DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
DOMINION EXPERIMENTAL FARMS

DIVISION OF POULTRY HUSBANDRY

PROGRESS REPORT

OF THE DOMINION POULTRY HUSBANDMAN
F. C. ELFORD

FOR THE YEARS 1931 TO 1933, INCLUSIVE

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DOMINION EXPERIMENTAL FARMS

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DIVISION OF POULTRY HUSBANDRY

PROGRESS REPORT OF THE DOMINION POULTRY HUSBANDMAN

F. C. ELFORD

INTRODUCTION

The work of the Division of Poultry Husbandry for the years 1931, 1932 and 1933 is covered by this report. In addition to the work of this Division at Ottawa, that of all the branch farms with poultry for the same three years, is briefly summarized. Since the large amount of work done in any one year, if reported upon even briefly, would be too great to come within the scope of this publication, it has been necessary to review the results of only the most outstanding projects actually investigated and to summarize them very briefly. Where the same projects have been in operation on a number of the experimental farms the results have been considered together in order to indicate any definite trend. Since the reviewing of such a large amount of data even in a superficial manner is a time-consuming task, the necessity for brief reference only to much of the work will be appreciated.

There is also included a report on routine and investigational work with diseases of poultry, prepared by the pathologist in charge of the poultry pathological laboratory stationed at the headquarters of this division.

The officers of this division responsible for the different sections of this report are as follows: George Robertson, Dr. A. Deakin, and S. S. Munro, for the section dealing with breeding and genetics; H. S. Gutteridge and S. Bird for the section dealing with research work other than breeding; A. G. Taylor for the section dealing with the Canadian National Egg Laying Contest; W. A. Garland for the sections dealing with farm egg and poultry accounts and exhibits; and J. L. Roy for the section dealing with field work in Quebec. The report of the pathological laboratory was prepared by C. H. Weaver and A. B. Wickware.

The data from the branch farms reviewed in this report were prepared by the assistants and poultrymen of the branch farms and made available through the courtesy of the superintendents of the different farms.

POULTRY BREEDING

The poultry breeding work on the experimental farms is divided into three principal phases of activity. The first phase is the supplying of improved bred-to-lay stock for farmers and poultrymen. In recent years, however, the increase in the number of pedigree breeders, the Record of Performance and Registration policies, and the growth of hatcheries has removed much of the responsibility from the experimental farms as sources of improved breeding stock. The second phase is the supplying of stock for nutritional and housing experiments. The third is that of testing out breeding practices and methods and the inheritance of the economic characteristics—meat, egg size, and egg numbers. In recent years the policy of each farm carrying on research projects in both nutrition and breeding has been changed to one of greater specialization.

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The projects on each farm now, with the exception of Ottawa, are generally either of a breeding or nutritional nature, the type of work emphasized being determined by personnel, facilities and location. Such specialization permits of more reliable results and a combined attack upon important problems.

Breeds

Domestic Fowl

Except on a few of the experimental farms, there is only one breed of fowl kept, as it is felt that more effective work can be accomplished with a single breed. Of the breeds, the Barred Plymouth Rock is the most popular, being kept at seventeen of the twenty farms at which poultry is maintained. Single Comb White Leghorns and White Wyandottes are next in order of numbers, being kept at three farms each, with Rhode Island Reds at one farm only. A few individuals of other breeds are kept on a few farms, usually for some special purpose, such as crossbreeding.

Turkeys

Turkeys are now kept only at one farm, namely, Scott, Saskatchewan.

Waterfowl

A few different species of ducks and geese are maintained at Ottawa.

Pedigree Breeding

With few exceptions, all breeding stock is bred from individually pedigreed birds that laid at least 200 eggs in their pullet year. This system of selecting breeding stock has been practised on the experimental farms for several years with the result that the stock used at the present time is descended from several generations of birds that have laid 200 eggs or more. The selection for egg weight is based largely on standard sized eggs, namely, 24 ounces to the dozen. The flocks on some farms average over this weight while those on others are slightly under. It is the ever-present problem of the breeder to combine high production with good egg weight. The very high-producing birds usually lay small eggs. Such birds are mated with large-egg-line males in order to combine the two characteristics.

A description of the pedigree system in use on the farms, breeding, record forms, trap-nesting, etc., is available on application to the nearest experimental farm.

Incubation

Records of fertility and hatchability are kept on all pedigreed eggs set. These figures are presented in Table 1 for the years 1931 to 1933, inclusive.

TABLE 1.—HATCHING SUMMARY OF DOMINION EXPERIMENTAL FARMS FOR 1931 TO 1933

Year	Total eggs set	Per cent fertile	Per cent total eggs hatched	Per cent fertile eggs hatched
1931	77,732	90·8	50·8	55·97
1932	62,444	82·3	51·5	62·7
1933	69,320	82·7	48·9	59·1

There is, of course, a good deal of variation in hatchability and fertility between the different males used on the different farms. Some males fail to mate with some females, and from some matings, especially in inbreeding experiments, the hatchability is very poor. There is also some variation from one year to another in fertility and hatchability. On some farms data are kept on the hatchability and fertility for the different months during the hatching season. The results of this work are given in the following table:—

TABLE 2.—MONTHLY HATCHING RESULTS

Year	Month	Total eggs set	Per cent fertile	Per cent total eggs hatched	Per cent fertile eggs hatched
1931	February	6,541	78·7	44·3	56·3
	March	30,084	81·8	42·5	51·9
	April	23,328	85·1	47·1	55·3
	May	3,192	86·6	54·1	62·5
1932	February	3,608	88·0	50·7	57·7
	March	28,625	78·7	49·0	62·2
	April	24,567	83·9	54·9	65·4
	May	2,472	76·7	48·8	63·5
1933	February	1,722	74·0	39·0	52·8
	March	26,369	79·6	45·4	57·1
	April	32,268	82·9	49·5	59·6
	May	8,362	87·5	55·7	63·6

It may be noted that in general both the percentage of fertility and that of hatchability are higher towards the end of the season. Some records are also kept on the fertility and hatchability of pullets as compared with yearling and older hens. Generally speaking the pullet eggs show a little less fertility and hatchability than those from yearling and older hens. On the other hand, more chicks are obtained from pullets during the breeding season since they lay eggs at a faster rate, as a rule. On several farms, different makes of incubators are used and records kept on the hatching results from each make are secured.

Rearing

Experiments on economical rearing and fattening rations are conducted with much of the young stock. Males are separated from the females at about eight weeks. The surplus males are sold as broilers or fattened for roasters or capons. In recent years the prevalence of poultry diseases has necessitated experiments with methods of handling young stock so as to keep them free from parasites and respiratory diseases. Thus, on some farms, the young stock are quarantined on ranges; that is, all contact, including that brought about by attendants, is broken between the old and young stock. In addition, houses are cleaned frequently and all litter destroyed, feed and drinking utensils are kept on wire and moved frequently to help check the spread of parasites, principally coccidia. A complete quarantine is very difficult to put into effect on the experimental farms, owing to visitors. Wild birds are also known to carry contagion which adds further difficulty to the problem of completely quarantining young stock.

Pullet Records

In the fall, pullets which are good representatives of the breed, free from standard disqualifications and reasonably well grown, are leg-banded and put into winter quarters. Where housing and nutritional experiments are being carried on, the flock is divided so that the pullets of a pullet-sister group are equally divided between the experimental pens as far as is possible. The birds

are trap-nested throughout the pullet year. Body weights are taken every four-weekly period. Egg weights are taken on some farms for all eggs laid by pullets throughout the pullet year. Other farms weigh all eggs up to December 15 and then all eggs laid during one week in every four weeks.

From these records it is possible to select those birds for breeders which commence laying a comparatively large egg. Many pullets take several months before they are laying standard-sized eggs. Males, whose full sisters do not lay standard-sized eggs by January or February, are not used as breeders. The heavier pullets within the flock tend to lay the largest eggs. This characteristic, however, is very variable and many comparatively small birds lay eggs over the standard size. The best method is to breed birds of around standard weight for the breed and then maintain the desired egg size by selection of breeders for this characteristic, and to incubate only eggs of at least standard size.

Progeny Test

It is well known that among a group of full-sister pullets some may be very good layers and others very poor layers. The same is true of the transmitting ability of full brothers. Males cannot be judged, however, with any degree of surety except by testing them through their daughters' production. This is known as the progeny test, and all males used for breeding on the experimental farms are subjected to this test. Thus the cockerels used for breeding are kept until the following breeding season and rated on their progeny according to: (1) fertility and hatchability; (2) range and adult mortality; (3) egg production up to January or February; (4) egg weight.

Males that give poor fertility and hatchability are not used a second year. Such males are culled after the first breeding season. The range and adult mortality of different males may run from 10 to 50 per cent, or more. Males whose progeny have a high death rate are not used a second year, neither are their sons, even if the production of the surviving daughters be very high.

The males chosen for second-year breeding work, together with their sons, are those whose daughters come into production at from six to seven months of age, lay at a good and uniform winter rate, have low mortality and egg weights that average around standard size by January or February.

Registration

Most of the farms submit one or two pens, annually, to the Egg Laying Contests located in the various provinces. The birds that are registered are entered in the registration policies and some registered males are sold.

Experimental Projects in Breeding

INHERITANCE OF EGG PRODUCTION

A comprehensive project on the inheritance of egg production was inaugurated in 1934. The method of attack has been, first, a consideration of the fundamental principles of Mendelian inheritance as applied to egg numbers and egg weight and, second, the analysis of pedigree breeding records amassed at the Central Experimental Farm and the branch farms. Attention has been particularly concentrated on the relative influence of environment and heredity on egg numbers and egg size. The work has, as its ultimate aim, the devising of practical methods of breeding which will produce the most efficient results per unit of time, labour and expense invested. It has been determined that environmental influences play a much larger part than has been hitherto

believed in determining egg numbers; in fact, non-genetic causes determine the greater part of the variation between individuals and between families. In egg weight, however, environmental influences play a smaller part than does heredity.

The selection of breeding males by means of the progeny test is the most efficient way to improve egg numbers. Even by this method, however, the identification of proven sires is a difficult problem. A method whereby sires may be rated on a definite basis of accuracy has been evolved, and tables which may be used for this purpose have been set up.

LINE-BREEDING

One of the problems of a poultryman with a well-bred flock is that of purchasing suitable males. The males introduced may be of different type and weight or not so highly bred for production, giving slower maturing daughters with a slower rate of production and undesirable egg size. Experiments are therefore conducted on line and inbreeding to determine to what extent a flock may be maintained at a high-producing level without introducing new blood. From the close and line-breeding experiments, the following conclusions are given: Close breeding, such as with full or half brother and sister, sire and daughter, etc., should not be continued more than one, or at the most, two generations. The most striking effects of continual close breeding are poor hatchability, a slower growth rate, slower feathering and poorer egg production. With line-breeding, or the continued mating of more distantly related birds, such as cousins or half cousins, ill effects may or may not appear, according to the quality of the parent stock. Some lines can be kept up to a very economical production through line-breeding. Males from such breeding give good results when outcrossed. On the other hand some of the results have been very poor, a large percentage of the stock being off colour and type and giving poor production. The conclusions are, therefore, that only stock of good colour, type, vigour, production, and egg weight should be used for line-breeding, and when generally poor results are obtained the whole line should be discontinued or outcrossed.

FERTILITY PROBLEMS IN THE MALE

In 1933, several rather fundamental studies were inaugurated on the physiology of sperm. These studies, while all closely related, were more or less distinct.

1. *Relation of testis hormone to sperm life in the isolated vas deferens.*

In mammals, it is known that the testis hormone preserves the motility and fertilizing capacity of mature sperm in the epididymis and vas deferens. This occurs under scrotal temperatures, however, the preserving action of the hormone has no effect when the epididymis is elevated into the body cavity. Since spermatogenesis in birds normally proceeds in a high body temperature, the effect of the testis hormone in birds is a point of considerable fundamental importance. The experimental method consisted of comparing, at varying post-operative intervals, the activity of spermatozoa recovered from the excretory ducts of totally castrated and testes-isolated males. Over 60 birds were used in this experiment.

Results show that the maximum life of sperm in the vas deferens of both groups is approximately 32 days. No differences were found between the groups. Contrary to the situation in mammals, therefore, the testis hormone in fowl, exerts no effect on the preservation of sperm life in the excretory ducts.

2. *The mechanism of sperm transportation.*

Recent studies indicate that agencies external to the spermatozoa are responsible for their transportation from the cloaca or distal end of the oviduct to the site of fertilization. Artificial insemination was used as the technique to investigate this problem. Comparisons were made between the fertility secured when sperm was liberated in the cloaca and in the distal oviduct itself. Preliminary work indicated a highly significant difference between the two but in later work, to confirm this, difficulties were encountered due to lack of knowledge concerning proper methods of handling the sperm *in vitro*. Evidence at present to hand indicates that the spermatozoa of the fowl are only feebly motile when suspended in artificial media at body temperatures but this motility increases to maximum as the temperature is lowered to approximately room temperature. At still lower temperatures the motility again decreases. A more comprehensive project designed to elucidate the effect of temperature and media on the motility and fertilizing capacity of fowl sperm is planned.

BLUE OINTMENT EXPERIMENT

One of the several methods used for ridding birds of lice is that of rubbing a little blue ointment around the vent and under the wings. However, if blue ointment is used on setting hens, none of the eggs hatch, owing to the small amounts of blue ointment that become smeared on the egg shell and penetrate into the egg thus poisoning the developing chick. An experiment was conducted to see if the blue ointment treatment of hens during the breeding season had any effect on hatchability of the eggs when hatched in an incubator, due to the possibility of some ointment getting on the eggs just after laying. The results indicate that hatchability is affected to some extent and, therefore, birds should not be treated with blue ointment either during, or a month or so before, the breeding season. Further details may be obtained by reference to Poultry Science, Vol. 12:6 page 378.

EFFECTS OF X-RAYS ON MALE BIRDS

In 1933, a project was inaugurated to determine the possibility of caponizing by X-radiation. This project has had the hearty co-operation of the National Research Council, in whose laboratories the necessary radiation was carried out. Since the testis hormone, which gives rise to the secondary sex characters of the domestic fowl, is a product, at least in part, of the interstitial tissue of the testes and since reported results on other forms of life indicate that this tissue is not destroyed by X-rays, positive results were not looked for. This proved to be the case. Considerable data, however, have been collected on the level of dosage necessary to affect germ cells on males of varying ages. These results show that the spermatogenetic tissue of the fowl is relatively resistant to X-radiation. While extensive destruction of germinal epithelium can be produced by exposure to X-rays, the capacity of the testis to recover and regenerate is great.

EXPERIMENTAL WORK OTHER THAN BREEDING

Brooding

For the most part, brooding experiments were in the field of feeding of brooding and rearing stock. Those projects sufficiently advanced to be worthy of reporting at the present time will be considered briefly.

VITAMIN EXPERIMENTS

Several experiments under this head, conducted at Ottawa, will be briefly reported.

Pilchard Oil (Vitamin A Content)—

In order to test the vitamin A content of pilchard oil, six pens of twenty-four chicks each were treated as shown in Table 3.

TABLE 3.—VITAMIN A CONTENT OF PILCHARD OIL

Pen	Ration	Supplement	Irradiation	Weight in grams
1	Vitamin A-free ration	1% pilchard oil	Ten minutes	426·0
2	Vitamin A-free ration	1% cod liver oil	Ten minutes	395·4
3	Vitamin A-free ration	No supplement	Twenty minutes	118·3
4	Vitamin A-free ration	2% pilchard oil	Ten minutes	421·5
5	Vitamin A-free ration	2% cod liver oil	Ten minutes	374·3
6	Standard ration	1% cod liver oil	Ten minutes	516·4

The irradiation was by the mercury vapour lamp and was used to supply the vitamin D equivalent. The results obtained are shown in the last column.

