Rings, 6.6
% Dead Germs, 28.3
1 egg broken (fertile) 1st test

Lot 5—Eggs Exposed at Five-Minute Intervals.

Eggs exposed to temperature of 26° F. and returned to the cellar at intervals of five minutes up to thirty minutes, with one lot exposed for one hour.

Outside Temperature	Period Exposed	Total No. Eggs Set	First Test			Second Test		Total Hatched	Per cent Fertile	Per cent Fertile Hatched	Per cent Total Eggs Hatched	Temperature
			Infertile	Blood Rings	Left in	Dead Germs	Left in					
26°F	5 minutes	10	2	.....	8	3	5	4	80.0	50.0	40.0	62°F
26°F	10 "	10	2	.....	8	5	3	3	80.0	37.5	33.3	"
26°F	15 "	10	4	1	5	1	4	1	60.0	20.0	10.0	"
26°F	20 "	10	1	.....	9	4	5	5	90.0	55.5	50.0	
26°F	25 "	10	4	.....	6	2	4	3	60.0	50.0	33.3	
26°F	30 "	10	2	.....	8	2	6	6	80.0	75.0	60.0	
26°F	60 "	10	3	.....	7	1	6	6	70.0	85.7	60.0	
	Control.	50	8	1	41	11	30	18	80.4	44.0	36.0	
	Total.....	120	26	2	92	29	63	46	76.6	50.0	38.3	

Total % left in hatched, 73%
Chilled average, % ferts, hatched 55.0
Control, % ferts hatched, 50.0

A somewhat remarkable coincidence is noticeable in the case of the eggs exposed for one hour, they having given the highest percentage of the fertile eggs hatched in both experiments.

SUMMARY TABLE OF CHILLING EXPERIMENTS.

Chilling Period	Total No. Eggs Set	First Test			Second Test		Total Hatched	Per cent Fertile	Per cent Fertile Hatched	Per cent Total Eggs Hatched
		Infertile	Blood Rings	Left in	Dead Germs	Left in				
5 minutes	10	2	.....	8	3	5	4	80.0	50.0	40.0
10 "	10	2	.....	8	5	3	3	80.0	37.5	33.3
15 "	40	11	3	26	11	15	7	72.5	24.1	17.5
20 "	10	1	.....	9	4	5	5	90.0	55.5	50.0
25 "	10	4	.....	6	2	4	3	60.0	50.0	33.3
30 "	40	12	4	24	9	15	12	70.0	42.8	30.0
45 "	30	3	3	24	9	15	6	90.0	22.2	15.0
60 "	40	10	1	29	7	22	15	75.0	50.0	37.5
3 hours	30	8	2	20	3	17	12	73.3	54.5	40.0
5 "	29	8	1	20	5	15	8	72.4	38.1	27.6
Control	60	13	4	43	17	26	17	78.3	36.2	28.3

The best hatch, as the records show, was 80 per cent of the fertile eggs, and this from eggs that had been packed ready for shipping, and exposed for five hours to an outside temperature that stood at 14 degrees F. It gradually rose to 16 degrees F. at one hour, to 24 degrees F. at three hours, and 26 degrees F. at the end of the period of five hours.

The results would indicate that strongly-germed eggs will stand more cold that it has been considered wise to subject them to, but there certainly must be a limit, and though the experiment did not determine precisely what the limit was, it would not be advisable for any person to leave hatching eggs exposed for longer than necessary.

The experiment is important, for it eliminates, to a large extent, the grounds of one frequent complaint regarding failure to hatch.

BROODING

Various brooding equipments are used on the Experimental Farms, and thorough tests made as to their suitability under all conditions. After several years' trial, it has been shown that for flocks of 200 or more chicks, the colony brooder stove gives the most general satisfaction. It is easy to operate, reliable and economical. It will hold from 200 to 700 chicks, and, if necessary, the flock may be divided when it includes chicks of various ages.

COST OF OPERATION

The cost of artificial brooding varies with the change of season and temperature. The quantity of fuel consumed to maintain a safe brooding condition under the hover will be greater for the early hatched chickens than when the season is farther advanced and the temperature higher.

With the natural method of brooding there is practically no variation in cost, the hens having to be fed, no matter what the temperature may be.

The following statement of cost of operation has been worked out with three brooders and with 25 hens. The figures in each case are on the basis of 500 chicks.

BROODERS—COST OF OPERATION

Type of Brooder	Amount consumed	Price	Cost of operation
Coal-burning stove	250 lbs. coal.	$16.00 per ton	2 00
Electroplanes	474 k.w. hrs.	0.04 k.w.	18 96
Radiator lamps	304 k.w. hrs.	0.04 k.w.	12 16
Hens (25)	Feed	5.25	5 25

NOTE.—The radiator lamps were similar to the type used in electric grates, and were all under the one hover. The hens were given 20 chicks each.

COLONY BROODER STOVE

With hover raised to show the heater

FEEDING EXPERIMENTS.

Experimental work on feeding has been conducted at the Central Farm, and though many of the experiments are by no means complete, a few of the results so far obtained are given. It might be noted that such experiments have to be conducted with a large number of birds in order to minimize the discrepancies caused by individual variation.

THE EFFECT OF CERTAIN RATIONS ON THE GROWTH OF CHICKS

The object of this experiment was to determine the effect of certain rations on the growth and vitality of young chicks.

Stock.—The chicks used were hatched on July 15, in a Mammoth Buckeye Incubator No. 7, and consisted of White Leghorns, White Wyandottes and Barred Rocks. These were divided and placed into 12 pens, of 42 chickens each. Pens 1 to 9 were made up of 31 Leghorns, 3 White Wyandottes and 8 Barred Rocks each. Pens 10, 11 and 12 had 31 Leghorns, 2 White Wyandottes and 9 Barred Rocks each. Thus each pen had 31 chicks of a light breed and 11 of a heavy breed.

Housing.—The chicks were housed in the brooder house of the Poultry Division of the Central Experimental Farm on July 16. Each pen consisted of two parts, one of which contained the brooder and the other the runway. Wood shavings were used as a litter, as the chickens in some of the pens received no green food, thus making the use of lawn clippings, which are generally used, impracticable.

Feeds.—The feeds under consideration were meat, eggs, milk and greens, to be fed with a basal ration, singly and in groups.

The groups were made up of:

Group 1.—Fed the basal ration, which consisted of commercial chick feed, scattered in the litter, with a dry mash of equal parts bran, middlings and cornmeal before them in a hopper.
Group 2.—Fed the basal ration plus one other ingredient.
Group 3.—Fed the basal ration plus two other ingredients.
Group 4.—Fed the basal ration plus three other ingredients.
Group 5.—Fed the basal ration plus four other ingredients.

Arrangement of Pens and Rations

Pen No.		Ration
Group 1.....	1	Basal ration.
Group 2.....	2	Basal ration and meat.
	3	Basal ration and eggs.
	4	Basal ration and milk.
	5	Basal ration and greens.
Group 3.....	6	Basal ration and meat and greens.
	7	Basal ration and eggs and greens.
	8	Basal ration and milk and greens.
Group 4.....	9	Basal ration, meat, milk and greens.
	10	Basal ration, meat, eggs and greens.
	11	Basal ration, milk, eggs and greens.
Group 5.....	12	Basal ration, meat, milk, eggs and greens.

Weight and Mortality.—The average weight of the chicks was taken when they were put in the brooder, and at the end of every week throughout the duration of the period. All birds which died were removed immediately. A record was made on the card beside the pen, and the total weekly mortality noted on the day the weighings were made.

Discussion of Results.—For the purpose of drawing deductions from this experiment it is best to consider the pens in the groups, as classified according to rations.

TABLE SHOWING EFFECTS OF VARIOUS RATIONS ON MORTALITY AND GROWTH OF YOUNG CHICKS

No. pen	Number of chickens at beginning of experiment.	Mortality during first week.	Mortality during second week.	Mortality during third week.	Mortality during fourth week.	Mortality during fifth week.	Mortality during five weeks.	Number of chickens alive at end of five weeks.	Total average gain in ounces during five-week period.	Ration
1	42	1	8	7	8	7	31	11	1·67	Basal ration.
2	42	6	6	8	5	1	26	16	3·32	Basal ration and meat.
3	42	4	2	2	3	7	18	24	3·44	Basal ration and eggs.
4	42	1	8	8	1	10	28	14	2 79*	Basal ration and milk.
5	42	3	2	6	5	8	24	18	2·81	Basal ration and greens.
6	42	2	9	5	0	14	30	12	3·54	Basal ration meat and greens.
7	42	2	4	3	0	1	10	32	4·29	Basal ration eggs and greens.
8	42	6	4	2	1	2	15	27	3·43	Basal ration milk and greens.
9	42	4	3	4	0	0	11	31	4·25	Basal ration meat, milk and greens.
10	42	3	1	0	0	0	4	38	5·26	Basal ration meat, eggs and greens.
11	42	4	2	1	0	0	7	35	4·70	Basal ration milk, eggs and greens.
12	42	1	2	3	1	0	7	35	5·75	Basal ration meat, milk, eggs and greens.

In considering the mortality table above, the following may be noted:—

Pen 1.—Fed a straight grain ration, suffered a loss of 31 chickens out of 42, only 11 surviving the experiment. The vitality of the chicks was very low throughout the whole test, and their general appearance was decidedly sickly, as evidenced by drooping wings and starved appearance. The remainder of the occupants of this pen would have died very soon had the experiment been prolonged.

Group 2: Pens 2, 3, 4 and 5.—In pen 3, fed eggs in addition to the basal ration, 24 chickens were alive at the end of the five weeks, this being the highest in the group. Pen No. 5, receiving greens, contained 18 living birds. Pen No. 2, receiving meat, contained 15; while 14 were alive in pen 4, fed milk in addition to the grain. In no case did the birds show normal growth and development. Basing the results on the feed used, eggs are superior to meat, milk or greens, while greens are more satisfactory than meat, which is more suitable for chicken feed than milk.

Group 3: Pens 6, 7 and 8.—The chickens in pen 7, fed the basal ration with eggs and greens, showed the lowest mortality, only 10 out of the initial 42 dying in the five-week period. Pen 8, fed milk in place of the eggs in pen 7, suffered a loss of 15; while in pen 6, fed the basal ration supplemented by meat and greens, 30 chickens died, only 12 being alive at the end of the five weeks. Since all these pens received greens, it is possible to compare meat, eggs and milk; and the results show eggs to be a better feed than milk, and meat the poorest of the three.

Group 4: Pens 9, 10 and 11.—This group contains the pen having the lowest mortality rate in the experiment. Pen 10, fed the basal ration supplemented by meat, eggs and greens, had a death rate of only 4, or 10 per cent, during the five weeks' period; 3 dying the first week and 1 the second. Pen 11 was second, with 7 dead. These received the same ration as 10, except that the meat was replaced by milk. Pen 9, receiving no eggs, was last, 31 birds being alive at the conclusion of the experiment. Judging from the results in pens 9 and 10, eggs are very superior to milk; and in pens 9 and 11 they are superior to meat, while the results in pens 10 and 11 show meat to be better than milk.

Group 5: Pen 12.—This pen, fed the basal ration and all four supplements, tied with pen 11 for second place, so far as the number of living chicks is concerned, 35 being alive at the end of the five weeks.

In considering the above table as to the growth of the young chicks, the following may be noted:—

Group 1: Pen 1.—This pen showed a gain of only 1¼ ounces per bird in five weeks, the least increase in weight of all pens.

Group 2: Pens, 2, 3, 4 and 5.—Pen 3, showing an average gain of 3.43 ounces, almost double that of pen 1, stands first in the group. This pen was fed a basal ration with eggs. Pen 2, receiving the same ration as Pen 3, except that meat was used in place of eggs, showed a gain of 3.32 ounces, and stands second. Pen 5, fed a basal ration but given green feed, gained 2.81 ounces per bird in five weeks; while 4, receiving a basal ration but having milk to drink, showed an increase of only 2.79 ounces per bird. Arranging the feeds in order of suitability to produce gains in chicks, they take the following placing: eggs, meat, greens, milk.

Group 3: Pens 6, 7 and 8.—Pen 7, having an average gain of 4.29 ounces, is the best in the group. Pen 6, receiving meat instead of eggs, showed a gain of 3.54 ounces; while 8, fed milk and greens, had a gain of 3.43 ounces. This again showed eggs to be better than meat, and milk poorest of the three.

Group 4: Pens 9, 10 and 11.—These pens being fed three of the four supplements, show better gains than either groups 2 or 3. No. 10, which showed the lowest death rate of all pens, showed the largest gain of the group, and second highest increase

in weight of all pens. The birds in this pen gained an average of 5.26 ounces. Pen 11, showing an average increase of 4.70 ounces, exceeded pen 9 by 0.45 ounce; the difference in the feed of these pens being that while 9 had meat, milk and greens, 11 had eggs, milk and greens.

Group 5: Pen 12.—This pen, having the basal ration supplemented by eggs, milk, meat and greens, showed a gain of 5.85 ounces. In other words, the gain in the five-week period was five times their initial weight.

Summary.—The feeds can be arranged in order of merit:—

Mortality—

Group 2: Eggs, greens, meat, milk.
Group 3: Eggs, meat, milk.
Group 4: Eggs, meat, milk.

Increase in Weight—

Group 2: Eggs, meat, greens, milk.
Group 3: Eggs, meat, milk.
Group 4: Eggs, meat, milk.

In summing up these results, the data for greens are not sufficient to place a definite value on this food, but it is well demonstrated that greens are essential to growth and vitality. Excluding greens, and awarding numbers 3 for first place, 2 for second place and 1 for third place, according to the value of the ingredient in the ration, we get the following: Eggs, 18; meat, 11; milk, 7; so this experiment has shown that eggs are better chicken feed than meat, and meat better than milk.

FEEDS AND FEEDING

SEMI-SOLID BUTTERMILK

A preparation known as semi-solid buttermilk has been shown at some of the large exhibitions, and has attracted considerable attention. A number of inquiries have been received as to its use as a substitute for fresh buttermilk; and in order to test it, a barrel was obtained from Bowes Limited, Toronto, a sample of which was submitted for chemical analysis, and reported on by the Dominion Chemist. A comparison with the analysis of fresh buttermilk is given below, and a simple calculation will show that one gallon of semi-solid buttermilk is the equivalent, from the standpoint of "solids" content, to 2¼ gallons of fresh buttermilk. The price of semi-solid buttermilk is eight cents per pound, f.o.b. Toronto, which makes the cost of a prepared diluted buttermilk (of the same strength or "solids" content as fresh buttermilk) $3.75 per 100 pounds. To this must be added cost of transportation of the product from Toronto, which would slightly increase the cost of the prepared buttermilk per 100 pounds.

Upon submitting a copy of this report and a sample to the manufacturers, a second barrel was obtained, a sample of which was submitted for chemical analysis and reported on by the Dominion Chemist.

This sample was of much better quality than the one previously analyzed and reported on.

Analysis of first and second samples of semi-solid buttermilk and fresh buttermilk:—

—	First sample semi-solid buttermilk	Second sample semi-solid buttermilk	Fresh buttermilk
Water	78·96	66·39	90·62
Protein	7·87	11·21	3·78
Fat	3·04	4·80	1·25
Milk sugar	7·20	14·52	3·38
Lactic acid	0·90	0·23	0·32
Ash	2·03	2·85	0·65
	100·00	100·00	100·00

Specific gravity..... 1·047
One gallon weighs..... 10·47 lbs.