Judged by growth, which is the chief function of vitamin A, all the oils fed gave similar results. The difference of 11·8 per cent in favour of 2 per cent pilchard oil over the 2 per cent cod liver oil pen is on the border line of significance.

It may be concluded from the above data that the sample of pilchard oil was at least the equal of the cod liver oil used, with a suggestion of superiority in so far as vitamin A content was concerned.

Pilchard Oil (Vitamin D Content).

Pilchard oil was biologically tested for its vitamin D content, using cross-bred White Leghorn x Barred Rock female chicks. A basal ration, which had been proven to produce rickets in four to five weeks time in the absence of direct sunlight, was used. The pens were arranged so that one pen received direct sunlight, one had no sunlight or substitute, one each with 1 per cent and 2 per cent unrefined pilchard oil, one each with 1 per cent and 2 per cent of cod liver oil and one with 2 per cent of refined pilchard oil.

The pilchard oil was a composite sample, dipped from different storage tanks of the oil, and thus was fairly representative of such oils. The cod liver oil was a Newfoundland oil which had previously given satisfaction. The data given in Table 4 were obtained:—

TABLE 4.—VITAMIN D CONTENT OF PILCHARD OIL

—	Weight in grams (6 weeks)	Ash content of bones (as % of highest content)
Direct sunlight (pullets)	307·4	93·0
1% pilchard oil (pullets)	342·5	100·0
1% cod liver oil (pullets)	349·6	97·8
2% pilchard oil (refined), (pullets)	305·1	80·8
2% pilchard oil (pullets)	294·6	93·3
2% cod liver oil (pullets)	306·5	97·6
No sunlight or substitute (cockerels)	192·2	55·6

From these data, growth may be considered to be normal for all pens with the exception of that receiving neither sunlight nor substitute, in which pen rickets was prevalent. Growth was exceptionally good on the 1 per cent levels of oil. The ash content of bones was also close to normal in all but the no sunlight or substitute pen. The 1 per cent pilchard and 1 per cent cod liver oil pens were again outstanding.

It may be concluded, from the above, that both the pilchard oil and cod liver oil used were well supplied with vitamin D.

It would appear that pilchard oil, if of similar quality to that used in this experiment, may be safely substituted for cod liver oil, it being of at least equal value in content of both vitamins A and D.

Vitamin Value of Various Fish Oils

A standard cod liver oil was contrasted with pilchard oil and with a cod liver oil concentrate for both vitamin A and vitamin D deficiency.

The following pens made up the test:—

Pen	Sex	Ration	Supplement	Irradiation
1	Cockerels	A-free	1/8% C.L.O. concentrate	10 minutes daily
2	Pullets	D-free	1% pilchard oil	None
3	Pullets	A-free	4% yeast	20 minutes daily
4	Pullets	D-free	1/8% C.L.O. concentrate	None
5	Cockerels	A-free	None	20 minutes daily
6	Cockerels	A-free	1% C.L.O.	10 minutes daily
7	Cockerels	A-free	1% pilchard oil	10 minutes daily
8	Pullets	D-free	None	None
9	Cockerels	Standard	1% C.L.O.	10 minutes daily
10	Pullets	D-free	1% C.L.O.	None

Cross-bred Single Comb White Leghorn male x Barred Rock female chicks were used and were separated as to sex, at hatching, by rate of wing growth. The A-free ration used, while not completely A-free, was extremely low in vitamin A and had previously been proven to give cessation of growth, lack of nervous control and finally death, if not supplemented with vitamin A from some source. This applies to the vitamin D-free ration, with the exception that extreme rickets and death were the results if no supplement was used. All rations used, by actual analysis, were practically identical in essential nutrients as follows:—

	Moisture	Ash	Protein	Fibre	Carbo.	Fat
A-free ration	9·53	4·98	18·63	3·18	57·17	6·25
D-free ration	9·81	4·66	18·34	3·83	56·86	6·50
Standard ration	6·44	3·53	19·56	5·13	53·79	7·55

Birds on the A-free ration were irradiated in order to be certain of a sufficiency of vitamin D. Thirty-three birds of one sex were used in each pen with the exception of the two pens receiving no supplement, and the pen with 4 per cent yeast, there being 22 of one sex in each of these.

The weights attained at seven weeks of age were as follows:—

Cockerels—

A-free + $\frac{1}{8}$ per cent C.L.O. concentrate—545·3

A-free + 1 per cent C.L.O.—559·6

A-free + 1 per cent pilchard oil—493·6

Standard + 1 per cent C.L.O.—572·4

A-free + no supplement—deficiency symptoms, little growth

Pullets—

D-free + $\frac{1}{8}$ per cent C.L.O. concentrate—490·8
D-free + 1 per cent C.L.O.—463·4
D-free + 1 per cent pilchard oil—452·9.
D-free + no supplement—rickets, little growth

The above data were examined statistically and the following differences found: Growth on the standard ration was significantly greater than that on the A-free ration + 1 per cent pilchard oil, and that on the A-free ration + 1 per cent cod liver oil than that on 1 per cent pilchard oil. All other differences are of no significance.

The birds on the standard ration are not comparable to those on the D-free rations because of the difference in sex. None of the growth differences between the different supplements of vitamin D are significant. The growth data for the pens without supplement and for that receiving yeast are not shown, as A-deficiency symptoms and rickets made them not comparable. Comparison of the bones of the chicks on the D-free ration without supplement and those receiving the supplements, for calcification by the line test, showed advanced rickets for the first mentioned while all chicks of the supplemented pens were apparently normal.

The addition of 4 per cent yeast to the A-free ration prolonged growth and the onset of A-deficiency symptoms to some extent.

It may be concluded from the above that all the supplements fed were good sources of vitamin A. The pilchard oil used was not so potent a source of vitamin A as was the cod liver oil used, although it was not significantly poorer than the cod liver oil concentrate.

All supplements were good sources of vitamin D and there was no significant difference between them.

The fact that the sample of pilchard oil used had been proven an equally good source of vitamin A one year previously would tend to suggest that some vitamin A potency had been lost under storage conditions, which were far from ideal. Vitamin D, being well known to be more stable, suffered only slightly, if at all, due to this storage. The cod liver oil used was under better conditions of storage and apparently did not lose potency in either vitamin.

SUNLIGHT, GLASS SUBSTITUTE AND THE MERCURY VAPOUR LAMP FOR BONE FORMATION

The cockerels in the above test were divided equally into pens, one pen receiving no sunlight or substitute, one direct sunlight, and three pens receiving sunlight through Vita glass, Vioray and Windolite, respectively. Exposure of another pen to a mercury vapour lamp for twenty minutes daily completed the test.

The following data were obtained:—

—	Average weight in grams (6 weeks)	Ash content of bones (as% of highest content) (pullets)
Direct sunlight	372·4	92·0
No sunlight or substitute	192·2	55·6
Ultra violet rays (mercury vapour lamp)	366·8	89·9
Vita glass	356·5	98·3
Vioray	340·4	82·8
Windolite	349·6	86·7

From the above it may be seen that growth was fairly normal except for birds in the no-sunlight or substitute pen which had rickets. Bone ash was also fairly normal although lower on the average than was produced by the oils used in the previous test. All the glass substitutes used, with the exception only of Vita glass, were less efficient than direct sunlight or the mercury vapour lamp, however.

EXPERIMENTS ON THE BRANCH FARMS

On several branch farms, vitamin-containing feeds were also tested as follows:—

At Ste-Anne de la Pocatière a test, in collaboration with the Poultry Division at Ottawa, contrasting direct sunshine, pilchard oil, and cod liver oil was carried out. Using 50 chicks to a pen and giving the above oils at a level of 2 per cent of the same ration, a difference in growth produced by pilchard oil over cod liver oil of 15 per cent, and of pilchard oil over direct sunshine of 13 per cent, was experienced. These differences were significant, but that between cod liver oil and sunlight was not so.

At the Dominion Experimental Farm at Nappan, Nova Scotia, and at the Experimental Station at La Ferme, Quebec, a test was carried out, also in collaboration with the Poultry Division at Ottawa, in which pilchard oil was contrasted with cod liver oil for its vitamin D content (ash in bones). The results fully substantiated those obtained at Ottawa, which have just been reported and will not be elaborated upon here.

A similar experiment carried out at Agassiz, British Columbia, showed a 15 per cent greater gain in weight in birds receiving pilchard oil over those receiving direct sunlight, and of 12 per cent in birds receiving cod liver oil over those receiving direct sunlight, both of which are significant. A repetition of this test the following year showed no significant difference between any treatments; therefore, it is apparent that the oils were of equal value for growth production.

At Kapuskasing, Ont., the equivalent value of these oils was also demonstrated.

Growth Production Experiments

EFFECT OF VARIATION IN PROTEIN LEVEL ON GROWTH PRODUCTION

Previous unreported work at Ottawa suggested that the level of minerals or ash, as it is called, in the growing ration, rather than the increase in protein, was probably responsible for increased growth with mashes containing increasing levels of animal feeds (high in ash). To determine the effect of increased levels of protein upon growth, a test was carried out in which the level of minerals was kept constant from mash to mash so that any difference in growth would be due to protein rather than to this factor. Not only was the ash level kept constant but it was made up to the level present in a mash known as ration A which had already given satisfactory growth. Table 5 shows the composition of the rations and their analyses.

TABLE 5.—COMPOSITION AND ANALYSES OF RATIONS

Ingredients	Pens								
	1 and 5	2	3	4	1 and 5	2	3	4	Ration A
Wheat bran	10	10	10	10	Fibre	3·07	3·26	3·38	3·46	—
Wheat middlings	15	15	15	15	Protein	12·11	14·31	15·78	17·14	—
Yellow corn meal	20	20	20	20	Carbo	57·25	54·53	52·73	57·82	—
Ground oat groats	30	30	30	30	Fat	4·35	4·62	4·81	4·22	—
Potato flour	17	11	7	5	Ash	3·94	4·12	4·24	4·30	—
Soya bean meal	3	9	13	15	CaO	0·64	0·67	0·78	0·79	4·34
Meat meal	2	2	2	2	P_2O_5	1·47	1·54	1·61	1·63	2·65
Fish meal	1	1	1	1	MgO	0·33	0·34	0·36	0·38	0·48
Buttermilk pd	1	1	1	1						
Bone meal	1	1	1	1						
Salt (Nacl)	½%	½%	½%	½%						
Cod liver oil	1%	1%	1%	1%						

Pens 1 and 5 received the same ration except that pen 5 had no mineral addition. The minerals added were 1·65 per cent, 1·5 per cent, 1·4 per cent and 1·3 per cent of tricalcic phosphate to pens 1 to 4 in that order. Tricalcic phosphate contains calcium and phosphorus in the same ratios as in bone. Thus all were made up to the ash of ration A at 5·61 per cent approximately, as determined from average analyses of Henry and Morrison. Unfortunately, actual analyses were not made available until the eleventh week of the test, at which time the rations were made equal in analysis to ration A as shown in the above table, by the addition of tricalcic phosphate and calcium carbonate at the following rates, 1·91 per cent and 3·48 per cent; 1·80 per cent and 3·52 per cent; 1·69 per cent and 3·48 per cent; 1·65 per cent and 3·50 per cent, for pens 1 to 4 respectively. The calcium phosphorus ratio was 2·7:1 for all rations. Since the other differences in analysis are slight and, owing to their nature, of little importance, any difference in growth must be due to the varied protein level, since all other environmental factors are properly controlled. The results given in Table 6 were secured.

TABLE 6

Pen	Treatment	Chicks	Initial weight per chick	Final weight per chick	Gain per chick	Per cent gain per chick	Grams of feed per gram of body weight
5	12·11% protein + minerals	50	36·7	911·2	874·5	2383	4·27
1	12·11% protein, no minerals	50	36·7	943·6	906·9	2471	4·58
2	14·31% protein + minerals	50	37·0	948·0	911·0	2462	4·71
3	15·78 protein + minerals	50	36·9	1015·2	978·3	2651	4·32
4	17·14% protein + mineral	50	36·8	1166·9	1130·1	3070	3·97

A statistical analysis of the data shows that the difference in body weight between pens four and five is very highly significant; that between pens three and four is also highly significant; that between pens two and three is significant, while that between pens one and five is of no significance. The difference between pens one and two is too small to be of any value.

It may be considered that all increases in protein level above 14·3 per cent improved growth considerably and at a greater rate as the protein level rose until 17·14 per cent was reached, beyond which level the data do not extend. There was a distinct tendency to reduction of the amount of feed required per gram of body weight as the protein level and growth rate increased.

It is also apparent from the above data that the addition of minerals to a low protein mash (12·11 per cent) had no beneficial effect. It would therefore appear that increase in protein level is of much greater importance to faster growth than is the addition of minerals.

EXPERIMENTS ON THE BRANCH FARMS

Experiments dealing with growth production, conducted on the branch farms, which are suitable for reporting here are as follows.

During 1933, at Fredericton three different types of rations for brooding chicks were contrasted: The Cafeteria ration, which consists of a mixture of grains and by-products based upon those selected by chicks given free choice, an ordinary brooding ration as used at Fredericton, and a high corn meal all mash ration known as the Wisconsin ration. For the production of growth the Wisconsin ration was decidedly inferior to the other two, but no significant difference existed between the Fredericton and Cafeteria rations.

Egg Production Experiments

Experiments on egg production constitute the great bulk of those carried on in the Experimental Farm System and particularly on the branch farms. The results of those tests which have been carried far enough to be of value are briefly reported here under the headings most suited to the individual features of the test.

PROTEIN FEEDS

Since one of the most important and expensive parts of the ration is the feed high in protein, a number of tests have been carried out comparing the efficacy of feeds of this type, most of which are of animal origin.

Meat Meal versus Fish Meal

In all, nine of the branch farms have carried out tests dealing with this subject, during the period covered by this report. The results obtained are somewhat contradictory, not only from farm to farm, but from year to year upon the same farm. In most cases this was undoubtedly due to a large extent to the comparatively small numbers of birds used in each test. Therefore, some years of repetition will be required before reliable results can be obtained. While it is difficult to combine the results from farm to farm owing to differences in breed, management, rations, etc., it appears upon analyses of all results that no significant difference existed between the meat meals and fish meals used, for the production of eggs. One of the most comprehensive of these tests, carried out at Morden over a period of three years, and involving 150 birds with each treatment, showed an average production for fish meal and meat meal of 86·77 and 85·24 eggs per bird respectively, a negligible difference.

Meat Meal versus Skim-Milk or Buttermilk

Thirteen tests, contrasting meat meal and skim-milk, were carried out by the various farms. While some conflicting data were obtained, there were only three instances in which skim-milk was not superior to meat meal. While the objections to combining the data above mentioned apply here also, although not to the same extent, it would appear that skim-milk fed freely was slightly more efficient than meat meal for the production of eggs.

The experimental farms or stations contributing to the above analyses of animal feeds for egg production were those at Morden, Agassiz, Fredericton, Lacombe, Ste-Anne, Scott, Rosthern, Brandon, Kapuskasing and Kentville.

VITAMIN FEEDS

Several tests of vitamin feeds for egg production were carried out during the period under review. Using a basal ration, similar to those commonly fed in the area, and with forty birds to a pen, it was determined at Rosthern that the addition of cod liver oil to this ration gave a significantly greater egg production than was obtained from the unsupplemented ration.

At Scott, using 25 birds per pen in each of two years, rations containing pilchard oil and cod liver oil were both found to give production superior to that from the unsupplemented ration. Although results were not consistent in this regard, there was a suggestion that the pilchard oil was slightly superior to the cod liver oil used.

At Sidney, using 35 birds and 50 birds per pen for two years, a slight but insignificant difference was obtained when cod liver oil was substituted for greenfeed in a laying ration. When both cod liver oil and greenfeed were fed, however, a significant difference in production was obtained over the ration containing greenfeed only.

At Kentville, using twenty birds in each pen, egg production was markedly superior for the standard ration plus cod liver oil over the basal ration alone.

GRAIN FEEDS

As would be anticipated, the bulk of experiments for egg production dealt with the comparative efficiencies of different grains and their by-products. This was particularly the case with the experimental farms in the Prairie Provinces.

Corn vs. Barley.

A very comprehensive test covering this subject was carried out at Morden over a period of eight years. The average production for the barley pens over this period was 79·4 eggs per bird, while for corn the production was 80·24 eggs, which may be considered as identical. These grains constituted 25 per cent of the total ration in each case, and cod liver oil was fed in both instances.

At Brandon, over a period of two years, corn was contrasted with barley for egg production, a total of 200 birds being given each treatment. The total number of eggs produced per 25 birds was 1838 for the corn pens and 1899 for the barley pens, the average mortality being 2·1 and 1·7 respectively. The difference, amounting to approximately 3·5 per cent, is in no way significant. Cod liver oil was also fed.

At Lacombe, over a period of three years and covering 160 birds in each pen, a difference of 4·3 per cent was obtained in favour of the barley fed birds, which is too small to be significant. Cod liver oil was fed to both pens throughout.

The station at Lethbridge carried on experiments over a period of years dealing with barley as a substitute for corn. Since the results which were obtained were at variance with those obtained elsewhere it was felt that some local factor or condition may have been the deciding factor. The factor of cod liver oil was introduced, in that a part of their experiments were conducted without the addition of cod liver oil to either ration. Since this investigation is being repeated the previous results will not be reported here.

It is quite obvious, from a consideration of the data presented above, that barley can be substituted satisfactorily for corn under the conditions of these tests, that is when cod liver oil is a part of the ration. Information is not yet available with regard to the comparative standing of these grains when cod liver oil is not fed.

Corn vs. Individual Grains other than Barley.

Several experimental farms also contrasted feeds containing corn with other feeds containing no corn and substituting with various other grains rather than barley. While the numbers of birds per pen were not great, even when combining all data, it is apparent that no serious ill effects were present through the elimination of corn from the ration.

Some of the substitutes used to replace corn products were hulless oats, whole oats and wheat, used as ingredients both of the scratch grain and of the mash mixtures. This work was carried out mainly at the following experimental farms or stations: Morden, Scott, Lethbridge, Fredericton, and Nappan.

Commercial vs. Home Mixed Grains and Mashes.

Some experimental farms have tested the value of commercial ready mixed grain and mash mixtures as against mixtures of grains and by-products grown in the area which they serve and which are readily available at a low price.

At Lacombe, using 40 birds to a pen, extending over the three-year period, a highly significant difference in egg production in favour of the home mixed ration was obtained. On other experimental farms greatly varying results were obtained, indicating without doubt that the quality of the commercial mashes available in different areas is a highly variable factor. It would appear, from a consideration of the experimental results obtained, that a ration can be compounded with the use of home grown grains and purchased concentrates, which will be as efficient as most commercial products. Under most circumstances the cost of the home grown ration will be considerably less.

Dry versus Wet Mash.

A number of experimental farms gave attention to the matter of the feeding of wet mash in addition to dry mash which was constantly before the birds, as against the common system of continuous dry mash feeding. Previous results summarized for the branch farms in earlier reports of this division were further confirmed during the past three years, principally by Rosthern and Cap Rouge. It is apparent that no benefit in health or egg production was attained through the feeding of wet mash, and the additional labour is, therefore, not repaid.

Miscellaneous Experiments with Grains.

At Rosthern, covering a period of two years and with 40 and 35 pullets to each pen for each of the two years, the comparative value of ground whole wheat in the mash, as against bran and shorts as a substitute, was the subject of experiment. No differences of any magnitude were obtained either in health or egg production; consequently it would appear that the whole ground grain may be used as a mash ingredient to substitute for its by-products.

At Brandon, a test was carried out over a period of two years, contrasting the use of the Trebi and O.A.C. varieties of barley for egg production. The former is a heavy-hulled coarser grain than the latter. It was found that no significant difference was obtained in using these barleys and that when of good quality one may substitute for the other.

At Agassiz, grain was fed by three methods: in measured quantity in the litter, freely in hoppers, and in troughs by measured quantity. A total of 180 pullets was used in each pen when the total period of four years was combined. While some differences occurred in different years, they were in no way significant, even with the fairly large numbers of pullets used; consequently, it would appear that any one of the three methods would be quite satisfactory.

Miscellaneous Experiments

Proprietary Foods.

In order to determine whether the addition of condimental feeds to a ration had any merit whatsoever, a test with laying hens was carried on at Ottawa during 1930-31. The proprietary supplement used was highly recommended in the advertising matter, and probably is representative of the highest quality of such products obtainable. Three pens made up the test, one on a control ration, one on the same ration plus the proprietary supplement, and one on a ration made up entirely of home grown grains plus the supplement. The results obtained are shown in Table 7.

TABLE 7.—RESULTS OF TEST OF PROPRIETARY SUPPLEMENTS

Feeds	Body weight	Gain in body weight per bird per day	Production per bird per day
	grams	grams	grams
Proprietary feed	1,682	−0·24	24·06
Control ration	1,723	+0·28	25·62
Proprietary feed (home grown ration)	1,690	−0·23	24·25

Statistical analysis of the above data showed none of the apparent differences to be significant. Hence it may be concluded that the feeding of such condimental foods is of no value in increasing egg production.

Milk Albumen versus Buttermilk Powder

A by-product of the cheese factory, milk albumen, was fed at Ottawa, as a part of a laying mash to a pen of laying pullets and controlled by a similar pen using the same mash with an identical protein level, but containing buttermilk powder instead of powdered milk albumen. No significant difference was obtained either in health or egg production between the two pens.

Best Kind of Litter

Three farms, Lethbridge, Sidney and Summerland, carried out tests contrasting peat moss and straw as litter for laying houses. While the results obtained are highly variable it is obvious that peat moss makes an excellent litter material. The cost is sufficiently greater, however, in many locations to make this factor the deciding one as to which will be used.

Hastening Maturity of Late Hatched Pullets

At Morden, the advisability of placing late hatched pullets in feeding crates in order to hasten the rapidity of their coming into egg production was tested out. Over a four-year period a slight but consistent advantage both in age at first egg and number of eggs produced was obtained from the birds confined in pens and fed rather than crated.

Temperature of Houses of Different Depths

At Harrow, laying houses of twenty feet depth and of sixteen feet were contrasted as to temperature during the year. The maximum temperatures registered very little difference in the two houses. A difference of two to three degrees, however, was registered on the average in favour of the deeper house during the months of December and January. In this connection, work done some time ago at Cap Rouge, where conditions are much more severe, indicates an appreciably higher temperature during the winter for the deeper house.

Lights versus No Lights

Eight years' results at Kapuskasing indicate a definite advantage in egg production by the use of lights during the winter months. Over the full year, however, no difference in production was obtained, indicating a higher production to be the case only during the winter period.

Broiler Fattening Test

It is a well known fact that protein requirements are high during the first ten or twelve weeks of a chick's life. For this reason it has been customary, in fattening broilers, to use meat meal in the mash as well as to mix the ration with liquid skim-milk. A test was carried out at Ottawa to demonstrate the soundness of this practice.

Two lots of thirty-six seven-week-old Barred Rock cockerels were placed in fattening crates, one lot receiving a mash made up of equal parts of ground whole wheat, ground whole barley and ground whole oats, plus skim-milk to make a batter consistency, while the other lot received the same mash plus 10 per cent of meat meal, the whole mixed with skim-milk.

Over a fattening period of two weeks a gain of 49·8 per cent was made by the pen receiving the mash, meat meal and skim-milk, and a gain of 51·2 per cent was made by the lot receiving the same mash, skim-milk, but no meat meal. The small difference of 1·4 per cent was not significant.

It is concluded, therefore, that in broiler fattening a mash of cereal grains or their by-products, plus skim-milk for mixing, is equally as satisfactory without the additional expense of meat meal.

Deterioration in Egg Quality During Shipment

Since deterioration in eggs under ordinary shipping conditions is considerable, a test was carried out at Ottawa in co-operation with the Poultry Division of the Live Stock Branch, to determine the reasons for this condition and to determine the remedies if possible. A large number of eggs were candled at this division, shipped to Charlottetown and return, a total distance of 1,800 miles with several transfers, and recandled upon arrival back in Ottawa. Each egg was candled and noted individually, according to the hen which produced it. Three cases were shipped while one remained in storage at temperatures similar to those encountered in transit. The data in Table 8 were obtained:—

TABLE 8.—RESULTS OF DETERIORATION TEST

—	Three large cases	Small case (stored, not shipped)
	%	%
Deterioration due to yolk	19·4	66·4
Deterioration due to albumen	59·2	4·0
Total (per cent of all eggs shipped)	74·8	70·4
Depreciation in value	17·9	10·1

Deterioration due to yolk was the most important factor in the stored case, whereas, in the shipped eggs, that due to albumen break down was much greater, which must be accounted for by the factor of agitation in handling and transporting. The total deterioration was not significantly greater for the shipped eggs but was economically more serious as instanced by the very significantly greater depreciation in value shown by those shipped. This is due mainly to the greater seriousness of albumen defects in grading eggs for market.

It was also found that some birds produced eggs which deteriorated little, if any, while others produced eggs which did not stand shipment and showed very heavy deterioration.

From the above it may be concluded that speed of delivery, care in handling and selection of stock from which eggs for distant shipping are chosen, all play an important part in placing a superior product upon the market.

Laying Batteries

The use of laying batteries as a method of carrying birds through their pullet year has made considerable headway during the past few years. The laying battery consists of a battery of individual pens, approximately twelve inches by sixteen inches, to which each bird is confined with access to its own feed and completely penned off from its neighbours. The advantages of this arrangement are several, namely, that each bird has access only to its own feed and hence the competitive factor in feed consumption is eliminated. Hence, a certain percentage of birds which in the ordinary laying house would be kept away from the troughs and might even be victims of cannibalism are permitted to live a normal existence and to maintain body weight and produce eggs, which otherwise would not be the case. Also, the evils of feather pulling and cannibalism are non-existent and it is believed that certain diseases such as coccidiosis and worm infestation are made less serious, due to the fact that the birds are upon wire floors and not in contact with their droppings. Considerations of time and expense are also favourable to batteries of this type, since trap-nesting is obviously unnecessary and the eggs need only to be gathered daily. Feeding may be automatic, as well as cleaning of the dropping pans, and, therefore, one man can look after many times the number of birds which he could take care of in the ordinary poultry pen. At least double the number of birds can be carried in a house of the same size where batteries are used, although sufficient insulation and heating of the building are necessary, which factors cut down the saving attained under this head. The original cost of the battery equipment is also fairly high although a long time investment is represented.

Laying batteries, sufficient to house 144 birds, were constructed at Ottawa by the use of pigeon exhibition coops. Seventy-eight White Leghorn pullets were carried in one set of these individual coops and sixty-six Barred Rock pullets in another. After some experiment, a mash which gave highly satisfactory results, was made up as follows: yellow corn meal 46 pounds; wheat bran 11 pounds; wheat middlings 11 pounds; ground oat groats 15 pounds; alfalfa meal 7 pounds; bone meal, buttermilk powder, fish meal and meat meal 2·0 pounds of each; salt 1 pound; cod liver oil 1 pound. This was fed freely as an all mash mixture.

Some difficulty was experienced in maintaining the White Leghorn pullets in good health and condition and mortality was high. It could not be determined whether this condition was a result of individual caging or otherwise, although the fact that mortality and condition among the Leghorn pullets in ordinary laying houses was not too good might be taken as indicating that the cages were far from wholly responsible.

With the Barred Rocks, much greater success was attained and both production and condition were quite good, although the conditions of housing of the cages were far from ideal. It was quite apparent that production markedly superior to that of similar birds, not individually caged, was being obtained. The average per cent production of thirty-eight birds which lived through the test (325 days) was 63·2 per cent or an average of 205·7 eggs per bird. Perhaps the most illuminating feature of this production was the fact that the variability in production from bird to bird was only 14·7 per cent as against a commonly experienced variability of approximately 25 per cent for similar birds kept on the floor, under ordinary housing conditions. Mortality was 22 per cent, which, while a high figure, was yet appreciably lower than that of the birds not individually caged.

The one respect in which the cages were inferior was in fertility and hatchability. The males were kept caged as well as the females, and the females were introduced into the male cage for mating. The fertility and hatchability obtained were practically negligible. An attempt was made to find out whether the caging of the males, or of the females, or both was responsible for this condition, but unfortunately the information was not obtained, chiefly due to the death of one of the males.

It would appear from a consideration of the above that laying batteries offer much promise as a means of carrying pullets through the laying year with high production and low mortality, with heavy breeds at least. Until reliable information is available it would seem to be the part of wisdom not to subject breeding stock to these conditions.

Poultry Housing Experiment

In order to determine whether improvement in housing conditions to the extent of insulation and heating was justifiable, a large laying house, at Ottawa, was divided into three pens: one of these was used as a control, was not insulated, and was ventilated only by cotton screens and a straw loft ventilator; another was carefully insulated and ventilated as just mentioned; and the third was insulated, heated and ventilated. The heated section contained 150 pullets and each of the other two, 100 pullets. The mean temperatures for the period of the test (Nov. 18, 1932, to June 12, 1933), were: heated pens 51·2 ± 0·43; insulated pens 42·6 ± 0·58; and control 38·0 ± 0·67 degrees Fahrenheit. It will be seen that the simple process of insulation gained approximately 4·6° of warmth over the control pen and that the temperature was maintained 13·2° higher in the heated pen than in the control. Another point of interest was the fact that 12·9 pounds of litter was used per bird in the heated pens, as against 46·9 pounds and 31·9 pounds respectively, for the insulated and cold pens. This constitutes a considerable saving in litter as well as in the time consumed in cleaning the pens. It also indicates, approximately, the condition of humidity in each of the pens. It was quite obvious, however, that the humid condition had no noticeable effect upon the condition of the birds, the reverse being apparently the case, as a matter of fact, since the birds in the insulated and control pens were in much better feather and appeared to be generally in better condition than those of the heated pens. The cost of fuel per bird for heating was 29·9 cents and of the greater requirement for litter for the insulated pen, 23·8 cents, hence this factor of additional litter amounted to 79·5 per cent of the cost of fuel for heating. The total cost of feed, fuel, litter, interest on investment, etc., was $1.81 per bird for the heated house as against $1.68 for the insulated. Since high mortality was experienced, due to an epidemic of bronchitis, the production obtained will not be quoted, as it would be unfair to certain of the pens. However, the test is being continued in order to obtain more accurate data.

General Comment

The experimental work dealt with in the previous pages represents a very much condensed résumé of a few only of the tests carried out during the period of years covered by this report. In many cases the projects were not sufficiently advanced to make the drawing of conclusions possible. In some cases the small number of birds used, or uncontrolled environmental factors, necessitated the repetition of the tests, therefore, they could not be reported. No attempt has been made to review the very large amount of data upon costs of incubation, brooding, feeding, etc., owing to the fact that these data are applicable only to the conditions in the immediate area served by the farm carrying out the test. The reader is therefore referred to his nearest experimental farm or station for information of this nature.

CANADIAN NATIONAL EGG LAYING CONTEST

Registration and Inspection

During the three years 1930-31, 1931-32 and 1932-33, fourteen egg laying contests were conducted yearly. The Canadian Contest was conducted at the Central Experimental Farm while the remaining thirteen contests were provincial in nature and were conducted on experimental farms or stations in the various provinces. A summary of the results by years is given in Table 1-C.

TABLE 1-C.—NAME OF CONTEST; NUMBER OF BIRDS; AVERAGE EGG PRODUCTION PER BIRD; LEADING PEN; PRODUCTION AND POINTS OF HIGHEST REGISTERED BIRD IN EACH CONTEST, 1930-31.