Since fresh buttermilk contains 9·38 per cent (average) solids, and the second sample of semi-solid had a content of 33.61 per cent solids, it is evident that 100 pounds of the latter (semi-solid buttermilk) would furnish 360 pounds of buttermilk, with a solid content equal to that of fresh buttermilk. The price of semi-solid buttermilk is $8 per 100 pounds f.o.b. Toronto, hence the cost of 360 pounds of the prepared (diluted) buttermilk would be $8 or $2.25 per 100 pounds. This is much cheaper than the sample previously reported on, but is nevertheless, much more expensive than fresh buttermilk.

To test the feeding value of this product, three pens of Leghorn pullets, as alike as possible, were used. These pens had all received similar rations during the month of April. During May, Pen 8, containing 15 birds, was then given semi-solid buttermilk, one pint per day, diluted with water. Otherwise, the rations were identical. The results are tabulated as follows:—

RESULTS OF FEEDING SEMI-SOLID BUTTERMILK AND FRESH BUTTERMILK

—	Pen No. 8 Semi-solid buttermilk		Pen No. 9 Fresh buttermilk		Pen No. 10 Water	
	Weight consumed	Value	Weight consumed	Value	Weght consumed	Value
	lbs.	$	lbs.	$	lbs.	$
Scratch grain	73	2·66	73	2·66	73	2·66
Dry mash	2	0·07	11	0·39	6	0·21
Beef scrap	3	0·19	2	0·12	3	0·18
Shell	5	0·10	4	0·08	3	0·06
Green feed	10	0·05	10	0·05	12	0·06
Buttermilk (fresh)	.....	.....	93qts.	1·15		
Semi-solid	15qts.	3·20				
Total value of feed	.....	6·27	.....	4·45	.....	3·17
Total value feed per bird	.....	0·418	.....	0·297	.....	0·211
Value of feed less buttermilk	.....	3·08	.....	2·30	.....	3·17
Average value per bird less buttermilk	.....	0·205	.....	0·220	.....	0·288
Total production of eggs	.....	261	.....	237	.....	199
Average production	.....	17·4	.....	15·1	.....	13·2
Average cost producing eggs	.....	28·8c. doz.	.....	22·5c. doz.	.....	19·1c. doz.

Summary

(1) Semi-solid buttermilk is a good egg-producing feed. It gave 24 eggs more than fresh buttermilk and 62 more than water.

(2) Eggs from hens fed semi-solid buttermilk cost 6·3 cents more per dozen than eggs from hens fed fresh buttermilk, and 9·7 cents more than from those fed water.

(3) Semi-solid buttermilk cannot be recommended for egg production if fresh buttermilk can be secured (at prices quoted).

(4) With eggs at 60 cents per dozen, semi-solid buttermilk gave exactly the same revenue over cost of feed as did water—$6.78.

(5) At the price quoted, and the same variation in production, semi-solid buttermilk could economically replace water only when eggs were above 60 cents per dozen.

(6) Though the cost per dozen is 3·4 cents more where fresh buttermilk is fed in place of water, it pays to feed buttermilk at 50 cents per hundred when eggs are worth over 42 cents per dozen.

TANKAGE AS A SUBSTITUTE FOR BEEF SCRAP

At the request of the Canadian Packing Company, feeding tests were made of three meat meals, submitted by the company to the Poultry Division.

In order to determine the manner of making up the rations, chemical analysis of these samples, Nos. 1, 2 and 3, were made, with the following results:—

—	No. 1	No. 2	No. 3
Moisture	7·52	9·60	14·38
Protein	32·20	43·09	45·32
Fat	13·65	8·35	8·42
Ash	46·61	32·50	29·26
Undetermined	00·02	6·46	2·62
	100·00	100·00	100·00

As mashes made containing these three samples were to be compared with a standard laying mash, three mashes were compounded, having approximately the same protein value. The following mixtures were therefore made:—

No. 1			No. 2			No. 3		
100	pounds	bran	100	pounds	bran	100	pounds	bran
100	"	shorts	100	"	shorts	100	"	shorts
100	"	cornmeal	100	"	cornmeal	100	"	cornmeal
36	"	meat meal No. 1	27	"	meat meal No. 2	25	"	meat meal No. 3

With rgard to the cost, it was assumed that beef scrap, 60 per cent protein, was worth $125 per ton, and the value of the samples of tankage was calculated from their protein content as follows:—

No. 1	$67 00	per ton
" 2	89 77	" "
" 3	94 44	" "

Bran was quoted at $2.85 per hundred, shorts $3.20, and cornmeal $4.25. Thus the mashes as mixed were each worth $3.52 per hundred.

Four pens of Leghorn pullets were used in the experiment and fed as follows:—

Pen 11—Standard ration and beef-scrap.
Pen 12—Mash No. 1 and No. 1 tankage.
Pen 13—Mash No. 2 and No. 2 tankage.
Pen 14—Mash No. 3 and No. 3 tankage.

All pens were fed same scratch feed and given unlimited shell, grit and water.

WEIGHT OF FEED CONSUMED AND VALUE, TOTAL AND AVERAGE COST, TOTAL AND AVERAGE PRODUCTION

—	Pen 11		Pen 12		Pen 13		Pen 14	
	Consumed	Value	Consumed	Value	Consumed	Value	Consumed	Value
	lbs.	$	lbs.	$	lbs.	$	lbs.	$
Scratch grain	67	2·45	60	2·20	60	2·20	59	2·16
Mash	9	0·32	17	0·60	8	0·28	12	0·42
Meat	2	0·13	1	0·03	3	0·19	3	0·19
Shell	3	0·06	5	0·10	3	0·06	4	0·08
Green feed	10	0·05	8	0·04	8	0·04	6	0·03
Total	.....	3·01	.....	2·97	.....	2·77	.....	2·88
Average cost bird	.....	·251	.....	0·198	.....	0·184	.....	0·251
Total production	114	.....	67	.....	118	.....	103	
Average production	7·6	.....	4·4	.....	7·8	.....	6·8	
Cost dozen eggs	31·6c.	.....	52·8c.	.....	·28c.	.....	33·5c.	

Summary

1. No. 1 tankage, the lowest in protein, is not a profitable substitute for good quality beef-meal.

2. Nos. 2 and 3 tankage proved profitable substitutes for beef-meal, and could be safely recommended for poultry feed.

NOTE.—Substitutes for guaranteed meat meal should be fed with discretion. If the composition of the substitute is unknown or not guaranteed, it is not advisable to use it until the quantity has been determined.

If it is used without this precaution, it is better to place it in convenient hoppers, where the birds can have access to it as desired rather than mixed in mashes.

VEGETABLE VERSUS ANIMAL PROTEIN

To ascertain the palatability, and the value as a food, of vegetable protein compared with animal protein, two experiments were conducted with twenty-six Leghorn cockerels. The material used for the two sources of protein were Soja bean meal and beef-scrap.

Palatability—The first experiment was to determine whether the vegetable protein material was palatable. To find this out, cockerels were fed a ration which contained Soja beans. The ration for palatability was:—

Morning—Cracked corn, wheat and oats.
Noon—Soja bean, ground and moistened.
Evening—Cracked corn, wheat and oats.

It was found that the birds ate the vegetable protein ration readily, either dry or when moistened with water, and at the end of the fourteen days' feeding, they were in good condition, combs bright red, and bodies well nourished; but there was no gain in weight.

Increased Weight.—In the second experiment 16 vigorous cockerels were selected and divided into four lots:—

Four birds pen fed a basal ration and ground Soja bean.
Four birds pen fed a basal ration and beef-scrap.
Four birds crate fed a basal ration and ground Soja bean.
Four birds crate fed a basal ration and beef-scrap.

The same protein content in each ration was obtained by mixing the following feeds in the quantities given below:—

Beef-Scrap	pounds	Soja Bean	pounds
Cornmeal	32	Cornmeal	29.14
Ground oats	48	Ground oats	44.12
Beef-scrap	20	Soja bean	25.5

The following table gives the gain in weight and the pounds of feed necessary to make a pound of gain:—

SUMMARY SHOWING WEIGHTS, GAIN AND FEED CONSUMED PER POUND GAIN

Number of birds	Starved weight beginning of experiment	Weight at end of experiment	Gain in 12 days	Pounds of feed to pound of gain	Ration and Method of Feeding
8	33·9	43·7	9·14	5·3	Soja bean crate fed and pen fed.
8	34·2	47·13	13·11	4·4	Beef-scrap crate fed and pen fed.

It will be seen from the above that the vegetable protein as contained in Soja beans was palatable, but that the beef-scrap gave the more economical gains, and though the birds, in the short space of three weeks, showed no ill effects from the Soja bean meal ration, it would without doubt be disastrous to continue this ration longer, under the same conditions as fed in the experiment. The ration being deficient in the essential mineral constituents, and the birds being deprived of the opportunity of securing them in the natural way, impaired vitality or death would eventually result. Soja beans contain one of the best vegetable proteins to be found, and could be fed to advantage where free range provides the other essential constituents to balance the ration. It cannot however, entirely take the place of animal feeds, which contain the necessary proteins plus the minerals.

CRATE FEEDING

The tendency, on the part of some, to use for crate feeding a ration high in protein, suggested a test between narrow rations (rich in protein) and wide rations (rich in fat).

The object of the experiment, therefore, was to determine the relative value of a series of rations, ranging from an extremely "wide" nutritive ratio to one correspondingly "narrow."

The Rations Fed

No. 1.—6 parts milk, 1 part ground oats, 1 part cornmeal, 1 part buckwheat, one-third part tallow. *Ratio: 1: 5.6.*

No. 2.—6 parts milk, 1 part ground oats, 1 part cornmeal, 1 part buckwheat meal. *Ratio: 1:5.09.*

No. 3.—4 parts milk, 1 part feed flour, 1 part bran. *Ratio: 1:3.2.*

No. 4.—4 parts milk, 1 part ground oats, 1 part shorts. *Ratio: 1:4.1.*

No. 5.—6 parts milk, 1 part ground oats, 1 part cornmeal, 1 part buckwheat meal. *Ratio: 1:5.09.*

FATTENING EXPERIMENT.—WIDE VS. NARROW RATION

TABLE showing ration, gains, pounds of feed to pound of gain, Cost of pound of gain and relative profit per crate

Crate	Ration	Weight starved	Weight 7 days	Weight 14 days	Weight 21 days	Gain 7 days	Gain 14 days	Gain 21 days	Average gain per day	Average gain per bird	Feed consumed	Pounds of feed to pound of gain	Cost of pound gain	N. Ratio	Loss and Gain Account						
															Live weight	Value at 15 cents lb.	Fatted dressed weight	Value at 25c. lb.	Increase in value	Total cost of gain	Net profit
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	$ cts.		lbs.	$ cts.	lbs.	$ cts.	$ cts.	$ cts.	$ cts.
1	6 pts. milk, 1 pt. oats, 1 pt. corn, 1 pt. buckwheat, ⅓ pt. tallow	53	65·5	70	76	12·5	17	23	1·09	·1·91	70·0	3·4	12·5	1:5·6	53	7 95	69·4	17 31	9 36	2 87	6 49
2	6 pts. milk, 1 pt. oats, 1 pt. corn, 1 pt. buckwheat	55	71	75	87	16	20	32	1·47	2·5	80·0	2·5	6·2	1:5·09	55	8 25	79·8	19·88	11 63	2 00	9 63
3	4 pts. milk, 1 pt. flour, 1 pt. bran	51	59·5	63	67	8·5	12	16	0·76	1·33	67·0	4·2	9·4	1:3·2	51	7	6559·0	14 75	7 10	1 50	5 60
4	4 pts. milk, 1 pt. oats, 1 pt. shorts	53	62	64·5*	72·5	9	11	19·5	0·93	1·70	72·0	3·7	8·7	1:4·1	53	7 95	65·8	16 38	8 43	1 69	6 74
5	6 pts. milk, 1 pt. oats, 1 pt. corn, 1 pt. buckwheat, beetmeal	56	66·5	74	82·5	10·5	18	26·5	1·26	2·20	80·0	3·0	6·7	1:5·09	56	8 40	74·13	18 69	10 29	1 77	8 52

1 bird removed weighed 3½ pounds. The feeds in the above ration cost per cwt. as follows: Milk, .30cts.: Oats, 2.35: Ground buckwheat 2.00: Feed flour 2.85: Bran 1.70: Shorts 1.80.

An attempt was made to increase the tallow to one-half part, and widen the ration to 1:7.1; but this resulted in an unpalatable and heavier feed than the birds could assimilate. The amount fed was doubtless the limit of pure fat material that could be supplied in a ration and give any likelihood of beneficial results.

Without skimmed milk, it would not be difficult to widen the ration by the addition of feed rich in carbohydrates, but such a ration would cause trouble, as the lack of animal matter always induces feather-pulling and like vices.

A small quantity of "beet pulp" was fed to the birds in crate No. 5, to decide the value of a substitute for green feed. The results, however, were not encouraging. It was apparently unpalatable, and the birds consumed so little that no advantage could be shown for the feeding.

TABLE SHOWING NUTRITIVE RATIO, COST AND PROFIT

Ration Number	Nutritive Ratio	Pounds feed for one pound of gain	Cost of one pound of gain	Net profit on twelve birds
			cts.	$ cts.
1	1:5·6	3·4	12·5	6 49
2	1:5·09	2·5	6·2	9 63
3	1:3·2	4·2	9·4	5 60
4	1:4·1	3·7	8·7	6 74
5	1:5·09	3·0	6·7	8 52

Summary.—The wide rations without tallow were most profitable, and the narrow the most expensive. It did not pay (13 cents per pound) to add tallow to the ration.

The extra finish usually looked for on tallow fed birds was not apparent on those from crate No. 1 when dressed.

The advisability of "finishing" poultry before marketing is apparent, and where skimmed milk is available, it can be put to no better use than to fatten what fowl are available, before killing, as it will be seen from the above table that almost any ration will improve the bird in the fattening crate, though the wide ration is preferable if the necessary ingredients are obtainable.

The usual methods and crates were adopted as described in Dominion Experimental Farms Bulletin No. 88.

POULTRY MUSTARD FOR LAYING HENS

Poultry mustard has been widely advocated among the many preparations placed on the market as stimulants to egg production, their functions being to increase the flow of gastric juices and to aid digestion. When this object is obtained a higher egg production may result. In the experiment a basal ration of recognized feeding value was fed, with various quantities of poultry mustard added, to three pens of Leghorn pullets; the results were as follows:—

Pen Number	Mustard daily dose	Yield Eggs	Feed	Mustard	Total
			cts.	cts	
8	1 T. spoon	31·8	66·8	3·3	70·1
9	2 T. spoon	29·6	76·7	6·6	83·3
10	Nil	31·5	83·6	.....	83·6

The advocates of poultry mustard advise its heavier use. While this test can in no way be taken as conclusive, the results do not indicate that the use of mustard increases production, although they would indicate that it lowers the consumption of feed to such an extent, as in pen No. 8 as to considerably reduce the cost of feed, and in pen No. 9, sufficiently to pay for the cost of the mustard.

FEEDING PITUITARY GLAND SUBSTANCE (ANTERIOR LOBE)

It is understood that the pituitary gland of the brain exercises a peculiar function over the control of body growth. The anterior lobe is not only considered to have a stimulating effect on the body growth, but there also seems to be a special function, influencing the early development of the sexual organs.

Extracts prepared from these glands have been used in numerous experiments, with varying success.

The injection of the substance by Pearl and Surface at Maine Experimental Station, in an effort to activate the resting ovaries, has not met with success, but the feeding of this substance by Louis N. Clark, of Oldham Farm, Port Hope, Ont., to hens in the height of the laying season, has considerably influenced the yield and increased the fertility.

More or less material concerning the feeding of this substance was published in scientific and poultry papers, and in order to ascertain if the substances had any value, and if such could be made use of in a practical way, experimental work by this Division was started in 1916.