Contest	Number of birds	Average eggs per bird	Average points per bird	Leading pen—number of points	Highest registered bird	
					Eggs	Points
Canadian	790	149·5	139·0	1,983·2	258	279·0
Prince Edward Island	190	183·9	199·6	2,851·8	271	322·0
Nova Scotia	310	184·2	185·9	2,303·7	277	315·6
Nova Scotia Southern	200	164·9	164·4	1,835·4	258	289·2
New Brunswick	190	206·6	211·8	2,303·7	277	315·6
Quebec Eastern	190	194·8	200·4	2,389·9	291	316·2
Quebec Western	190	177·6	186·0	2,513·1	278	333·6
Ontario	690	164·3	160·1	2,283·4	287	291·8
Ontario Western	260	155·1	157·8	2,329·7	284	294·3
Manitoba	250	183·3	182·2	2,293·3	284	328·9
Saskatchewan	230	160·8	168·9	2,340·3	244	291·4
Alberta	270	192·9	199·7	2,483·3	287	324·7
British Columbia	460	202·5	214·7	2,764·6	324	361·2
Vancouver Island	340	202·0	211·2	2,543·2	310	365·7
Total	4,560	176·2	178·1	—	—	—

NOTE.—Ten birds constitute a pen.

TABLE 2-C.—NAME OF CONTEST; NUMBER OF BIRDS; AVERAGE EGG PRODUCTION PER BIRD; LEADING PEN; PRODUCTION AND POINTS OF HIGHEST REGISTERED BIRD IN EACH CONTEST, 1931-32.

Contest	Number of birds	Average eggs per bird	Average points per bird	Leading pen—number of points	Highest registered bird	
					Eggs	Points
Canadian	620	159·0	157·3	2,257·6	289	314·7
Prince Edward Island	180	206·1	214·2	2,679·2	271	313·2
Nova Scotia	290	155·9	160·0	2,283·2	255	302·6
Nova Scotia Southern	170	176·1	177·6	2,141·2	274	289·9
New Brunswick	280	167·5	168·5	2,193·4	264	291·4
Quebec Eastern	200	189·1	199·1	2,355·3	254	292·4
Quebec Western	200	182·5	192·2	2,254·7	255	310·0
Ontario	690	168·4	168·9	2,331·9	283	327·9
Ontario Western	340	179·8	189·1	2,330·2	306	332·4
Manitoba	210	182·6	189·2	2,565·1	255	292·8
Saskatchewan	180	131·5	139·7	1,775·7	243	284·4
Alberta	260	175·1	182·8	2,449·1	268	314·8
British Columbia	450	197·2	212·0	2,791·7	301	345·1
Vancouver Island	300	195·1	202·9	2,729·9	301	352·6
Total	4,370	Average 174·5	Average 179·4	—	—	—

NOTE.—Ten birds constitute a pen.

TABLE 3-C.—NAME OF CONTEST; NUMBER OF BIRDS; AVERAGE EGG PRODUCTION PER BIRD; LEADING PEN; PRODUCTION AND POINTS OF HIGHEST REGISTERED BIRD IN EACH CONTEST, 1932-33.

Contest	Number of birds	Average eggs per bird	Average points per bird	Leading pen—number of points	Highest registered bird	
					Eggs	Points
*Canadian	395	203·5	211·4	2,646·9	277	323·8
*Prince Edward Island	150	200·7	211·5	2,385·4	283	277·3
*Nova Scotia	217	206·7	216·1	2,601·9	282	328·9
*Nova Scotia Southern	170	212·8	217·8	2,460·3	286	334·4
*New Brunswick	247	205·2	219·5	2,898·1	304	349·3
*Quebec Eastern	148	212·0	226·8	2,490·0	273	312·0
*Quebec Western	143	204·0	215·3	2,493·7	267	301·8
*Ontario	512	200·4	213·2	2,767·7	321	378·9
*Ontario Western	209	226·7	248·7	2,925·7	313	357·6
*Manitoba	169	196·5	205·5	2,301·2	265	308·7
*Saskatchewan	112	155·1	164·3	2,134·0	299	324·6
*Alberta	144	200·3	216·0	2,526·5	279	318·4
*British Columbia	445	222·9	243·1	2,925·5	309	359·9
Vancouver Island	340	193·1	205·9	2,600·7	302	356·6
Total	3,401	204·9	209·6	—	—	—

* Numerous pens and birds were removed during the contest year in the interests of economy. The figures for the 1932-33 contests are not comparable with those of other years.

The total number of birds entered each year, together with the average egg production for the fourteen years the Canadian National Egg Laying Contest has been in operation are presented in Table 4-C.

TABLE 4-C.—BIRDS ENTERED IN CONTEST—BY YEARS

Contest year	Total number birds	Average production per bird
1919-20	1,610	122·5
1920-21	2,480	137·0
1921-22	2,590	143·3
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
1929-30	4,320	178·1
1930-31	4,560	176·2
1931-32	4,370	174·5
1932-33	3,401*†	204·9

* Number of pens withdrawn. † See footnote, Table 3-C.

As can be seen in Table 4-C the number of birds in the contests has gradually increased each year. The increase in the number of birds entered was rapid during the first six years and fairly constant during the years 1924-25 to 1929-30. In the year 1930, another contest was started at Harrow, in Western Ontario, which accounts for the number of birds entered for that year.

The lack of increase in number of birds as shown for the years 1924-25 to 1929-30 can be attributed wholly to lack of contest accommodation, as no additional accommodation for contests was built during that period. The number of breeders desirous of entering birds in the 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.

REGISTRATION

Female birds are granted registration providing they lay 200 eggs or over in any of the Canadian National Egg Laying Contests or in the Registration Progeny Test, providing the eggs average 24 ounces per dozen. Males are registered providing they are bred from second or subsequent generation registered females and from approved or registered males. All birds to qualify for registration must be free from standard disqualifications and typical of the breed. Females laying eggs with shell colour not characteristic of the breed are disqualified and refused registration.

During the year 1930-31, 1,756 birds were registered in Canada. This total was made up of 1923 females and 463 males.

In the year 1931-32 the number of birds registered showed a very substantial increase. The total number of registration certificates issued was 2,212, made up of 1,511 females and 701 males.

The year 1932-33 had the largest number of birds registered in the twelve years the system has been in operation. Registration certificates were issued for 2,419 birds, made up of 1,829 females and 590 males.

The distribution of breeders by provinces showing the number of registered hens mated and chicks banded is shown in Table 5-C.

TABLE 5-C—DISTRIBUTION OF BREEDERS, REGISTERED BIRDS AND CHICKS HATCHED FOR THE YEARS 1931, 1932 AND 1933.

Province	1931			1932			1933		
	Breeders	Registered hens	Chicks banded	Breeders	Registered hens	Chicks banded	Breeders	Registered hens	Chicks banded
Prince Edward Island	7	46	388	8	57	425	7	94	992
Nova Scotia	4	39	664	6	46	582	6	66	616
New Brunswick	26	198	2,799	31	281	4,573	53	295	4,183
Quebec	29	219	3,306	27	238	3,168	23	286	2,907
Ontario	73	330	5,340	78	335	5,374	73	595	9,175
Manitoba	18	90	903	11	60	280	11	38	395
Saskatchewan	17	70	924	17	70	498	12	62	897
Alberta	16	90	870	17	94	1,317	20	124	1,445
British Columbia	74	798	12,051	68	655	8,395	69	749	11,008
Total	264	1,880	27,545	260	1,836	24,572	254	2,309	31,113

REPORTS

At the end of each week a report was sent out from each egg laying contest 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 included many poultry breeders and contest managers in England, Ireland, Scotland, France, Holland, Australia, New Zealand and South Africa.

At the completion of each contest year, a production and identification chart was prepared and sent to each breeder, giving him important details 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 number if she was the daughter of a registered hen, the flock name and breeder's mark and the tattoo marks 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 any were present.

With such complete information at hand the breeder should be prepared to act wisely in the mating 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.

INSPECTION

During the years 1931, 1932 and 1933, a number of inspectors was engaged in the work of inspection of registered stock.

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-nests and hatching records and instructing breeders as to the best methods of handling them.

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 passing and tattooing qualified cockerels from registered matings.

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

7. Wing labelling pullets for the Registration Progeny Test, checking on the work during the year, and tattooing qualified females.

8. 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 the 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 is often heard: "Why does the inspector not make more visits to the flocks doing work under the registration plant?"

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

Registration Progeny Test

The Registration Progeny Test on the owner's plant was continued during the years 1930-31, 1931-32, and 1932-33. During 1930-31, there were 285 birds on the plants of eleven breeders. In 1931-32, the entry totalled 600 birds on the plants of fourteen breeders and in 1932-33 there were 1,300 birds entered on the plants of thirty-four breeders. The trap-nesting of the daughters of registered hens on the owner's plant has developed rapidly, doubling the figure of the preceding year on three occasions, and prospects for the work in the immediate future are very encouraging.

The demand for registered stock both in Canada and abroad is growing rapidly and so keen has this demand become that even female birds which are registered are picked up when available. The demand for registered cockerels is being enhanced yearly because of the excellent results which have been secured from those cockerels which have been used in flock improvement work. The pullet progeny have demonstrated that they are bred to produce large eggs and lots of them. Good reports of this work are being received from registration inspectors, promoters and breeders themselves.

The Blue Book

The third annual breeder's catalogue, known as the Blue Book was issued by the Canadian National Poultry Record Association in 1931 and the fourth issue came out in February 1932. This Blue Book contains the constitution of the association, the rules and regulations of the egg laying contests, and articles relating to poultry breeding and registration work. In addition the Blue Book contains advertisements from the leading poultry breeders throughout Canada.

This publication has become popular and has been distributed to poultry breeders in all parts of the world. The majority of copies have gone to breeders in Canada and the United States. Not a few inquiries from outside countries are being received for registered breeding stock, and business with reliable poultry breeders is ever on the increase.

Registration Exhibits at Fairs

Displays of registered birds at fairs and exhibitions are increasing. During the years 1932 and 1933, displays were put on at Fredericton, N.B., Montreal, Que., the Canadian National Exhibition at Toronto in August, the Royal Fair at Toronto in November, and the Poultry Show at Vancouver, B.C.

The displays at Fredericton were unique in that production bred birds were the only ones on display, the entire poultry building being turned over to the breeders of production bred birds. These displays were excellent and produced good results. Charts showing the pedigree of all registered birds were displayed on the coops, which added to the appearance and value of the exhibit.

The exhibits at the Canadian National Exhibitions were small and were purely educational in nature. Registered birds of the Barred Plymouth Rock,

C.N.P.R.A. exhibit—Royal Winter Fair.

White Wyandotte, Rhode Island Red and White Leghorn breeds were on display, with pedigree charts showing the pedigree of each bird. There were a few young birds on exhibition as well.

The displays at the Montreal poultry shows were representative, with over 100 registered birds on exhibition. These consisted mainly of Barred Plymouth Rocks and White Leghorns with a few representatives of White Wyandottes and Rhode Island Reds. These displays created much interest and sales of registered birds were good.

The Vancouver Poultry Show added a new feature to their display in 1932 by providing classes for registered birds of the required breeds. The venture was successful, there being over 100 registered birds entered. This added feature was the result of co-operative effort between the Provincial Department, the British Columbia Poultry Association and the Registered Poultry Breeders' Association of British Columbia. All parties concerned were well pleased with the display.

The exhibit of registered birds at the Royal Winter Fair has increased in volume each year. Regarding the quality of the birds, everyone expressed satisfaction with both the type and colour of the exhibits. Outstanding advancement has been made in this regard in the last few years and displays like the 1932 and 1933 Royal go a long way to induce breeders to improve their lines and to show the birds to the best advantage.

Over 150 registered birds were on display in 1932 and over 200 were assembled at the 1933 exhibit. The breeds represented were White Leghorns, Barred and White Plymouth Rocks, White Wyandottes, Rhode Island Reds, Light Sussex, Australorps and Anconas. The major part of the display was made up of Barred Plymouth Rocks and White Leghorns, and the quality of the male birds shown was very excellent indeed. The Royal Winter Fair management were highly pleased with the display and complimented the breeders on the excellence of the birds shown.

Sales of registered birds at these Royal Winter Fair displays were particularly good, especially those of male birds. The demand for information regarding registered birds at these shows continues to increase yearly, which would indicate that the real poultry breeder is desirous of securing high class breeding stock and has learned that the place to secure such stock is out of the best registered flocks.

FARM EGG AND POULTRY ACCOUNTS

During the period covered by this report there was a much keener demand for farm egg and poultry account forms than had been noted for some years. This was possibly due to the fact that the value of farm produce on the whole had reached an extremely low level and the farmer, as a consequence, was looking to his poultry as a major means of revenue.

The account forms are being used not only by farmers but by poultrymen, fanciers and backyarders, with flocks ranging from ten birds to one thousand. At times there were over three hundred, scattered through every province of the Dominion, taking advantage of these forms.

Each month a circular letter was issued dealing with disease, feeding, management and current problems. The correspondence side of the form proved to be an excellent means for the airing of views, troubles and uncertainties, and in many cases serious leakages were checked in this manner.

The result of a survey taken from figures supplied on the accounts for the years 1931, 1932 and 1933 include the following:—

—	1931	1932	1933
Average egg production per bird.....No.	169·2	159·3	155·9
Average cost of feed per bird..... $	2·34	2·04	1·73
Average profit over cost of feed from eggs per bird..... $	0·99	0·78	·0·82
Average receipts from poultry sold per bird..... $	1·16	0·77	0·82
Total average profit per bird..... $	2·05	1·55	1·65
Feed cost per dozen eggs.....cts.	16·6	15·4	13·3
Average price received per dozen eggs.....cts.	22·7	21·3	19·6

NOTE.—The average cost of feed per bird is not quite correct, as the feed fed to the growing stock is charged to the layers; this also would influence the average profit.

The profits quoted indicate only profit over cost of feed. Interest on investment or labour costs cannot be given, due to the fact that the original form must be a simplified type of book-keeping.

In the years mentioned, there has been a continual drop in the average price received for eggs by the dozen; however, this loss was compensated for in 1933 over 1932 by the increased price received for dressed poultry and the decreased cost of feed.

In spite of the comparatively low prices received for eggs, over the three-year period, there was only 1·6 per cent of the farmers taking advantage of the account forms that failed to pay feed costs for the year. In 1931 there was no loss recorded, which was probably due to a higher egg production combined with higher prices received for poultry products in that year over the two following years. The largest profit made by a breeder in the three-year period was $7.34 a bird, obtained from a small flock of forty-one birds.

Lower production has been indicated but the average production is still far above the average egg production per bird in Canada. Since these averages are compiled from the reports of different breeders each year, part of the decrease is probably due to that factor, also to the fact that more home-grown grains were used, with a general shortage of money preventing the purchase of additional ingredients to balance the rations made up of materials available on the farmer's home plant.

In conclusion, it might be said that the figures quoted in the preceding paragraphs should be ample proof that poultry farming, when science and good business methods are applied, can be conducted at a fair profit under the most adverse market conditions. Scientific aid applied in a practical manner is continually helping to put the poultry industry on a firmer basis.

EXHIBITS

During the three-year period from 1931 to 1933 inclusive, exhibits of an educational nature were presented at a large number of poultry shows, exhibitions and winter fairs. Exhibits have long been an excellent means of imparting information of an educational nature to the public, and during the three years mentioned, they were received with even greater favour, due possibly to the novel means of presentation. These exhibits also served as a means of making contact with people interested in poultry work, providing a satisfactory method of distributing literature.

In the preparation of exhibits from the Poultry Division, first thought was given to the material to be used, making sure that it was not only timely but of actual importance, and where possible based on the results of experiments or findings of the division; secondly, the manner of presentation was considered

from all angles, striving to produce an exhibit of originality and sufficient attractiveness to demand attention in a field that is filled by commercial exhibits that have in recent years reached a high order of merit.