Preparation of the substance.—The pituitary substance was prepared as follows: The pituitary gland was dissected out from beef cattle under six months old, and the posterior lobe and all adhering tissue discarded. The anterior lobe was weighed, ground to a paste with pestle and mortar, to it was added three times its weight of milk sugar, and the whole was thoroughly mixed. This paste was dried at room temperature and ground to a powder.

In all, four experiments have been made: (1) to arrest the moult, and, if possible, to recover the egg yield of a pen of hens that were just showing signs of approaching the resting period and gradually ceasing production; (2) to assist the maturing of pullets; (3) to increase the egg yield throughout the winter months; (4) to increase egg production (a second experiment).

Experiment No. 1, to arrest the moult and recover egg yield.—This experiment was started July 4, 1916, after some of the hens had shown signs of moulting. The duration of the experiment and the actual time of feeding was ten days, though the experiment extended over thirty days. The thirty days were divided into periods of ten days each, a preliminary period of ten days in which the hens became used to their feed and quarters, then the ten days for feeding the pituitary substance, and a post period of ten days to show the effects if any, of the dosing.

Eighty White Leghorn pullets were used, and were apparently healthy, well matured, and vigorous birds, hatched in the spring of the previous year, and mated with males of the same age.

Pen 1 consisted of 20 overage hens from the flock of 80, and, after the preliminary period of ten days, these were fed individually, one pill per hen daily of the pituitary gland substance—a dose of 0·33 grammes.

Pen 2 consisted of 40 hens divided equally from the flock and used as a control, and fed a standard egg-producing ration, minus the dose of pituitary gland substance.

Pen 3 consisted of the remaining 20 hens, and as nearly as possible equal to pens 1 and 2. These were fed a dose of the substance of 0·33 grammes daily per hen, in a moist mash.

The small quantity of mash used for this purpose, in which the substance was carefully mixed and evenly distributed, so as to ensure each bird's getting as nearly as

possible a full share, was the same kind as that supplied in the hoppers of all three pens, and which was kept before the birds at all times.

All pens were of the same size, and the yards, though limited, were similar and sufficient, and were well equipped with green feed.

At the commencement of the preliminary period, the egg yield of the control pen was higher that that of the pituitary fed pens, and though the general tendency of the three pens was downward, both the pituitary fed pens held their own, and even increased slightly during the ten days experimental period. In the experimental period of ten days, the tendency in pens 1 and 3 was upward, while in pen 2, the control, it was downward. In the post period the tendency of all three pens was downward.

The appearance of the birds was in favour of the pituitary fed pens, as they appeared to have more vigour during the experimental period than did the control pen.

The fertility was apparently not influenced by the feed. During the preliminary period the percentage of fertility and hatchability of the eggs from all three pens was uniformly high.

At the close of the experiment another effort was made to prove the efficacy of the substance, by reversing the method of dosing pens 1 and 3, i.e., feeding the pill to pen 3 and vice versa; but without any apparent effect.

Experiment No. 2, to hasten maturity and to increase production.—On August 25, 30 growing Barred Rock pullets were selected, divided into two even lots, placed in two similar houses, pens 23 and 24, and fed the same, except that one was given in the mash daily a quantity of pituitary substance equal to 0·33 grammes per bird.

The pullets were good thrifty birds from about four to five months old, and the division into the two flocks was made so that there was only one-half pound difference in the total weights of the two lots.

The ration was:—Scratch feed—equal parts cracked corn, wheat, and oats. Dry mash in hopper consisting of 2 parts bran, 2 parts shorts, 2 parts cornmeal, 1 part beef-scrap, and 1 part gluten. Charcoal, grit, and oyster shell *ad lib.*, and a generous supply of roots.

At the end of the test, out of the 15 hens in the pituitary pen, 9 were laying, one with 39 eggs to her credit in 44 days, with a total yield for the 49 hens of 120 eggs since the first dose of the substance.

At the same date 5 hens had started laying spasmodically in pen 24 (control), with a total yield of 43 eggs.

The eggs from pen 24 (dosed) were at this time averaging one ounce per dozen heavier than the eggs from the undosed pen.

Experiment No. 3, to increase egg yield during winter months.—A pen of 10 White Leghorn pullets was separated from a uniform flock of 50 birds, and 10 of the remaining 40 used as a control.

The ration was the same as that already described in the record of experiment No. 2, and the dose of 0·33 grammes per head pituitary gland substance, was given in a little wet mash daily. The egg yield for the four months was:—

Month.	Pituitary fed.	Non-Pituitary.
December	21	13
January	152	150
February	113	98
March	114	130
Totals	400	391

Very little advantage was gained by dosing, except that the size of the eggs increased considerably. Many eggs laid were abnormal, and the largest dozen selected on one occasion in February weighed 28 ounces—an extraordinary weight for Leghorn pullets that were late hatched, and that laid their first egg in December.

There were two deaths in the pituitary pen, and in both instances, upon examination, the hens proved to be "egg bound"—due no doubt to the abnormal size of the egg about to be laid.

The average increase in weight of total eggs laid per hen was 18·7 per cent greater in the pituitary pen.

Experiment No. 4, to increase egg yield during winter months.—A further test was made with 30 Leghorn pullets, composed of 15 pairs of full sisters. Each pair was divided, in fact one sister was given a capsule of the substance once a day and the other sister given none. Excepting for the substance, all feeds given were similar, and they were housed in the same pens. The results by months were as follows:—

Month.	Pituitary fed.	Non-pituitary.
November	78	59
December	162	94
January	84	110
February	78	93
March	62	71
April	89	94
Totals	547	521

It will be seen that the early feeding showed better production in the pituitary fed pens, but the effects of it wore off, and at the end of the six months' test the pituitary pen was only 26 eggs ahead.

Summary.—The four experiments would indicate: (1) For a period of one or two weeks the substance increases production. (2) If the feeding is continued the substance loses its efficacy. (3) There was practically no difference between the results from feeding in the pill or in the mash. (4) The substance hastens early maturity to a considerable extent. (5) The results so far obtained are not such that the substance can be recommended for general use.

COST OF PRODUCING EGGS

Figures on cost of production have been secured at several of the plants, as well as at Ottawa, and as the contests form good media for obtaining cost figures, they are included. It will be noted that the figures are for the cost of feed only. No estimate is given for buildings, depreciation, or labour. It might be of interest, however, to note that for an average flock, one hour per day should be more than sufficient labour for 100 hens. This hour a day should cover all the general work in connection with the plant, and the incubation and brooding as well. Where trapnests are used and records kept, it costs about $2 per hen per year more to attend to them. This cost, of course, varies with the number of birds and convenient arrangements, but it may be taken as a fair average.

Canadian Contest.—For the first sixteen weeks, November 1 to February 22, the Barred Rocks laid an average of 25·8 eggs at a cost of feed of 97 cents, and the Leghorns 21·4 eggs at a feed cost of 80·4 cents. The cost per dozen for these months was: Rocks 45·1 cents, Leghorns 45 cents. For the whole period of 52 weeks, the Rocks averaged 147 eggs at a cost of feed of $3.10 or cost per dozen of 25·3 cents. The Leghorns laid 154 eggs each, at a feed cost of $2.63, each dozen costing in feed 20·4 cents.

All the Contests.—Costs in all the contests for feed only, for the six months November 1, 1920, to March 20, 1921, 20 weeks, were:—

Ontario	29	cents per dozen.
Canadian	31	" "
Manitoba	31	" "
British Columbia	33	" "
Alberta	35	" "
New Brunswick	39	" "
Saskatchewan	41	" "
Cap Rouge	57	" "
Prince Edward Island	63	" "

COST INFLUENCED BY THE AGE

The most profitable layer is the bird that produces during the winter months, and to get her, she must be hatched early.

SOME FACTORS IN EGG PRODUCTION

APRIL THE BEST MONTH TO HATCH

Each year, the month the pullets are hatched on the Farms System is noted, and the pullets compared as to yearly production. The results show that April is the best time to hatch layers.

To emphasize this fact, a summary of results has been compiled from the records kept for some years at several poultry plants of the Experimental Farms system, and the average struck from many records of early pullets, late pullets, yearling hens, and two-year-old and older hens.