In the past three years many new forms of presentation were used. For example, in 1932, instead of using the ordinary time-worn panel, cartoons were used on the western circuit. These cartoons embodied material of a very serious and important nature yet the caricatures immediately put the observer in a very receptive frame of mind, and told their story in a breezy and amusing form which would be remembered much more readily than if the material had been presented in a dry and staid manner. This form of presentation met with sufficient success to warrant the use of cartoons at numerous fairs afterwards.

At the Canadian National Exhibition in Toronto it has been the practice to use baby chicks as a means of attraction. However, in 1932, by way of variation, coloured chicks were used. The story being conveyed was proper housing. There were two runs used, one devoted to poor housing and unsanitary conditions as compared with proper housing under sanitary conditions, a number of white chicks being placed in the good run, with a number of chicks dyed green placed in the poor run. The caption read: "We have turned green with envy of our neighbours." This exhibit caused quite a sensation and was a means of attracting huge crowds to the Experimental Farms' stand.

For the Canadian National Exhibit in 1933, ducklings were used. The material used was the results of experiments on the growing of green ducks on water and off water. This exhibit proved equally as attractive as the 1932 exhibit and served as a change from the use of baby chicks, which had been used for many years at this fair.

In addition to the regular exhibit work for 1933, exhibits were staged by this division both at the World's Grain Conference in Regina and the World's Poultry Congress in Rome, Italy.

At Regina grain had to be used as the theme or body of the exhibit, relating its value to the poultry industry, and vice versa. In the presentation of this exhibit grain was called "The Hub of the Poultry Industry." A large painting of a grain field was used as a background, with a large cut-out of a sack of grain in the foreground. This sack represented a hundred-pound unit of grain. Travelling on a chain were models of a duck, turkey, roaster, capon, broiler, and goose, and a case of eggs. Each model carried a sign, which explained the number of pounds or dozens of each, as the case might be, that a hundred-pound unit of mixed grain would produce. The models appeared from behind a panel on the right and disappeared behind a panel on the left. The material on these panels was made up of poultry statistics, and comparisons with other phases of agricultural endeavour. This exhibit met with favour, possibly on account of its unique design and appropriateness.

Exhibits have been sent to various Poultry Congresses, but, due to the peculiar shape of the space available at Trajan's Market in Rome, Italy, for the 1933 congress, the exhibit had to take on an entirely new form when compared to exhibits used at previous congresses. As Trajan's Market was built originally in the year 400 B.C., it is not hard to conceive the difficulties encountered when planning an exhibit of a modern nature suitable for presentation in a market stand which to all intents and purposes was meant to be used by ancient Roman merchants. However, an exhibit was built to comply with the space available, and, to say the least, it was one of the outstanding attractions of the entire exhibition. At times it was impossible to crowd another person into the Canadian booth, which should speak well for the interest shown by Europeans in Canadian poultry and poultry policies. The exhibit to Rome was built to fit a sixteen-foot space, using a large painted peacock with spread tail as a centre piece. The peacock stood on a raised dais which bore the title "Canada's National Poultry Policies." An opening was cut in the peacock's tail through which appeared a series of typical Canadian poultry scenes depicting

the following: Farm Poultry, Approved Hatcheries, Record of Performance, Registration, Research Laboratories, Poultry Education, Marketing, and Grading of Products. Each scene appeared for a duration of twenty seconds. On each side of the peacock, decorative fronts for bulletin machines were placed, behind which the machines operated, allowing the story of Canadian poultry to be told on a series of cards. One machine told the story in Italian while the other told its tale in English. All the background for the exhibit was black, which made the whole arrangement very striking. In one corner of the stand the mounted model of No Drone 5H, the World's Champion Egg Layer, was on display. This was also much admired.

Canadian exhibit at the fifth World's Poultry Congress, Rome, Italy.

In the Live Bird Exhibit, Canada had twelve trios of representative varieties and strains. The registered and R.O.P. birds had their pedigrees and records placed over them, which immediately took the eye of foreign purchasers. As much as these production-bred birds were admired they did not over-shadow the exhibition-bred poultry that Canada had on display, the Italian love of beauty having its sway in this respect.

In addition to the shows mentioned, the Poultry Division had panels or exhibits at the following exhibitions on some occasion during the three years in review: Central Canada Exhibition, Ottawa; Canadian National Exhibition, Toronto; Western Fair, London, Ontario; Lindsay Fair, Lindsay, Ontario; Quebec Exhibition, Quebec City; all the Class A fairs on the Western Canada show circuit, and also on the Maritime circuit. Of course there were also panels sent to numerous Class B and county fairs throughout the Dominion.

Exhibits were presented at the following Winter Poultry Shows: Ottawa, Toronto, Stratford, Waterloo, Picton, Kitchener, in Ontario; Amherst in Nova Scotia and Montreal in Quebec.

The material used in the making up of exhibits for the above-mentioned fairs included the following: General poultry practices; intestinal parasites and their control; egg production as affected by balanced and unbalanced rations; proper poultry housing; progeny testing of sires; crate feeding of poultry; the use of poultry as a medium for marketing low priced grains; poultry diseases and their control and growing of green ducks. These subjects do not entirely cover the field of exhibit work from 1931 to 1933 but serve only as examples of the type of materials used.

Assistance was rendered where possible, in short courses, field days, and in judging of poultry at small fairs within a short distance of Ottawa.

In the space available it is impossible to give detailed accounts of all the exhibits that have been prepared by this division; however, in conclusion, it can be said that the exhibit work on the whole proved to be an excellent means of feeling the public pulse, and helped greatly in the distribution of information and literature. With each exhibit, mimeographed circulars devoted to the work emphasized in the exhibit were carried and distributed to those interested. In most cases the material used was felt to be the factor of most importance to the success of poultrymen and farmers in the community in which the exhibition or show was held, with the idea in mind of trying to educate along the lines that were most needed.

FIELD WORK IN QUEBEC

Under this heading are included the following activities of the division: A, French correspondence; B, French monthly report form service; C, poultry shows; D, visits to branch farms in Quebec; E, registration work.

The French correspondence continues to keep up steadily and letters are received not only from the province of Quebec, but also from many French Canadians living in other provinces and in the United States. Several letters have come to hand from France, Belgium and Spain, from people who wish to take up poultry farming in Canada. The increase of correspondence, during the last three years, with reference to poultry diseases was very significant.

French Monthly Report Service

The French monthly report service supplements survey work, for through it valuable data are obtained, and information is given to farmers or poultrymen who cannot be visited personally. This service helps the farmers to keep an account of their poultry. This is followed by a personal letter, provided that a study of this report reveals any condition which needs comment.

It is interesting to note that some of the first 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 conduct it on a business basis.

The circular letter sent out every month has been maintained for the current year and it was noticed that correspondence from the monthly reports increased very much during last year. These forms are often instrumental in stopping serious leakages and are a strong contributing factor in increasing the efficiency of poultry farm management, which is shown by the increased profits of these poultrymen from year to year.

The results from the French monthly reports for 1931, 1932 and 1933, taken from thirty-four flocks averaging 85 birds each are as follows:

The average egg production per bird was 136; the average feed cost of eggs per dozen was 16·9 cents, while the average selling price of eggs per dozen was 24·5 cents; the average yearly feed cost per bird was $1.93, and the average profit over cost of feed per bird was $2.14.

The average egg production was much lower than in previous years, due probably to the Quebec Government giving much more assistance to beginners in poultry work.

The average profit per bird was also lower than in former years because the egg prices were not maintained during past winters, and the heavy flow of eggs from other provinces on the Montreal market caused prices to break sharply well in advance of the usual time.

Poultry Shows

A very attractive exhibit, comprising interesting and educational coloured transparencies, and models of useful appliances, with appropriate legends was sent to the Montreal Poultry Show, during the past three years, 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.

This exhibit has been greatly appreciated, and has proved an excellent medium for bringing the work of the division to the notice of the farmers and public.

Visits to Branch Farms in Quebec

Periodical visits are made to the Ste-Anne de la Pocatière, La Ferme, Cap Rouge and Lennoxville branch farms in order to help and advise the poultryman at each station in his general work, such as checking up poultry records and seeing that these are up to date, going into the work of the plant with the poultryman, and outlining and definitely starting experiments. The poultryman is given help in his mating, brooding, hatching and breeding, and in the pedigree work throughout all its phases, including the selection of pullets, the culling of the hens, picking the breeding cockerels, etc.

Registration Work

In the province of Quebec there are four experimental stations. Two of these have laying contests, situated respectively at Ste. Anne de la Pocatière, Quebec East, and Lennoxville, Quebec West. Both come under the supervision of the superintendent at each station along with the Quebec Poultry Inspector. To the inspector also falls most of the work of looking over the birds entered for different contests and the supervision of the details of registration.

As registration work is new for a certain number of breeders, the necessary pedigree work connected with it is not understood as it should be, and it is, therefore, necessary to give the breeders instructions in this also.

By special request the French Canadian member of the division was asked to make a few demonstrations and delivered talks on poultry in Russell and Prescott counties during the last three years.

REPORT OF THE POULTRY PATHOLOGY LABORATORY OF THE HEALTH OF ANIMALS BRANCH FOR THE YEARS 1931, 1932 AND 1933

The following is a report of the routine and investigational work of the Poultry Pathology Laboratory for the years 1931, 1932 and 1933. An attempt is made to review, as concisely as possible, this work which is a co-operative undertaking between the Health of Animals Branch and the Poultry Division of the Dominion Experimental Farms.

1931

Routine Laboratory Service

During the year, 2,878 specimens were submitted for laboratory examination, as shown in Table B 1. The average number of specimens for the past eight years was approximately 1,600 per year, and this year shows an 80 per cent increase over that average with an increase of 52 per cent above the preceding year.

The amount of material comprising the routine examinations constitutes a heavy drain on the time and facilities of a small laboratory, and as indicated it continues to increase with each succeeding year. In eight years there has been an increase of approximately 185 per cent in the number of specimens examined. And, while this material creates a burden, it nevertheless does provide for the accumulation of a wealth of information. In a measure it shows the nature, extent and distribution of diseases in the poultry flocks generally. The dead birds received from the local plant and the Egg Laying Contests each have their own peculiar pathological significance which is being utilized in studying various phases of avian pathology. Some of the accumulated data on the latter material has been worked over and published in part. If the contests represent current practices in the handling of production flocks, the information accumulated therefrom should be of value alike to the poultryman and the pathologist. It informs the farmer of the average incidence of the various diseases, and the large percentage of birds which die as a result of failure of one or more of the vital body functions. On the other hand, the information is drawn upon for guidance of research work in the definite study of particular diseases on the complexes that so frequently occur in nature.

Table B-2 gives the diseases occupying the first five positions for each of the eight years from 1924 to 1931, as they occurred in the autopsy reports from this laboratory. Of twelve and three-quarter thousand autopsies, 52·5 per cent of the total appeared among the first five diseases on the list. And while many of the other diseases each appeared as the responsible disease it does tend to show the relative importance of a certain few diseases. In the eight years, intestinal parasitism (pathological) leads with 20 per cent of the total autopsies. It occupied first position in all but one of the years; peritonitis is second, cannabilism third, pullorum fourth, and roup fifth. The position of the current year's disease incidence is the same as for the average with the exception that reproductive disorders take fifth place. Of the eight diseases contributing to the listings, five are considered as being of a non-communicable nature.

Heat prostration occasioned relatively high losses, which occurred over a period of but a few days. These losses were confined almost entirely to a small-sized flat-roofed type of house, which emphasizes the need for a better understanding and appreciation of the environmental requirements of fowls.

Leucocytozoon anatis, a blood parasite infection in ducks, was unusually plentiful during the year. The reported mortality in flocks, positively diagnosed as suffering from the infection, varied somewhat with the season of the year, which was probably correlated with the activities of the black fly, now looked upon as being the active transmitter of the parasite. The losses generally were high. It is interesting to note that the years of prevalence of this disease among domestic ducklings coincide with the short crop of wild ducks, which presumably nest over a region infected by black flies.

Pullorum testing was continued on the flocks of the experimental farms. During the year, 11,136 blood samples were submitted to the agglutination test.

TABLE B-1.—AUTOPSY REPORT FOR THE YEAR ENDING OCTOBER 31, 1931

Item No.	Disease	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Totals	Per cent
1															
1	Intestinal parasitism—pathological	21	37	49	43	21	12	23	83	123	120	77	41	650	22·58
2	Roup and chicken pox	.....	1	3	1	4	4	.....	.....	.....	.....	.....	.....	13	0·45
3	Roup only	4	9	13	34	16	24	20	23	10	8	11	5	177	6·15
4	Pox only	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	0·34
5	Infectious bronchitis	6	5	5	2	23	.....	.....	.....	.....	1	.....	.....	42	1·45
6	Tuberculosis	3	3	3	1	2	1	4	5	3	5	7	1	38	1·32
7	Pullorum	.....	.....	.....	.....	3	49	48	77	7	1	1	.....	186	6·46
8	Pericarditis	2	.....	2	1	1	3	4	.....	3	1	.....	.....	17	0·59
9	Vent gleet	.....	3	2	2	2	1	.....	.....	.....	.....	3	2	15	0·52
10	Peritonitis	10	7	15	28	31	29	27	25	23	15	10	11	231	8·02
11	Diseases incident to egg production	3	4	4	8	6	14	25	30	32	24	27	8	185	6·42
12	Avitaminosis	4	4	2	8	11	7	16	18	61	10	20	8	169	5·87
13	Cannibalism	19	10	5	7	28	38	40	11	15	13	3	27	216	7.50
14	Haemorrhage	4	6	5	12	11	15	9	1	6	3	9	3	84	2·91
15	Visceral gout	.....	2	2	.....	3	3	2	3	3	.....	.....	7	25	0·86
16	Digestive and liver trouble	3	7	5	10	8	9	2	2	5	3	2	3	59	2·05
17	Tumor	1	5	11	8	6	8	3	5	2	5	5	2	61	2·11
18	Leukemia	3	8	5	6	6	5	3	4	10	3	3	6	62	2·15
19	Paralysis	.....	.....	.....	.....	2	.....	.....	.....	.....	16	11	1	30	1·04
20	Heat prostration	.....	.....	.....	.....	.....	.....	.....	1	64	1	5	.....	71	2·46
21	Undetermined and decomposed specimens	5	3	5	5	7	44	127	195	52	19	26	9	497	17·26
22	Miscellaneous	.....	1	2	2	3	5	2	9	16	6	1	2	49	1·70
	Total	88	115	138	178	194	271	355	492	435	254	221	137	2,878	.....
	Per cent totals	3·05	3·99	4·79	6·18	6·74	9·41	12·33	17·09	15·11	8·82	7·67	4·76	.....	.....

TABLE B-2.—DISEASE INCIDENCE FOR THE FIRST FIVE POSITIONS FOR THE EIGHT YEARS 1924 TO 1931, TAKEN FROM THE AUTOPSY REPORTS

Year:	1924	1925	1926	1927	1928	1929	1930	1931	Totals
Disease	Number and per cent	Number and per cent	Number and per cent	Number and per cent	Number and per cent	Number and per cent	Number and per cent	Number and per cent	
Parasitism	129 12·73	155 17·08	379 29·49	340 19·40	301 21·19	292 17·60	325 19·92	650 22·58	2,571 20·08
Peritonitis	66 6·51	89 9·81	77 5·99	90 5·13	126 8·87	143 8·61	180 11·03	231 8·02	1,002 7·83
Reproductive	59 5·82	53 5·84	74 5·75	139 7·93	.....	.....	.....	185 6·42	510 3·98
Cannibalism	.....	.....	71 5·52	.....	109 7·67	185 11·15	267 16·36	216 7·50	848 6·62
Pullorum	.....	.....	155 12·06	105 5·99	92 6·47	100 6·02	152 9·31	186 6·46	790 6·17
Haemorrhage	72 7·10	53 5·84	.....	.....	.....	.....	.....	.....	125 0·97
Roup	259 25·56	73 8·04	.....	64 3·65	150 10·56	194 11·69	.....	.....	740 5·79
Avitaminosis	.....	.....	.....	.....	.....	.....	141 8·64	.....	141 1·10
Totals	585	423	756	738	778	914	1,065	1,468	6,727
Total autopsies	1,013	907	1,285	1,752	1,420	1,659	1,884	2,878	12,798
Per cent of total autopsies	58·14	46·63	58·83	42·12	54·78	55·09	56·52	51·00	52·56

1932

Routine Laboratory Service

The laboratory, during the year, handled a total of 2,351 specimens. The information obtained by this means may be of great value, providing it is taken advantage of by those operating the sources of origin of the material. It is also of value to the laboratory in establishing incidence of disease, seasonal distribution, and for the study of the gross and microscopical pathology of the various diseases.

Table B-3 records the total autopsies for the year, according to cause and by month. Intestinal parasitism again tops the list, with over 13 per cent of the specimens examined. Cannibalism is second, with 12½ per cent, laryngotracheitis third, with 10¾ per cent, peritonitis fourth, with slightly less than 10 per cent, and avitaminosis fifth, with better than 8¾ per cent. These five diseases include more than half the causes in the total specimens examined.

Two transmissible diseases fill high positions, while the other three positions referred to are due to sporadic diseases. The latter are responsible for a relatively large part of the mortality in this listing, and, if representative of poultry flocks generally, it must be a heavy drain on the returns in poultry keeping.

Among the 172 specimens recorded in the item of undetermined and decomposed specimens are a large number where but a partial examination was made for some one definite determination. These were from groups of fowls on nutritional experiments, where it was necessary only to exclude a certain deficiency, and when the point in question was settled further examination was deemed unnecessary.

Tables B-4 and B-5 represent, respectively, Barred Plymouth Rock and Single Comb White Leghorn carcasses originating from the farm poultry plant. They were birds in their pullet year. Contrary to previous years, when fowls which were not doing well productively were withdrawn and killed, this year the policy was altered so that birds should remain in the pens a full laying year, or until such time as they were removed through death. This, for the first time, makes possible a determination of the incidence and the causes of the mortality.

The outstanding feature of these tables is the extent of the mortality of the flock. Mortality totals for the two breeds are not significantly different but the reverse holds good for the incidence of certain diseases. Parasitism runs highest in the Barred Rock breed, being approximately double that in the Leghorn fowls. Since, however, one-quarter of the flock of the latter was killed by cannibalism, and as there may be a relationship between parasitism and some of the cannibalism, possibly no significance exists in the recorded difference between the breeds. Deaths occurring from parasitism are fairly well confined to the first four months of the year.

Roup and pox are higher in the Leghorns, although they suffered practically no mortality from laryngotracheitis, while approximately 12½ per cent of the Rock flock succumbed to the latter ailment. This appears as an acute epizootic of violent but short duration.

Peritonitis occupies first place of importance in numbers of sporadic disease deaths in the Rocks, claiming more than 6¾ per cent of the flock. The recording for the Leghorns is slightly lower.

Avitaminosis averages about the same for the two breeds, at 3 per cent. If 3 per cent of the flock succumbs to this ailment it seems probable that other, and probably many more individuals, are threshold cases. It is generally agreed to-day that visceral gout is but a manifestation of a vitamin A deficiency and indications point to at least a part of the cases of non-specific inflamma-

tions of the peritoneum as originating from the same cause. Deaths from visceral gout in the Rocks are the equal of the number from avitaminosis, but since from this cause diagnosis is possible only in fowls dying a natural death, and with many birds having been removed from the pens *in extremis* and killed, the chances are that the number should be actually considerably higher. In the Leghorns, the visceral gout cases are but half of one per cent, but what has been said regarding the Rocks is applicable to them, and in addition some at least of the cannibalized subjects more than likely were suffering a similar affliction, their untimely deaths acting to prevent its detection.

Cannibalism among the Leghorns is ten times greater than among the Rocks. All previous autopsy compilations have shown a higher incidence for the Leghorns but in this instance the percentage is unusually high.

Tables B-6 and B-7 cover the mortality occurring in the Canadian and the Ontario Egg Laying Contests. These two tables contrast quite sharply in a number of respects. In the first place the Canadian has double the percentage deaths of the Ontario contest. Laryngotracheitis, roup and peritonitis are all higher in the former contest, particularly the first-mentioned disease. Cannibalism is the only disease decidedly higher in the Ontario than in the Canadian contest.

Tuberculosis is recorded in the Canadian contest. This detectable communicable disease should not be permitted entrance into contests with their potentialities for disease dissemination. If this should occur it would appear to be but rational disease control to immediately disqualify an entry showing evidence of this infection and to take appropriate steps to see that the infection has not become established in other entries, preferably at the time, and certainly before they are returned to their owners.

An interesting difference occurs in the numbers of deaths from laryngotracheitis in the two contests and the plant flock. The Ontario contest records show no deaths from this malady. It is possible that, through a fortunate chance, the virus of the disease was not introduced into this contest, or if this had occurred, then the fowls' environment or other factors were such that the ailment did not develop in serious proportions. On the plant, however, the disease was present in the fowls included in the two separate calculations —Leghorns table B-5, and Rocks table B-4. While these represent different breeds of fowls, nevertheless, it is believed that no essential breed difference exists between them in respect to this ailment. This statement is supported by the fact that the incidence of the disease was the same in these breeds in the Canadian contest.

Drafts and dampness are considered as prime contributing causes to outbreaks of respiratory diseases in fowls, and it is interesting that the same type of building housed the birds where laryngotracheitis destroyed so many fowls. This, of itself, would mean little, but previous clinical evidence has indicated that the long shallow house, evidently through drafts, does predispose to respiratory ailments, and this instance tends to confirm previous observations. Pathological evidence indicates that the environmental requirements of fowls may not be adequately met by the present day style of poultry house construction, and that the question should not by any means be considered settled.

Tuberculosis appears relatively easy to control in poultry and there seems little excuse for the maintenance of a flock harbouring this infection. Roup, on the other hand, has defied attempts at active immunization and it seems probable, for some time at least, that its control will be most effective by avoidance of conditions conducive to the active development of the malady. Intestinal parasitism (worms and coccidiosis) is a very serious ailment among fowls, as indicated by Table B-1. The extent of the trouble is directly traceable to the

established practices existing in poultry keeping. The rational means of control exist in altering the practices which have been responsible for the bringing about of these conditions. That this is feasible has been amply demonstrated. Pullorum disease, that scourge of young chickhood, can be controlled without serious question of doubt.

With all of these transmissible diseases controlled, there would be still left the major part of the deaths contained in these tabulations. In the table with the best showing (No. 5) where a negligible contagious disease mortality is recorded there is still a loss of practically a quarter of the flock. The solution of this sporadic disease complex and its control seems to offer the greatest possibilities to the poultry industry, yet it is the one receiving the least attention the world over.

During the year, 7,170 blood samples were submitted to the agglutination test for the detection of carriers of pullorum disease.

RESEARCH IN DISEASES

The limited time available, after attending to the routine demands of the laboratory, has been given to the study of certain phases of several diseases. This has applied to chicken pox, laryngotracheitis, intestinal parasitism, neurolymphomatosis gallinarum, cannibalism and avitaminosis.

Separate reports are being prepared dealing with laryngotracheitis and cannibalism.

TABLE B-3.—AUTOPSY REPORT FOR YEAR ENDING OCTOBER 31, 1932

MATERIAL FROM ALL SOURCES

Item No.	Disease	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Number	Relative per cent
1	Intestinal parasitism, pathological	31	34	14	20	6	9	9	51	50	43	20	23	310	13·18
2	Roup and chicken pox	.....	3	3	3	3	4	.....	.....	.....	.....	.....	.....	16	0·68
3	Roup only	6	11	18	22	22	16	4	7	4	2	2	1	115	4·89
4	Pox only	1	7	7	15	3	1	1	.....	.....	.....	.....	.....	35	1·48
5	Laryngotracheitis	3	29	60	128	24	9	.....	.....	.....	.....	.....	.....	253	10·76
6	Pullorum	.....	.....	.....	.....	.....	41	47	14	.....	.....	.....	.....	102	4·33
7	Tuberculosis	2	2	4	1	1	.....	5	4	2	.....	1	.....	22	0·93
8	Pericarditis	1	.....	3	4	1	2	1	4	3	1	1	1	22	0·93
9	Vent gleet	2	6	6	2	1	4	5	2	4	2	2	2	38	1·61
10	Peritonitis	19	16	17	21	21	25	22	18	15	19	16	25	234	9·95
11	Reproductive	3	9	12	14	7	15	12	13	11	11	7	7	121	5·14
12	Avitaminosis	9	22	13	12	13	32	21	23	20	21	10	11	207	8·80
13	Cannibalism	45	20	21	15	37	62	30	29	12	6	8	9	294	12·50
14	Haemorrhage	1	8	7	8	6	5	10	1	5	4	2	.....	57	2·42
15	Visceral gout	4	6	5	5	3	2	5	4	3	.....	2	4	43	1·82
16	Digestive and liver	1	12	9	11	7	5	8	7	7	6	4	7	84	3·57
17	Tumor	4	6	5	9	7	11	2	3	7	6	8	6	74	3·14
18	Leukemia	4	3	3	4	.....	4	2	4	4	4	2	4	38	1·61
19	Paralysis	.....	.....	3	.....	2	.....	.....	.....	11	22	31	19	88	3·74
20	Heat prostration	.....	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	2	0·08
21	Undetermined and decomposed specimens	6	2	10	10	13	29	37	29	12	12	6	6	172	7·31
22	Miscellaneous	.....	5	3	3	1	4	5	8	6	3	2	7	44	1·87
	Total	142	201	220	307	178	280	226	222	176	163	124	132	2,351	.....
	Per cent	6·03	8·54	9·35	13·05	7·57	11·90	9·61	9·44	7·48	6·93	5·27	5·61	.....	.....

TABLE B-4.—MORTALITY CAUSES, CENTRAL EXPERIMENTAL FARM POULTRY PLANT—BARRED PLYMOUTH ROCKS

Item No.	Disease	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Misc.	No.	Relative per cent	Absolute per cent
1	Intestinal parasitism, pathological	4	12	13	7	9	1				1	7				54	18·94	11·61
2	Roup and chicken pox			1	1											2	0·70	0·43
3	Roup only	1			3	2		1		1						8	2·80	1·72
4	Pox only			5												5	1·75	1·07
5	Tuberculosis																	
6	Laryngotracheitis			27	31											58	20·35	12·47
7	Pericarditis				1			1		1						3	1·05	0·64
8	Vent gleet	1	1	3	2		1	4	1							13	4·56	2·79
9	Peritonitis	2	3	6	4	4	1	6	0	1	2	1	2			32	11·22	6·88
10	Reproductive			1		2		2	2		1			1		9	3·15	1·93
11	Avitaminosis			1			1	1	2	1	3	4	1			14	4·91	3·01
12	Cannibalism	3	2	2		2		2				1				12	4·21	2·58
13	Haemorrhage			2		1	1		3		1		1			9	3·15	1·93
14	Visceral gout	5	2	5		1					1					14	4·91	3·01
15	Digestive and liver trouble			1	5	2			3	2	1	1	2			17	5·96	3·65
16	Tumor	1		1		2		1			2	1	1	1		10	3·50	2·15
17	Leukemia	1	1	1			1	2				1				7	2·45	1·50
18	Paralysis				1											1	0·35	0·21
19	Heat prostration																	
20	Undetermined and decomposed specimens	1		1		1		1	1	1	1		1	1		9	3·15	1·93
21	Miscellaneous	1			1				1						5	8	2·80	1·72
	Totals	20	21	70	56	26	6	21	13	7	13	16	8	3	5	285	61·29	
	Relative per cent	7·01	7·36	24·56	19·64	9·12	2·10	7·36	4·56	2·45	4·56	5·61	2·80	1·05	1·75			
	Number of birds adjusted for calculation of absolute percentages	465	445	424	354	298	272	266	253	246	233	217	209	206	201	303		
	Absolute per cent	4·30	4·71	16·50	15·81	8·72	2·20	7·89	5·13	2·84	5·57	7·37	3·82	1·45	2·48		65·11	

Five birds died and 18 killed upon which no autopsies were held.

TABLE B-5.—MORTALITY CAUSES, CENTRAL EXPERIMENTAL FARM, POULTRY PLANT—SINGLE COMB WHITE LEGHORNS.

Item No.	Disease	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Misc.	No.	Relative per cent	Absolute per cent
1	Intestinal parasitism, pathological	4	2	7	3	3	.....	1	.....	1	.....	.....	1	.....	.....	22	8·83	5·99
2	Roup and chicken pox	.....	.....	1	1	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1·20	0·81
3	Roup only	.....	1	.....	2	3	.....	.....	1	.....	1	.....	.....	.....	.....	8	3·21	2·17
4	Pox only	.....	1	2	3	9	3	.....	.....	1	.....	.....	.....	.....	.....	19	7·63	5·17
5	Tuberculosis	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	Laryngotracheitis	.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	2	0·80	0·54
7	Pericarditis	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1	0·40	0·27
8	Vent gleet	.....	.....	1	.....	.....	.....	.....	2	1	1	.....	.....	.....	.....	5	2·00	1·36
9	Peritonitis	1	.....	.....	1	2	.....	1	6	2	1	3	1	2	.....	20	8·03	5·44
10	Reproductive	2	1	1	1	.....	3	3	2	1	2	4	2	.....	.....	22	8·83	5·99
11	Avitaminosis	.....	.....	.....	.....	.....	3	.....	.....	.....	2	5	1	.....	.....	11	4·41	2·99
12	Cannibalism	7	17	8	5	6	12	16	7	4	2	2	4	.....	.....	90	36·14	24·52
13	Haemorrhage	.....	.....	.....	.....	.....	.....	1	1	.....	.....	.....	.....	.....	.....	2	0·80	0·54
14	Visceral gout	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	1	.....	.....	2	0·80	0·54
15	Digestive and liver trouble	.....	.....	1	2	.....	.....	.....	.....	.....	1	.....	.....	1	.....	5	2·00	1·36
16	Tumor	.....	1	.....	.....	.....	1	.....	.....	1	1	1	.....	1	.....	6	2·40	1·63
17	Leucosis	2	.....	.....	.....	.....	.....	.....	1	.....	1	1	1	.....	.....	6	2·40	1·63
18	Paralysis	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	Heat prostration	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	Undetermined and decomposed specimens	.....	1	.....	.....	.....	.....	.....	1	1	1	.....	2	1	.....	7	2·81	1·90
21	Miscellaneous	.....	.....	.....	.....	.....	2	.....	.....	1	.....	.....	.....	.....	15	18	7·22	4·90
	Totals	16	25	21	18	24	26	22	21	14	13	16	13	5	15	234	63·76	.....
	Relative per cent	6·42	10·04	8·43	7·22	9·64	10·44	8·83	8·43	5·62	5·22	6·42	5·22	2·00	6·02	....	.....	.....
	Number of birds adjusted for percentage calculation	367	351	326	305	287	263	237	215	194	180	167	151	138	133	247	.....	.....
	Absolute per cent	4·35	7·12	6·44	5·90	8·36	9·88	9·28	9·76	7·21	7·22	9·58	8·60	3·62	11·27	....	67·84	.....

Fifteen died or were killed upon which no autopsies were held.