The individual pen results naturally vary a good deal on account of the different climatic conditions, the late pullets and hens showing to better advantage in the milder localities. This can be attributed to a short winter season; but when a general average is taken, the early hatched pullet is easily shown to be the most profitable producer, and this means that she is not only the heaviest producer, but also the most economical.

In considering the average weight per dozen of eggs laid, it may be pointed out that though the pullet average is below that of the yearling hen and the two-year-old, this is primarily caused by the few exceptionally small eggs that a pullet produces at first, which are sufficient materially to reduce the average. In most utility breeds, the pullet's eggs so soon attains a fair marketable size that this slight impairment cannot offset her claim to the distinction of being the best and most profitable bird to keep.

PULLETS VERSUS HENS

This table gives a summary of average results at several Experimental Farms for the past three winters, from records of many pens of pullets, yearlings, two-year-olds and over:—

Age	Number of birds	Average weight per doz.	Average price per doz.	Total value of eggs	Cost of one dozen
				$ cts.	cts.
Early pullets	292	23·2	43·2	451 73	18·3
Late pullets	152	22·7	43·1	221 88	56·0
Yearling hens	161	24·7	47·0	176 48	78·2
Two years old and over	79	24·2	44·0	13 94	$5 73

ELECTRIC LIGHT TO INCREASE PRODUCTION

For some time it has been a question whether artificial light in the poultry house was a benefit or not, and to help solve the problem, this division made a test during two winters with Barred Rock and White Leghorn pullets.

During the first six winter months, forty Rocks were divided into two pens, twenty of which were given light in the afternoons and evenings during the short days. Two Tungsten 40 watt lamps were turned on before dusk in the afternoon, and turned off at nine o'clock at night. In neither case was the yield heavy, but the lighted pens gave considerably the better results.

The summary of these two pens for the six winter months is as follows:—

The lighted pen laid 1,106 eggs, with a total value of $54.93. Cost of the feed was $22.53, cost of light $2.40, a total cost of $24.93. This gave a balance over cost of feed and light of $30, or a cost per dozen eggs of 27·0 cents.

The dark pen laid 636 eggs with a total value of $29.46. The cost of the feed was $21.09. This gave a balance over cost of feed of $8.37. The cost per dozen eggs was 39·8 cents.

During the following winter 80 pullets, 40 each of Barred Rocks and White Leghorns, were selected and divided into pens of 20. One pen each of Rocks and Leghorns were given light, and the same number kept as checks. The light was turned on in the middle of November when the days grew short, a week or two after the pullets were put into their winter quarters. The light was continued until the middle of March, when the longer days made the light unnecessary. The light consisted of two 40 watt lamps for each pen of 20 birds. It was turned on at 6 a.m. and left till daylight, turned on again in the afternoon before dusk and left till 9 p.m. At first the lights were turned on and off several times at night, to induce the pullets to go on to the roosts, but before long the birds seemed to know when they were expected to go to bed, and went without any such inducements.

The yields.—The yields were not high in either case, and the total difference in egg yield in the six months' test was not large, but the forty birds with light gave a larger balance over cost of feed than the forty without light. This difference was made up in the time the eggs were received. Those with the light gave their heaviest yields in December and January, while by far the heaviest months for the Leghorns without light were March and April, and for the Rocks, January and February.

The totals of lighted pens in the two experiments.—The total figures for the two with the light are: Number of eggs, 2,470; value, $136.32; cost of feed, $55.48; cost of light, $3.20; balance, $77.64; or a cost of 28.5 cents per dozen.

The totals of dark pens in the two experiments.—Those without light laid 2,242 eggs: Value, $118.90; cost of feed, $60.10; balance, $58.90; and cost of one dozen eggs 32.1 cents.

For early winter eggs during the short days, the light does increase the egg yield, but later in the season the yield is not as heavy as with birds that have not had the light. The advisability of using light therefore, will depend upon what is wanted. If early winter and high priced eating eggs are the object, the lights are an advantage: if eggs during the hatching season, the lights are a disadvantage.

HOUSING

The farmers' straw loft for 100 hens, described in Bulletin No. 87, continues to give satisfaction in each province where it is used. When it is not convenient to face the house towards the south a row of windows along the north side a few inches above the floor helps in keeping the house bright during the late afternoon. Care must be taken to make these windows tight so that no draught will be admitted.

The colony house, described in the same bulletin, is still being recommended. It is this type of house that is being used to accommodate the brooder stove which gives such splendid success in brooding chicks in flocks of from 200 to 500.

The pipe brooder house described in Bulletin No. 87, which is used at the Central Farm and at three of the Branch Farms, is satisfactory for early chicks and for experimental work with nursery chicks, but for general farm or for commercial hatching it is not to be compared with the colony house and brooder stove.

BREEDING

The pedigree work being conducted at the Central Farm and at a number of the branch Farms is producing valuable results. Each year brings a larger number of high producers, which in turn are able to transmit their producing qualities to the offspring. More than ever is attention drawn to the fact that high production can be secured in Canada. A few instances of production on the Experimental Farms may be noted:—

Experimental Station, Kentville, N.S.—The twelve breeding pens are filled with birds that in their pullet year laid an average of 197 eggs—the highest producer laying 270. It was at this Station that one Barred Rock pullet laid 104 eggs in 104 days.

Experimental Farm, Indian Head, Sask.—Last year 105 pullets gave an average of 183·7 eggs, the highest being a pullet with 292 eggs.

Experimental Station, Lethbridge, Alta.—A selected pen of 55 pullets hatched in March and April gave an average of 203 eggs in one year from the time the first egg was received from the flock. The highest individual production was 265 eggs.

Experimental Farm, Brandon, Man., had a Contest pen record last year of 2,041 eggs from 10 birds— an average of 204 eggs per bird.

Experimental Station, Sidney, B.C. (V.I.).—A white Wyandotte flock of 200 pullets gave an average of 195·97 eggs, 29 of the birds being above 175 eggs, and 82 above 200. At this Station a production of 300 eggs a year has been reached, and the standard has been raised, so that now no bird is kept for breeding if she does not lay 200 eggs during the first year; nor is any cockerel retained if his mother laid fewer than 250 eggs in her pullet year.

Many other instances of high production could be given, for the consistent work of the whole system is gradually producing birds that DO lay, and whose offspring are also real producers. Cockerels from such birds are valuable as breeders, even though mated to mediocre females. That this fact is recognized by the public is evidenced by the demand that the Farms have received for such stock.

Full details of the system of marking and pedigreeing were included in last year's report.

EGG-LAYING CONTESTS, 1919-20

The Canadian Poultry industry has been making rapid progress during the last few years, but the standardization of the laying contests marks one of the most advanced steps ever made, not only in Canada, but the world over. These contests serve as a medium through which poultry registration can be obtained, and in so doing, are not merely spectacular events but serve a definite purpose.

On November 1, 1919, the Dominion Experimental Farms started seven contests which included: The Canadian Egg Laying Contest, Ottawa, Ont.; Prince Edward Island Egg Laying Contest, Charlottetown, P.E.I.; Nova Scotia Federal Egg laying Contest, Nappan, N.S.; Quebec Egg Laying Contest, Cap Rouge, P.Q.; Manitoba Egg Laying Contest, Brandon, Man.; Saskatchewan Egg Laying Contest, Indian Head, Sask.; and the Alberta Egg Laying Contest, Lethbridge, Alta. These Contests were conducted for 52 consecutive weeks and closed on October 29, 1920.

In each contest 10 birds constituted a pen, and the number of pens in each was: Canadian, 50; Prince Edward Island, 21; Nova Scotia, 20; Quebec, 20; Manitoba, 20; Saskatchewan, 20; and Alberta, 11; making a total of 162 pens in all contests, and, for all contests, of 1,620 birds.

TABLE SHOWING VARIETIES REPRESENTED, AND NUMBER OF BIRDS OF EACH

(The breeds appear in order of popularity as to numbers of individuals.)