TABLE B-6.—MORTALITY CAUSES, CANADIAN EGG LAYING CONTEST, 1931-32

Item No.	Diseases	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Totals	Relative per cent	Absolute per cent
1	Intestinal parasitism, pathological		2											2	0·48	0·22
2	Roup and chicken pox			2		1	1							4	0·95	0·45
3	Roup only	1	1	11	5	13	9	2	3	1	1	2		49	11·75	5·54
4	Pox only			1										1	0·23	0·11
5	Tuberculosis								1					1	0·23	0·11
6	Laryngotracheitis			19	115	22	6							162	38·84	18·32
7	Pericarditis				2	1	1	1	1		1			7	1·67	0·79
8	Vent gleet	1						1	1			2		5	1·21	0·56
9	Peritonitis	4	3	6	5	6	5	7	6	5	3	6	5	61	14·62	6·90
10	Diseases incident to egg production	1	2	1	2			4	2	3	2	1	1	19	4·55	2·14
11	Avitaminosis			1	3	2	3	4	2	3	5	1		24	5·75	2·71
12	Cannibalism	4	2		1	1	2	1	6	3		1	1	22	5·27	2·48
13	Haemorrhage	1	1		1	2	1		1	1		1		9	2·15	1·01
14	Visceral gout		1	1	4	1		2		1				10	2·39	1·13
15	Digestive and liver trouble		3		1	1				2	2	1		10	2·39	1·13
16	Tumor		3	1			2				1	3	2	12	2·87	1·35
17	Leukemia	1		2		1			2	1			1	8	1·91	0·90
18	Paralysis					1								1	0·23	0·11
19	Heat prostration								1					1	0·23	0·11
20	Undetermined and decomposed specimens			2	1			1		1	1			6	1·43	0·67
21	Miscellaneous							1	1	1				3	0·71	0·33
	Totals	13	18	47	140	52	30	24	27	22	16	18	10	417		
	Relative per cent	3·11	4·31	11·27	33·56	12·47	7·19	5·75	6·47	5·27	3·83	4·31	2·39			
	Absolute per cent	1·47	2·03	5·31	15·83	5·88	3·39	2·71	3·05	2·48	1·80	2·03	1·13		47·17	

TABLE B-7.—MORTALITY CAUSES, ONTARIO EGG LAYING CONTEST, 1931-32

Item No.	Disease	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Totals	Relative per cent	Absolute per cent
1	Intestinal parasitism, pathological	2												2	0·47	0·21
2	Roup and chicken pox															
3	Roup only		2	2	1					1				6	2·84	0·65
4	Pox only															
5	Tuberculosis															
6	Laryngotracheitis															
7	Pericarditis				2									2	0·95	0·21
8	Vent gleet									1				1	0·47	0·11
9	Peritonitis	1	3	3	5	2	1	3	4	4	5	5	1	37	17·52	4·06
10	Diseases incident to egg production			1	1		4		5	3	2	2	1	19	9·02	2·08
11	Avitaminosis			1	1	3	3		4	2	3	3	3	23	10·89	2·52
12	Cannibalism	4		4	1	6	11	14	13	6	3	2	1	65	30·78	7·14
13	Haemorrhage			1	2	2	1	1		1	2			10	4·74	1·09
14	Visceral gout	1		2			1	2	3			1	1	11	5·22	1·20
15	Digestive and liver trouble		1			3		1		3	1			9	4·26	0·98
16	Tumor				1			1				1		3	1·42	0·32
17	Leukemia				2		1			2	1			6	2·84	0·65
18	Paralysis															
19	Heat prostration										1			1	0·47	0·11
20	Undetermined and decomposed specimens			2	1	2	3	3	1		2	1	1	16	7·70	1·75
21	Miscellaneous															
	Totals	8	6	16	17	18	25	25	30	23	20	15	8	211		
	Relative per cent	3·79	2·64	7·58	8·05	8·53	11·84	11·84	14·21	10·90	9·47	7·10	3·79			
	Absolute per cent	0·87	0·65	1·75	1·86	1·97	2·74	2·74	3·29	2·52	2·19	1·64	0·87		23·18	

1933

During the year, this laboratory has met to the best of its ability, considering its limited facilities and meagre staff, the large and increasing demands for its services from varied sources. It is called upon by and co-operates with several other agencies, including governmental services, educational institutions, etc., and the widespread nature of this is probably due to its being the only laboratory in Canada specializing in and dealing exclusively with the diseases of domestic fowls.

The activities of the laboratory have fallen naturally into two phases, one dealing with the study and investigation of certain diseases and the other with the diagnosis of diseases and the institution of appropriate control measures. These divisions may also be classified as research or investigational and routine or applied science. A sharp line of separation cannot be drawn between these two activities as the former is commonly based upon the orderly application of well established detailed technique while the latter frequently necessitates a considerable amount of original work.

ROUTINE LABORATORY SERVICE (APPLIED SCIENCE)

During the year, a total of 1961 fowl specimens were examined and reported upon. The results are set forth in table B-8 showing the pathological conditions encountered and their calendar distribution. The peak for the year occurs in the springtime, May, and is due to the relatively large number of chicks examined at that period. According to this tabulation, three communicable diseases appear in roles of major importance, including intestinal parasitism, laryngotracheitis and pullorum disease. An almost equally high incidence occurs among certain organic diseases such as peritonitis and cannibalism and the latter group of diseases collectively comprises a larger number than those of a specific nature.

Installation of equipment for the pursuit of histo-pathological examinations and an extension of the haemocytological determinations have accordingly improved the character of this service.

Serological Diagnosis

The year's activities in the examination of the blood of fowls for the existence of pullorum disease were considerably greater than in any previous corresponding period. Blood samples, numbering 14,796, were submitted to the agglutination test, employing the standard tube method. The origin of this material and the time of the tests are given in Table B-9.

On the completion of the Egg Laying Contests for the current year the birds were submitted to the test and the findings are tabulated as Table B-10. The results are interesting, in that of the same twenty-eight hundred fowls in these contests only 3·34 per cent gave positive agglutination reactions. This was from a total of 370 pens. Of chief interest, however, is the fact that reactors were encountered in only 48 of these pens, and of the 448 birds comprising this group 21·42 per cent reacted positively. Indication is given of a relatively high infection in a comparatively small percentage of the total entries, constituting a disease menace to the remainder, the major part of the contest entries.

Research

As in former years investigational work has been mainly directed to the problem of adult fowl mortality, a matter of great economic importance to the poultry industry.

Sporadic diseases here occupy a position exceeding the specific disease losses. Two conditions of the former group have been chiefly considered. These

are cannibalism and avian dermatitis. A paper on cannibalism is in the scientific press at the time of writing. The dermatitis, evidently an unreported abormality, is characterized by an intense inflammation of the corium. This destroys the life of the feather with a subsequent breaking of the shaft near the surface of the epidermis. Thus, bald patches appear on the body with a vivid reddening of the skin.

TABLE 8-B—AUTOPSY REPORT FOR THE FISCAL YEAR ENDING MARCH 31, 1934

Item No.	Disease	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
1	Intestinal parasitism	10	15	33	80	30	35	48	21	9	16	5	11	313
2	Roup and chicken pox	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	Roup only	2	5	6	6	4	.....	8	7	7	1	6	10	62
4	Pox only	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
5	Laryngotracheitis	3	.....	3	.....	1	2	2	.....	29	36	24	71	171
6	Pullorum disease	2	70	29	2	.....	.....	.....	1	.....	.....	4	2	110
7	Tuberculosis	2	2	1	3	3	1	3	1	3	3	2	2	26
8	Pericarditis	3	3	1	4	1	4	1	1	3	3	2	2	28
9	Vent gleet	1	1	.....	.....	.....	.....	.....	1	1	.....	2	1	7
10	Peritonitis	17	22	20	16	16	18	16	11	5	8	5	16	170
11	Reproductive	7	5	7	11	4	3	4	3	4	4	6	7	70
12	Avitaminosis	6	13	6	9	10	6	1	4	9	5	2	11	82
13	Cannibalism	22	26	16	10	15	5	4	19	3	12	10	24	166
14	Haemorrhage	7	7	7	5	2	4	4	3	4	8	6	7	64
15	Visceral gout	4	1	1	1	2	7	2	.....	1	2	2	4	27
16	Digestive and liver trouble	8	8	3	5	2	2	5	4	3	9	5	9	63
17	Tumor	6	2	8	2	6	4	.....	3	2	2	4	8	47
18	Leucosis	6	8	4	4	5	6	2	6	5	12	5	15	78
19	Paralysis	3	4	5	4	7	14	6	14	3	3	7	6	81
20	Heat prostration	.....	.....	3	.....	1	.....	.....	.....	.....	.....	.....	.....	4
21	Undetermined	26	90	56	44	28	18	9	6	6	15	6	11	310
22	Miscellaneous	13	7	7	6	3	4	5	17	4	3	6	6	81
	Total	153	289	216	212	140	123	120	128	101	142	109	223	1,961

TABLE B-9.—AGGLUTINATION TESTS FOR THE DETECTION OF CARRIERS OF B. PULLORUM INFECTION

Source	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Total
Experimental farm flocks	.....	2,162	4,197	121	320	.....	31	6,831
Egg laying contests	220	2,099	248	11	.....	.....	.....	2,578
Other sources	335	1,992	271	655	597	200	1,337	5,387
Total	555	6,253	4,716	787	917	200	1,368	14,796

TABLE B-10.—RESULTS OF AGGLUTINATION TESTS OF THE 1932-33 EGG LAYING CONTESTS

Contest	Number of pens	Number of birds tested	Number of reactors	Per cent reactors	Number of pens involved	Per cent of pens involved	Number of birds remaining in infected pens	Per cent reactors in infected pens
Canadian	54	413	7	1·69	6	11·11	42	16·66
Ontario	80	532	25	4·71	12	15·00	93	28·88
Manitoba	19	191	11	5·75	2	10·52	19	57·89
Quebec Eastern	20	157	4	2·54	2	10·00	18	22·22
Quebec Western	20	155	3	1·93	2	10·00	22	13·63
New Brunswick	32	256	8	3·12	6	18·75	54	14·82
Nova Scotia	33	215	0	.....	.....	.....	.....	.....
Nova Scotia Southern	20	198	1	0·50	1	5·00	11	9·09
Prince Edward Island	20	151	3	1·98	2	10·00	23	13·05
Vancouver Island	34	376	22	5·8	9	26·4	101	21·78
Alberta	19	154	12	7·79	6	31·58	65	18·46
Saskatchewan	19	70	0	All birds tested at beginning of contest in 1932.				
Total	370	2,868	96	3·34	48	12·97	448	21·42

Studies With Avian Coccidiosis

The recently published work by Tyzzer has very materially cleared the understanding of this disease, but, being an academic study, it still leaves certain phases unanswered in the application of control measures against the malady. These apply particularly to the epidemiology of the disease.

So far the mode of transmission of the parasites has not been settled to the entire satisfaction of all parties. A pharmaceutical concern has emphasized the possibility of spread through incubation by parasites carried upon the shells of the eggs.

In the disease control work on the flocks of the various experimental farms, it has been observed that coccidial as well as other intestinal parasitisms were eradicated, in so far as subsequent crops of fowls were concerned, when brooding and rearing operations were maintained with complete segregation between the parasitised old birds and the young stock. This shows that the infection is not carried on the fowls' eggs through incubation at least with any degree of frequency. If coccidial oocysts are present on the shells of eggs from infected fowls, as one might expect, then it would appear that the conditions of incubation are not suitable to the propagation of the parasites, otherwise the chicks should show evidences of infection. As stated, it has been frequently observed that this does not occur, at least not commonly, and it was naturally concluded that this phase may be left in abeyance pending the settlement of other important avenues of infection.

In the work referred to, by Tyzzer, the ease of transmission by human agencies was observed and was emphasized as a special consideration when studying more than one strain of coccidium at one time. This coincides with clinical evidence upon which recommendations in control have for some years been based.

The equivalent of chronically infected or carrier cases among adult birds has been frequently encountered in routine diagnostic work, and that, with the ease of transmission of the parasites by human beings, might explain the frequency of occurrence of the disease in young stock. It did seem advisable, however, to obtain information on the duration of infection under natural conditions, and experiments were conducted to this end.

Experiment to Determine the Coccidial Infectivity of Polluted Yards

The yards selected had fowls reared upon them during the preceding years, and that stock invariably showed infestation with coccidia and various other intestinal animal parasites. In fact, the yards had at one time been used as brooding paddocks for the regular plant operations; the increasing parasitism, however, had caused their abandonment for that purpose and they were still being used for certain experimental rearings. These yards were separated from the yards of the permanent houses of the adult stock by a laneway with a wire fence on each side of it. Consequently, the intermediate hosts of tapes such as grasshoppers (which were very plentiful and eaten in great numbers by the fowls) could freely move from one set of yards to the other.

The house, previously used for housing adult fowls, was cleaned by scrubbing with hot lye water and the equipment, water fountains, pans and hoppers were heat sterilized. This equipment was placed on wire covered racks and the water receptacles covered to prevent excessive contamination of the contents. Beginning on July 11, the house was moved once weekly, and, although the distance was not great, it did help to reduce the time spent by the birds on the

soiled area which develops in front of the houses. Previous to moving the house, the chicks each week were given physic with Epsom salts, and the house was cleaned of litter before being moved.

The attendant, a laboratory assistant, cared for the stock and remained away from other poultry houses during the period. His feet were covered by rubbers when entering the compound and this foot covering was left at the entrance.

Stock used for the experiment consisted of 200 Single Comb White Leghorn day-old chicks which were hatched on June 18, and went direct from the incubator to the experimental house. They were hatched from eggs from the regular plant stock, the source of chicks for all experimental purposes, and from which the chicks for stock replacements are obtained. These facts are mentioned because the numerous autopsies conducted upon the experimental chicks (other than in this experiment) and the replacement of stock chicks serve as checks or control to the findings in this experiment.

It was anticipated that parasitism would develop in the birds during the experiment; it was hoped, however, to avoid the carrying in of parasites by the attendant. The arrangements as outlined, it was believed, would mitigate against excessive multiplication of the parasites existing in the compound at the beginning of the experiment, which, if given free way, could reach a point where they would cause the destruction of a sufficient number of birds to spoil the usefulness of the experiment. Coccidial infectivity of the soil being under investigation, the destruction of a large part of the stock by worm infestations could reduce the numbers below the desired working number. The plan used was evidently fairly successful in maintaining the infestations close to the number picked up by the individuals from their surroundings without undue multiplication in that generation of fowls.

Brooder mortality consisted of four deaths, all within the first week, and were due to extraneous causes. At intervals, during the late summer, birds were killed for examination for intestinal parasites. The first of these specimens examined on August 10 were found infested with tapeworms and ceca worms.

Symptoms of coccidiosis were at no time in evidence nor could their presence be demonstrated at autopsy. There remained the possibility of a minimum dosage having established infection in the birds, the sanitary arrangements having maintained that level without the development of clinical evidence of infection, or the autopsies made at a time failing to demonstrate infection. If this were the case the birds would be immune to subsequent infection, and, in order to determine whether or not this was so, birds were subjected to natural means of infection as well as artificial inoculation. These exposures were first made on August 11 and were repeated again on September 3. They were readily infected, naturally and artificially, with species *Eimeria tenella, E. necatrix* and *E. acervulina.*

From this it may be concluded, that, while fowls previously reared on these paddocks were invariably sufferers from coccidiosis, the parasites had failed to persist from one year to the next. It appears that the carrying of coccidia into the compound had been successfully guarded against. Heterakis, apparently, were more time-resistant or else they were transmitted with even greater ease than are coccidia. Tapeworm infectivity, with or without the assistance of infected intermediate hosts, had either carried over or else the infection had been carried in. It is interesting, regarding the latter, to note in an experimental house separated from the compound and the plant runs by only a laneway and a fence, that in the stock with access to cemented runs taeniasis did not occur.