1st. Barred Rocks	540
2nd. White Leghorns	440
3rd. White Wyandottes	210
4th. Rhode Island Reds	180
5th. Buff Orpingtons	40
6th. Silver Wyandottes	40
7th. Brown Leghorns	30
8th. Partridge Rocks	20
9th. Buff Wyandottes	20
10th. Anconas	20
11th. Black Leghorns	20
12th. Campines	20
13th. White Rocks	10
14th. White Orpingtons	10
15th. Sussex	10
16th. Hamburgs	10
17th. Canadians	10

RECORD OF PERFORMANCE

Contests are at present a means of qualifying for Record of Performance certificates. These certificates are given for pure bred birds, not otherwise disqualified, which lay, during the contest year, 150 eggs weighing at least 24 ounces to the dozen. Advanced Record of Performance certificates are given for birds which lay 225 eggs during the same time.

Twenty-five per cent of all the birds in the 1919-20 contests were granted Record of Performance certificates, but less than one per cent laid enough eggs to entitle them to the Advanced Record of Performance certificates.

FEED ACCOUNTS

To keep the feed accounts accurately, and, at the same time, to find out the cost per dozen of eggs, the year was divided into thirteen periods of four weeks each. All feed was weighed when put into the pens, and, at the end of each four-weekly period, what remained unused was again weighed, and the amount consumed recorded.

THE SECOND SERIES OF CONTESTS 1920-21

In addition to the contests already in operation the following were started on November 1, 1920:—

New Brunswick Egg Laying Contest, Fredericton, N.B.
Ontario Egg Laying Contest, Ottawa, Ont.
British Columbia Egg Laying Contest, Agassiz, B.C.

The addition of these three contests to those already in operation places one laying contest in each province, and the "Canadian" at Ottawa. The Canadian egg laying contest is open, but the provincial contests are confined to the province in which the contest is held. The following is the number of entries in each contest for 1920-21:—

Contests.	No. of entries.
Canadian	50
Ontario	24
Prince Edward Island	25
Nova Scotia	22
Quebec	20
Manitoba	23
Saskatchewan	19
Alberta	21
British Columbia	27
New Brunswick	21

DISEASES

Dr. A. B. Wickware, Pathologist of the Health of Animals Branch, has been in charge of poultry disease work throughout the year, and a very brief summary of his work follows:—

SENSITIZED EXPERIMENTS WITH TUBERCULOSIS

This study, which was carried on for a period of three months, was conducted for the purpose of throwing more light on the relationship of avian tuberculosis to that of cattle. Unfortunately, the study had to be discontinued owing to an enforced absence from duty at a particularly critical period of the investigation.

STUDIES OF THE ANTHELMINTIC VALUE OF DRUGS IN THE CONTROL OF TAPEWORM AND ROUNDWORM INFESTATIONS IN POULTRY

Various remedies were tried, and a paper embodying the results is now ready for publication.

STUDIES ON PARASITES AND PARASITIC DISEASES

This work includes the collection and indentification of tapeworms, roundworms, mites, lice, etc., infesting poultry in Canada. Already a considerable number of different species of parasites have been collected and identified. These studies will later be supplemented by work on their life histories, with the object of being able to control more readily the sources of infection, and to institute preventive measures.

Preliminary studies have been carried on relating to roup, chicken pox, acute bronchitis, etc., to determine the mortality rate; the efficacy of various remedies now advocated for use; and the relationship of the various forms of this disease to the other.

Vaccines have been used in the outbreak of chicken pox, and fairly favourable results have followed its administration. Out of one hundred affected cockerels, all showing manifestations of the disease, fifteen were lost, the death of at least eight of these birds being due to injuries inflicted by other cockerels in the pens.

Various medicinal remedies have been tried in the treatment of such conditions as vent gleat, prolapsus, etc., and are being continued until such time as a curative remedy is found.

A certain amount of photography has been carried on to record cases such as ovarian cysts, obstruction of the oviduct, tumors of the heart, leukemia, etc. These photographs are to be used for lantern demonstrations and for insertion in future publications.

MISCELLANEOUS

Under this heading appears matter which does not seem to belong to any of the foregoing.

EGG PRESERVATIVES

New methods of preserving eggs are constantly appearing, and almost every year tests are made of such. This year all the preparations used locally were tested against the two old and tried methods, lime water and water-glass, and, as is usually the case, none of the newer systems proved superior to the old. The Cap Rouge Station has also conducted experiments along this line, with the same results. In all, seven methods were tested, requiring thirty dozen eggs. These seven methods were:—

No. 1—Wrapped in tissue paper.
No. 2—Dipped in boiling water and wrapped in tissue paper.
No. 3—Dipped in boiling water.
No. 4—Liquid preservative.
No. 5—Eze.
No. 6—Lime water.
No. 7—Water glass.

The period of preservation was from February 11 to June 11, 1921. All eggs when put down were new laid, infertile, sound in shell, and clean, stored in standard crates with clean fillers, and resting on a cement floor of cellar, temperature 40 to 65 degrees F.

No. 1—36 eggs wrapped in tissue paper.
No. 2—36 eggs dipped in boiling water and immediately withdrawn and wrapped in tissue paper.
No. 3.—36 eggs dipped in boiling water and immediately withdrawn and stored unwrapped.
No. 4.—72 eggs coated with "Liquid preservative" and stored unwrapped.
No. 5—72 eggs coated with "Eze" preservative.
No. 6—72 eggs kept immersed in lime water (saturated solution) and stored in cement cellar, temperature 40 to 65 degrees F.
No. 7—72 eggs kept immersed in water glass (sodium silicate) solution and stored in cement cellar, temperature 40 to 65 degrees F.

RESULTS

Upon examination of the eggs at the close of the test, and allowing 100 for the eggs having the best contents, and 100 for the eggs having the best appearance on the outside (shell) the different processes stood as follows:—

Method.	Content	Shell.
Lime water	100	100
Water glass	100	50
Wrapped and dipped in boiling water	40	100
Unwrapped and dipped in boiling water	40	100
Eze	80	25
Liquid preservative	30	50
Unwrapped (no treatment)	20	100

As the shell is of more importance than the contents, the order of preference must be determined largely by the suitability of the contents for food.

AUTOMATIC FEEDER

An automatic feeder was given a trial in a pen of Leghorn pullets. This device consisted of a receptacle that held about two gallons of whole or cracked grain, which

was scattered through the litter by the action of the hens in picking at a bait suspended under the hopper.

The saving in labour with an appliance of this kind is considerable, and the flow of feed can be fairly regulated; but the egg yield was not appreciably influenced.

Automatic Feeder

The illustration shows an automatic feeder at work in the yard. The feeder is convenient for the person who cannot be on hand at regular feeding time, but does not cut down the feed cost of production.

NON-FREEZING DRINKING FOUNTAIN

This is a device consisting of a container with a small trough attached, into which the water flows, beneath which is a small coal oil lamp intended to keep the water from freezing. This worked very well until, at a temperature of 7 degrees below zero, the water in the trough froze. No appreciable increase was shown in the egg yield from the use of the tepid water in the fountains for drinking. As long as the lamp lasted, it no doubt saved labour; but from a limited experience it cannot be recommended.

DEMONSTRATIONS AT WINTER FAIRS AND POULTRY SHOWS

An attractive exhibit, comprising interesting and educational coloured transparencies, and models of useful appliances, with appropriate legends, has, for the third winter in succession, been sent to the principal winter fairs and poultry shows, in charge of an official of the Division competent to give reliable advice, and to demonstrate the construction and economical advantages of the originals of the models and the use of the feed rations displayed.

The exhibits have been very cordially received and greatly appreciated, and have proved an excellent medium for bringing the work of the Division to the notice of the farmers and public.

They have proved of value in getting in touch with the right man. Many farmers or their wives, who hesitate to write to the Experimental Farms, or question in a public lecture room, will approach for information, when given the opportunity these exhibits afford.