Neuro-Lymphomatosis Gallinarum

(RANGE PARALYSIS)

This disease, seemingly of increasing incidence, the cause of considerable losses and the occasion for much concern among poultrymen has been the subject of varied and protracted study. Pathological studies have established the consistency of certain lesions, and from these studies there has been a tendency to look upon the abnormality as being of a disease entity. This view is open to question. Geneticists, noting a variation in incidence, have endeavoured to ascribe a great deal to genetic factors, and while it is reasonable to expect the occurrence of a family difference in the working of the defence mechanism or even the predisposition to organic disease it seems improbable, nevertheless, that this complex disease problem would be solved other than by continued or sustained investigation along pathological lines.

In the intestinal parasitic control work, clinical evidence has shown a remarkable agreement between these troubles and range paralysis. Where flocks were badly parasitized and the succeeding generations were reared parasite-free by breaking the life-cycle of the parasites, the paralysis ceased to be a problem.

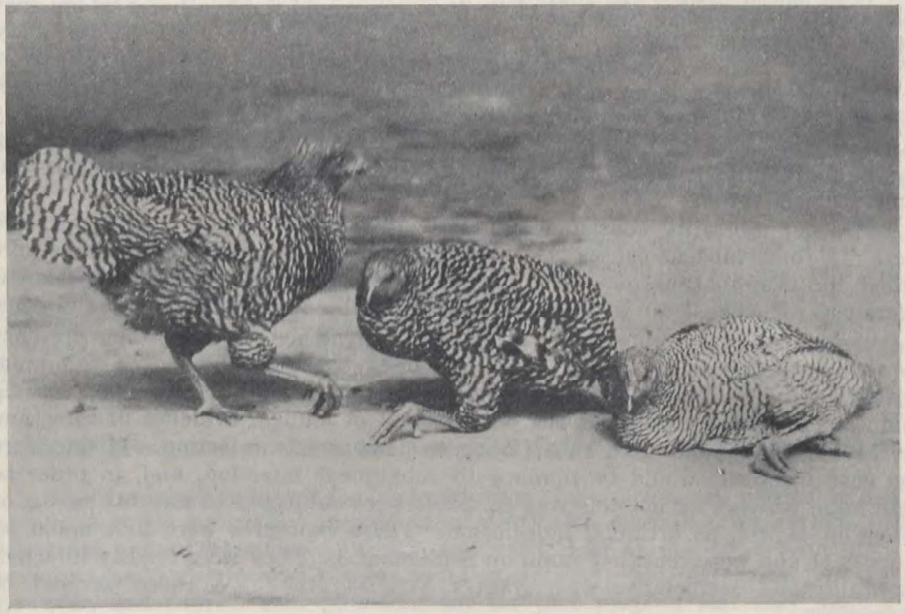

FIG. 1.—Cases of the so-called range paralysis which occurred in large numbers in a group of fowls following an attack of coccidiosis by several species of that parasite.

The work with coccidiosis during the current year has been productive of information regarding the occurrence of paralysis, tending to further associate the paralysis with parasitism, especially coccidial.

It has been possible to compare, with regard to paralysis, stock reared from the same parentage under conditions both negative and positive to coccidial infestation. One group was reared under conditions of stock segregation wherein coccidia of five of the six known species (*Eimeria mitis, E. acervulina, E. maxima, E. necatrix* and *E. tenella*) were carried to the birds by human agencies. The land used for brooding and rearing was virgin to poultry culture, and the houses with their equipment were handled in a manner known to render them free from

coccidial infectivity. The second group was brooded and reared on land of previously known worm infectivity, this being established during preceding years. Coccidia evidently being unable to maintain an existence during the interval from one season's operations to the next and not having been carried to the stock, the fowls remained coccidial free. This stock, however, did show round worm and tapeworm infestations.

The coccidiosis developing in the first group was serious in nature, causing a mortality in certain infections (*E. necatrix*) as high as twenty per cent. This occurred when the birds were three-quarters grown. Typical symptoms of the disease condition commonly referred to as range paralysis developed in this group at the early adulthood stage of their life, although at this time there was no active evidence of parasitism. (Figure 1.)

Group two remained free of evidence of paralysis.

In numerous instances, with flocks showing a heavy parasitism with abundant evidence of paralysis, as previously mentioned, when succeeding generations were reared parasite-free, paralysis ceased to be a worry. These circumstances seemingly not only further incriminate parasitism as a factor in the so-called range paralysis, but support the belief of the role played by coccidia in its production.

Observation on the Recoverability of Fowls Suffering With Range Paralysis

Records are available on the incidence of range paralysis which show the relative frequency of paralysis in flocks suffering from the trouble, but there is little recorded on the recoverability of affected fowls. Judging from observation of the disease condition, the per cent recovery is low, and this is emphasized by the report of Pappenheimer, Dunn and Cone, in which but one case of recovery is reported among the great number of fowls referred to as coming under this observation. It is not clear in the report mentioned that the cases studied contained only fowls suffering from the ailment commonly referred to as range paralysis. Among the illustrations there is one representative of an avitaminosis which is known to show a high degree of recoverability, and as this is given as a case of range paralysis it seems possible that the two conditions have been confused to some degree.

From the character of the pathology of the malady, with the extent and nature of the nerve tissue involvement, a high death rate might be reasonably anticipated. Certainly if the pathological changes, the cellular infiltrations of the nervous tissues, produced actual destructive changes of those tissues, persistency of the symptom of paralysis could at best be expected to follow.

It had been observed that paralyzed birds, whether or not they consumed food, would continue to lose weight often to the point of extreme emaciation before life became extinct. In some individuals the appetite remained fairly good, thus tending to indicate that the progressive emaciation resulted from improper utilization of foods rather than being due entirely to restricted consumption.

This suggested the advisability of endeavouring to favourably influence the food utilization by the subjects in order to ascertain whether or not there would follow an improvement in the general physical well being and the subsequent effect, if any, that this might have upon the paralysis. Accordingly eight fowls were selected, showing the usual paralytic symptoms of the trouble. The selection was made in order to make the two groups into which they were divided comparable regarding the similarity of the paralysis. The birds were housed in adjoining compartments of an adult fowl battery. Their food supply consisted of a laying mash kept constantly before them in dry form. Fresh water was always available. The experiment commenced on August 14.

FIG. 2.—Range paralysis.

FIG. 3.—Range paralysis.

Pen No. 1 was given, once daily, a No. 1 gelatine capsule per bird, filled with a tonic mixture composed of equal parts of ground ginger, gentian, nux vomica and sulphate of iron.

Pen No. 2 received no medicinal treatment and served as a control to the experiment.

Results of the experiment are given in the following table.

Figures 2 and 3 are representative of paralytic birds taken for experimentation.

FIG. 4.—Fowl recovered from range paralysis.

RESULTS OF A MEDICINAL TREATMENT ON BIRDS SUFFERING FROM RANGE PARALYSIS

Bird No.	Termination	Weight gain	Weight loss
Pen No. 1—Treated			
96	Recovered	6 ounces	
97	"	6 ounces	
98	"	1 pound, 1 ounce	
100	Died (Sept. 1)		7 ounces
Pen No. 2—Control			
92	Died (Sept. 3)		
93	" (Aug. 31)		7 ounces
94	" (Aug. 31)		7 ounces
95	" (Aug. 28)		1 pound, 7 ounces

The total gain in pen No. 1, after deducting the seven ounces lost by the bird which succumbed, was 2 pounds 5 ounces. Pen 2 had a total loss of 2 pounds 5 ounces, giving a spread between the two pens of 3 pounds 10 ounces. Bird No. 100, in the treated pen, suffered the entire loss during the first week of the experiment. Its death occurred on the sixth day of the third week, and unfortunately its dead weight was not taken; consequently, it is not known whether or not a further loss developed a short time prior to death. The three remaining birds in pen No. 1 made complete recovery as indicated in figures 4 and 5. This change occurred with remarkable suddenness, the comb development, evidence of production at an early date and normal walking gait, attesting to the completeness of recovery. The birds were then killed and autopsied but there was no visible evidence of disease observed at that time.

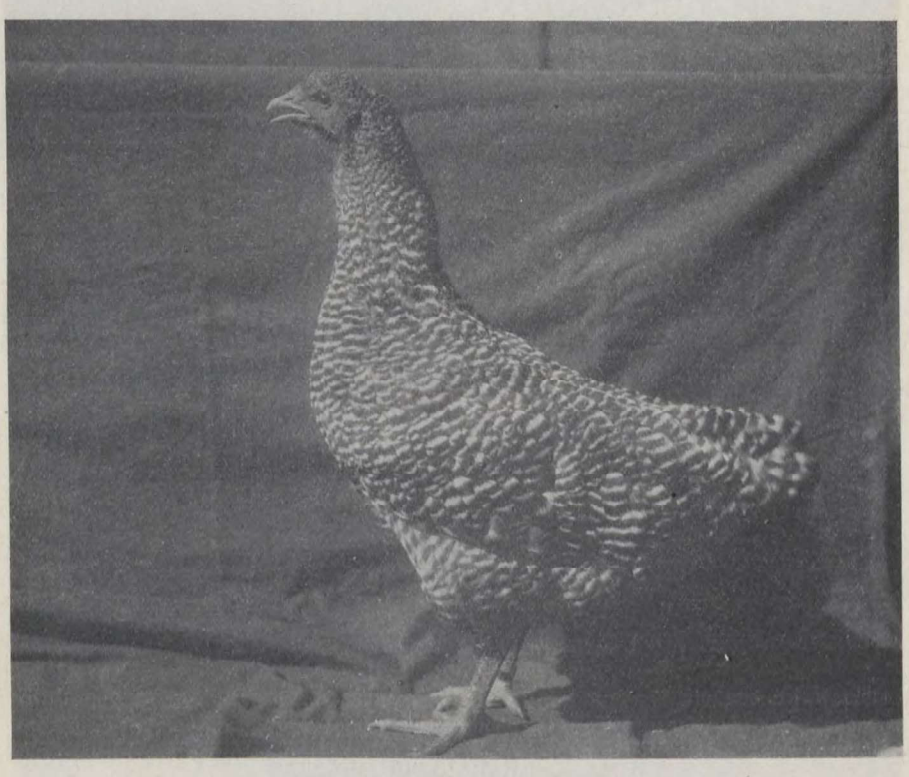

FIG. 5.—Fowl recovered from range paralysis.

Figure 6 shows the two groups of birds at the end of the second week of the experiment.

The sudden improvement of the physical condition to a complete cessation of symptoms and return to apparent normal health, with the low mortality rate in the treated pen, 25 per cent as against 100 per cent in the control pen, would indicate a high rate of recoverability from the disease under the conditions prevailing in this experiment. While the numbers were small, it, nevertheless, seems improbable that the differences developing between the two groups should be a matter of chance.

It would appear that the symptoms of paralysis present in these birds were due to functional interference with the nervous system rather than to nerve

tissue degeneration or destruction. The cases used in this experiment were of recent development and these findings do not exclude the possibility that, with time, more permanent injury might result to the nerves. In the early stages, however, even after power of locomotion had been lost, paralytic symptoms soon ceased upon improvement of the general physical condition of the subjects, while paralysis persisted up to the time of death in the controls.

The employment of medicinal agents is not advanced as a means of combatting range paralysis, but the evidence does point quite distinctly to the probability of a relationship between the general physical condition and a functional paralysis existing in the earlier stages of the disease at least.

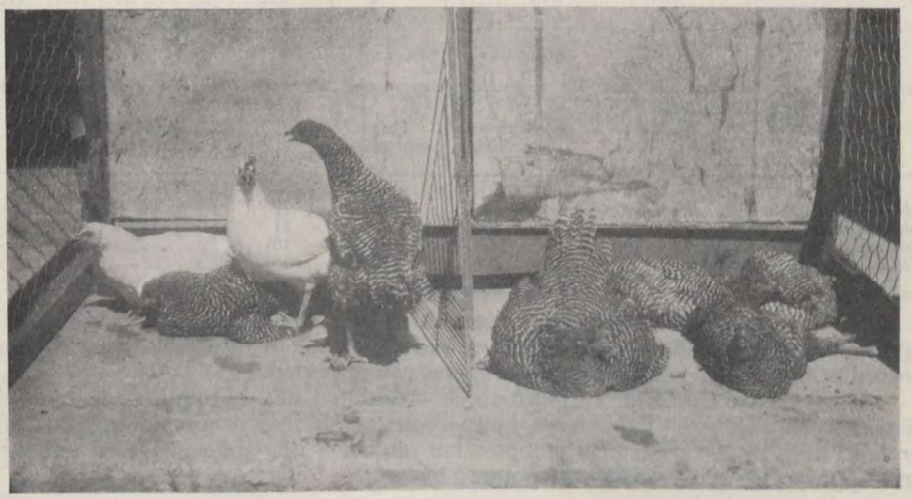

FIG. 6.—Group of paralytic fowls at the end of the second week of the experiment. Left group treated, right group untreated.

Report of Studies to Determine the Efficacy of a Proprietary Preparation, "Anti-Pullorum," Intended to Prevent and Eliminate Pullorum Disease in Baby Chicks

In arranging the experimental study of this product, arrangements were made, in keeping with the usual and accepted procedure in scientific investigations, to provide against chance happenings occurring which would complicate the findings and make them difficult of interpretation. Since such great differences may occur in outbreaks of natural infection of pullorum disease making it difficult to obtain like infections for the experimentally treated infected groups and the positive controls, it was decided, in the interests of definite, comparable and readable results, to subject each individual to a given amount of infection. The amount was made comparable between groups.

In pullorum disease the chicks receive infection principally in one of two ways. One avenue is that of the infection carried on the egg yolk from the carrier infection of the ovary of the hen. This type of infection starts early, in fact before the chick hatches, and kills many chicks before they hatch. An approximation of this type of infection was made experimentally by intraperitoneal inoculation. The second avenue to be duplicated was of alimentary origin which in the natural state occurs through chicks ingesting infection through cohabitation with chicks harbouring infection at the time of hatching. This was arrived at through oral administration of a culture of the *Bacillus pullorum*.

TABLE B-11.—RESULTS WITH ANTI-PULLORUM

Material—6 pens of 30 day-old chicks brooded in battery brooder.)

Pen letter	Infected	Treatment	Mortality	B. pullorum isolations	B. pullorum not isolated	Per cent dying of pullorum
A	Yes	Yes	22	17	5	56
B	Yes	No	24	17	7	56
C	Yes	Yes	25	19	6	63
D	Yes	No	25	16	9	53
E	No	Yes	3	Nil	.....	.....
F	No	No	4	Nil	.....	.....

MORTALITY SUMMARY

—	Number of chicks	Total mortality	Per cent	Due to pullorum	Per cent
Infected and treated	60	47	77	36	60
Infected and not treated	60	49	81	33	55
Not infected, treated	30	3 } 7	10 } 11·6	.....	.....
Not infected, no treatment	30	4 }	13 }	.....	.....

The effect, if any, favourable or otherwise, which the drug might have upon chicks independently of infection had to be taken into consideration and accordingly a negative control treated pen was provided.

Altogether six pens of Leghorn-Rock cross-bred day-old chicks, 30 to each pen, were made up. They were housed in a standard commercial battery brooder and fed a ration of a composition and in a manner considered suitable and appropriate to the needs of young chicks.

Summary and Conclusions

1. The proprietary product known as Anti-pullorum, under controlled conditions of experimental study, had no effect in controlling or preventing the death losses in chicks when infected with *B. pullorum*, the causative organism of pullorum disease. The death losses from pullorum disease were slightly higher in the infected and treated than in the infected and untreated pens.
2. The mortality in the noninfected pens was 11·6 per cent, while a 77 per cent death rate occurred in the infected-treated pens. This would indicate the unsuitability of the treatment as a replacement of pullorum eradication methods.
3. Anti-pullorum had no apparent effect upon noninfected chicks in so far as could be judged by mortality rate.

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