The models displayed were of sound practical value to the farmer, and the original houses and implements that they represented were easily constructed from the plans and specifications contained in the literature distributed.

The samples of feeds, and the rations advised from them, were of practical value, and easily procurable if not at hand on the Farm.

It has generally been possible to erect an exhibit of this nature in about ten districts during the winter season, having due regard to the locality, convenience of transportation, and date.

FARM EGG AND POULTRY ACCOUNT FORMS

If the poultry flock is to be successfully handled, some simple system of accounting is almost essential.

The great demand for something of this kind induced the Poultry Division to send out forms, upon request, on which the farmer can keep a record of his poultry operations, and, providing a copy of this monthly account is returned to the division, a supply of the blank forms is continued.

The object of the request for a copy of this account is to ensure its use in a proper manner, and to render assistance by way of suggestions and criticisms.

It is seldom that the farmer is able to point out the profit or loss on his poultry, on account of the small individual expenditure and return. This laxity is more general with the poultry flock than with any other branch of the farm work.

An effort has been made to give him, in the simplest form, a method of keeping an account of the gross expenditure and returns, so that he can readily determine whether this branch of his work is giving him a satisfactory profit.

As the profit or loss is governed by the increase or decline in egg yield, and as this is influenced to a very great extent by the care, management, and feeding, a monthly egg record is shown on the account form, so that by reference, he can readily check up and rectify errors that are at once apparent by the fluctuation in yield.

The advantage of this work is mutual; the farmer, if he desires, has individual attention to his troubles, and from the duplicate account form he returns monthly, the Poultry Division obtains reliable first hand records of conditions in his locality.

From these forms it has been possible to extract the following tables, which are of value in answering correspondents as to the advisability of engaging in or extending their poultry operations. The tables include, by province or section, the most popular breed, the actual prices received by the farmer for his products, average number of hens kept on the farm, egg yield, value of eggs and poultry sold, expenditure on feed and appliances, and profit per head.

TABLE showing breeds in order of their popularity on the farms of the Dominion.

Province	White Leghorn	B. P. Rock	White Wyandotte	R. I. Red	Mongrel	Buff Orpington	Ancona	Other pure breed	Brown Leghorn	Minorca
Quebec	2	1	2	3	4	5	5	5	5	5
Maritime provinces	4	2	1	3	5	7	6	6	6	6
Ontario	2	1	3	4	5	8	6	7	7	8
Prairie provinces	1	2	4	3	5	4	7	7	7	8
British Columbia	1	5	2	3	4	6	7	7	7	6
Dominion	1	2	3	4	5	6	7	8	8	9

The preference for White Leghorns on most of the big commercial plants is probably responsible for the place the breed occupies in the popularity table; but the margin that divides any of the first three breeds is very small.

TABLE giving average price received for eggs as reported by farmers throughout the Dominion in 1919-20, with maximum, minimum, and monthly average for provinces.

Province	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Ave.	Max.	Min.
Quebec	75	93	84	79	74	60	58	58	63	69	75	85	72	125	55
Maritime provinces	76	83	80	76	73	54	45	55	60	65	66	75	67	90	38
Ontario	77	87	82	72	61	48	50	51	56	60	64	69	65	100	40
Prairie provinces	60	72	77	72	54	45	44	44	45	51	62	59	57	100	30
British Columbia	87	80	64	58	49	46	51	52	69	64	68	76	64	100	35
Dominion	75	83	77	71	62	51	50	52	58	62	67	71	65	125	30

TABLE showing average number of hens, cost of maintenance, and profit over cost of feed, of the poultry flocks on the farms of the Dominion, from which complete returns are available on Experimental Farms Monthly Farm Egg and Poultry Account Forms. November 1, 1919, to October 31, 1920.

Province	Average No. of hens on farms	Average egg yield	Average value of eggs sold		Average value of poultry sold		Average expenditure on flock for feed		Average Expenditure on flock for appliances, etc.		Average total revenue		Average total expenditure		Average cost per hen for feed		Average profit per hen over cost of feed	
			$	cts.	$	cts.	$	cts.	$	cts.	$	cts.	$	cts.	$	cts.	$	cts.
Quebec	44.2	106.6	286	43	84	42	195	97	39	33	370	85	235	30	4	43	3	95
Maritime provinces	104	122.2	611	27	184	13	500	48	70	28	795	35	570	76	4	81	2	83
Ontario	31.5	119.6	188	77	73	82	147	98	21	06	262	59	169	04	4	69	3	84
Prairie provinces	35.7	107.2	179	55	53	27	102	17	96	62	232	82	198	79	2	86	3	66
British Columbia	221	144	1,550	25	161	06	1,049	48	96	89	1,711	31	1,146	37	4	7†	2	85
Dominion	87.3	119.9	443	25	111	34	399	21	64	83	674	58	464	05	4	58	3	15

The prices shown on this table may be slightly in advance of those obtained by the general run of the farmers, as it is more than likely that those farmers who have kept account of their poultry operations closely enough to submit an account monthly to the Poultry Division have also given very careful study to market conditions, and have obtained a slightly better price for their product than have those who have not given this branch of their work the same attention.

DISCUSSION OF TABLES

The figures throughout the tables are compiled from the actual experiences obtained from the commercial plant, the farm, and back-yard plants, and can be confidently studied as an example of the average success that may be expected with poultry, when ordinary care with regard to feed and management is exercised.

The table may be inflated in value compared with the condition on the average farm. The number of hens to the farm for the Maritime Provinces for instance, is certainly above the average for those provinces.

There is a great probability that those who are successful are encouraged to put forth a greater effort, while those who do not meet with the same success, are inclined to become careless, or to drop their operations altogether.

It is, therefore, from the former that the greater number of records are obtained, and the figures demonstrate the average success that may be expected from the farm flock, with proper feed, care, and management.

The average prices for feed per hen are high, but the year 1919-20 was remarkable for the high price of all feeds, and prices obtained for the product were correspondingly enhanced. The average cost for feed was considerably lower in the Prairie Provinces, but this is attributed to the cheapness of home grown grains, and to the quantities of waste grain and elevator screenings that are used for poultry feeds at little or no cost.

By reference to the table of average prices obtained for eggs, it will be noticed that the farmers of the Prairie Provinces received less for their product; but the low price of feed amply compensated them, and the margin of profit compared favourably with that obtained in other parts of the Dominion.

The number of large commercial poultry plants in British Columbia explains the high average number of hens per farm, and the relatively smaller margin of profit is attributed to this, and to a higher expenditure per head for appliances.

Where large exclusive plants exist, more elaborate equipment is needed, and the yield and profit are proportionately smaller as compared with the mixed farm, with its small flock, home-grown feed, and home-made appliances.

CO-OPERATION WITH THE ILLUSTRATION STATIONS

As a part of the extension work carried on by this division, it was arranged, through the Supervisor of Illustration stations, to supply one or two sittings of eggs to each of the Farms upon which this work is being conducted. These were supplied by a Branch Farm or Experimental Station in the province in which the Demonstration Farms were operated.

Where it was convenient for the farmer who received eggs to come to the Experimental Farm or Station, he was urged to do so, and, when he came for the eggs, the opportunity was taken to show him the other departments of the farm.

INSPECTION

Mr. J. C. Morgan, Maritime Province Poultry Superintendent, has been kept busily engaged inspecting the egg laying contests throughout the Maritime Provinces and Quebec, and assisting in supervising the work of the various Branch Farms. His services have also been in almost constant demand for institute work, short courses, fairs and demonstrations.

BULLETINS

Bulletins Nos. 87, 88 and 89 having been exhausted, they have been rewritten during the year, as also a number of the exhibition circulars. The correspondence, and the demand for blue prints, circulars, bulletins, and other information have increased materially during the year, as has also the number of visitors at the Central plant and the Branch Farm plants throughout the System. In fact the poultry plants have been one of the connecting links between the public and the Farm, for, everybody being more or less interested in poultry, the good prices received for the products have made people anxious to get all the up-to-date information, in order to obtain the best returns possible.